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1

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ANATOMY AND MECHANICS OF STRUCTURES AROUND THE VESICAL NECK: HOW VESICAL NECK POSITION MIGHT AFFECT ITS CLOSURE

AIMS OF STUDY

Initiation of micturition is associated with vesical neck descent, and arrest of urination, with its elevation. Simple displacement of the vesical neck could not influence its intraluminal pressure, unless some structure opposes this displacement. This study examines the morphology and mechanics of this region to see if some structural arrangement might allow vesical neck position to influence its opening or closure.

METHODS

Three types of observation were used to study the tissues around the vesical neck, minimizing distortion created by opening the retropubic space: 1) Dissection of an embalmed cadaver by removing the pubic bones. 2) Examination of 1500 serial Mallory and elastin stained histologic slides of the pelvic viscera from 8 individuals, (0-37 years); fixed, *in situ*. 3) Dissection of 20 fresh cadavers (17-78 years) where tissues could be manipulated to recreate different vesical neck positions.

RESULTS

An 8 cm fibrous band, composed primarily of collagen (arcus tendineus fasciae pelvis=ATFP), is suspended between the lower pubic bone and ischial spine bilaterally. A separate group of collagen, elastin, and smooth muscle fibers, (precervical arc=PCA) runs in a transverse orientation, between the two ATFP's in their anterior half and attachs to the anterior vesical neck (VN). In this region of the ATFP, the medial levator ani muscle (LAM) arises 3cm above the ATFP from its origin on the superior pubic ramus to run posteriorly, lying lateral to the ATFP. Posterior and lateral to the VN, the vaginal wall (VW) and VN's adventitia are attached to the LAM muscle, allowing it to control VN position through these connections.

The configuration of the PCA changes with VN movement in a way which could influence VN closure. Relaxation of the LAM (Figl) allows the VN to rotate posteriorly and inferiorly, by its attachment to the vaginal wall and VN adventitia, so it lies behind and below the origin of the PCA, in an orientation where the PCA pulls anteriorly on the VN,

facilitating its opening. When the LAM contracts (Fig2) to resume its normal resting tone, it moves the urethra anteriorly. This compresses the VN against the PCA, favoring closure.

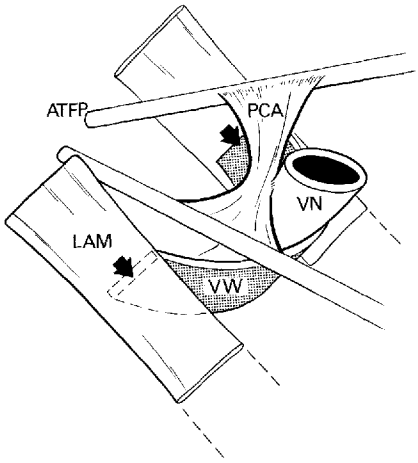

Figure 1: Relaxation

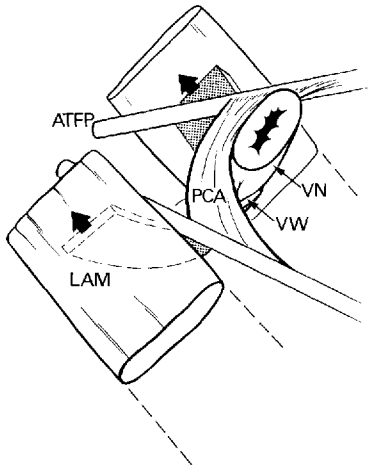

Figure 2: Contraction

CONCLUSIONS

These anatomical observations, suggest the following hypotheses. Relaxation of the levator ani muscles favors vesical neck opening by placing it in a posterior-inferior position where the PCA pulls its anterior wall forward. Contraction, moves the VN anteriorly, compressing it against the PCA, favoring closure.

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IN VIVO MEASUREMENT OF DYNAMIC DETRUSOR STIFFNESS WITH SMALL AMPLITUDE FORCED OSCILLATIONS.

AIMS OF STUDY

The visco-elastic characteristics of the passive detrusor have been extensively studied in the past and several types of lumped parameter models have been proposed. The validity of such models, however, have not been tested in the actively contracting bladder. The aim of this study was, using the forced oscillation technique, to measure in vivo the change in visco-elastic properties of the detrusor brought about by active contraction.

METHODS

Mongrel dogs were anesthetized with sodium pentobarbital, and their bladders surgically exposed through an abdominal incision. The proximal urethra was isolated at the level of the prostate to allow

external urethral perfusion. Starting with an empty bladder, 100 cm^3 of saline were slowly introduced at 30 ml/min into the bladder with a small amplitude oscillatory volume (1 cm^3) of normal saline superimposed on it. The oscillatory volume was generated by a linear-motor-driven syringe at frequencies of 2 and 4 Hz and introduced to the bladder through a 9.53 mm ID uncompliant plastic tube across the detrusor wall. Instantaneous flow was measured with an electromagnetic flow meter between the oscillatory pump and the bladder. Isometric detrusor contraction was induced by continuous intraurethral flow which was maintained for the duration of the contraction. Detrusor pressure (P_{det}) and instantaneous flow (Q) were recorded in a computer throughout the maneuver. Instantaneous bladder volume (V_{bl}) was calculated by numerical integration of the flow signal, and dynamic detrusor stiffness (ψ) was calculated from the ratio of the peak-to-peak amplitudes of the oscillatory components of P_{det} and V_{bl}.

RESULTS

Strong bladder contractions were consistently induced and sustained for more than one minute by continuous intraurethral infusion (fig 1). The contractions were characterized by a rapid increase in mean detrusor pressure ($\overline{P_{det}}$), followed by a 30- to 50-second plateau of slowly decreasing pressure, and ending with a more rapid deactivation phase. ψ was less than 4 cmH_2O/cm^3 at low bladder volume and increased to 6 cmH_2O/cm^3 during the slow infusion period. Bladder contraction was accompanied by a rapid increase in ψ, which varied in direct proportion to $\overline{P_{det}}$ and reached values above 45 cmH_2O/cm^3 (Fig 3a). There was a constant phase lag angle (ϕ) of 30° between pressure and volume which was independent of $\overline{P_{det}}$ (Fig 3b). The elastic component of ψ was calculated from the component of P_{det} in-phase with V_{bl} and the viscous component was calculated from the component of P_{det} 90° out-of-phase with V_{bl}.

Increasing frequency to 4 Hz increased the magnitudes of ψ and ϕ (Fig 3). This change resulted in an increasing in the viscous component of ψ while the elastic component remained unaffected by frequency.

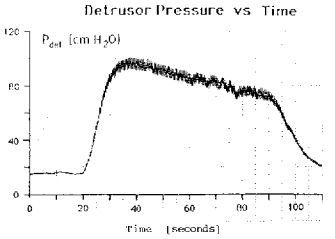


Fig 1: Detrusor Pressure with superimposed oscillations

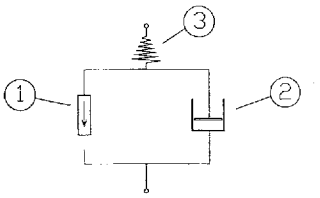
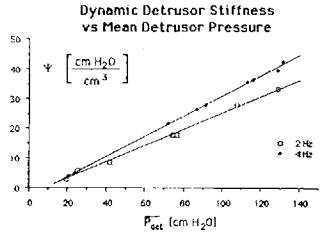


Fig 2: Model of Detrusor



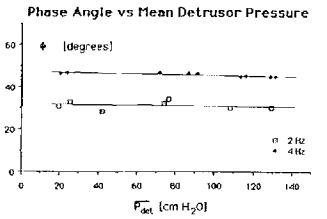


Fig 3: Magnitude (ψ) and Phase (ϕ) of dynamic detrusor stiffness vs mean detrusor pressure, $\overline{P_{det}}$.

CONCLUSION
The measurement of dynamic stiffness using the small amplitude forced oscillatory technique selectively measures the fast responding elements of the muscle. Slowly adapting elements, with time constants much longer than the period of oscillation, are therefore not tested with this technique. The measurement, however, has the advantage that it can be performed under both active and passive muscle conditions. The findings that the elastic component of ψ increases linearly with generated pressure, and that only the viscous component was affected by frequency, suggest a new physical model of detrusor muscle mechanics. In that model, the contractile element consists of a force source (1) in parallel with a Newton element, (dash-pot, 2) and in series with a non-linear Hook element (spring, 3) with elastic constant proportional to deformation (fig 2).

3

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EFFECTS OF ANAESTHESIA ON URETHRAL SPHINCTER DURING INCONTINENCE SURGERY

AIMS OF STUDY
Several methods of testing urethral sphincter function during surgery of stress urinary incontinence have been described and are in current use. These include measurement of urethral length (Mitrani 1971, Stamey 1980), urethral pressure (Reid 1985), urethral angle (Cutner 1985), observation of passive urine flow (Stamey 1973) and stress leakage (Pereyra 1982, Mundy 1983) and endoscopic (Stamey 1980, Williams 1982) and sonographic (Richmond 1987) visualisation of the bladder neck. The modifying effect of anaesthesia on urethral function is usually disregarded.

PATIENTS AND METHODS
Urethral and bladder pressure were measured continuously and the fluid bridge test was used intermittently (to detect bladder neck opening on applying suprapubic pressure) in 81 patients during induction of anaesthesia, administration of individual anaesthetic or adjunctive agents and during induction and reversal of neuromuscular blockade. Subjects were supine with comfortably full bladder (mean 416 ml, sd 134). Four were excluded (2 data inadequate, 2 unstable bladder) leaving 77 evaluable patients. 55 were continent and 22 stress-incontinent.

RESULTS
Bladder neck opening occurred more readily under anaesthesia particularly after muscle relaxation (Table 1).
Urethral pressure (measured 1.0 cm from bladder neck) was reduced significantly with most anaesthetic agents (Table 2).

Table 1: Anaesthesia on Bladder Neck opening (FBT)

Anaesthetic Agent	opens less readily	no change	opens more readily	p
Morphine/fentanyl	1/8	6/8	1/8	NS
Thio/Alth/halothane	0/18	6/18	12/18	<0.05
Relaxant	0/33	7/33 *	26/33	<0.002
Spinal	0/6	3/6 #	3/6	NS

* In 2 cases and # in 3 cases of GSI bladder neck already opened readily and no further change could be demonstrated.

Table 2: Anaesthesia on Urethral Pressure (UP) 1.0 cm from bladder neck

Anaesthetic agent	n	Mean UP (sd) (cm H_2O) pre-drug	post-drug	Ratio post:pre	p
Thiopentone	8	59.4 (19.2)	29.3 (14.2)	0.49	<0.002
Althesin*	6	71.9 (37.5)	43.9 (31.8)	0.61	<0.01
Halothane	8	72.8 (25.4)	57.7 (18.7)	0.79	<0.01
Morphine	4	63.5 (29.5)	51.5 (21.4)	0.81	NS
Fentanyl	5	54.5 (12.7)	48.9 (17.3)	0.90	NS
Alcuronium/thiopent.	18	46.7 (27.2)	15.2 (11.6)	0.33	<0.002
Alcuronium/halothane	8	73.1 (19.9)	39.7 (22.1)	0.54	<0.02
Pancuronium/Althesin	4	58.2 (31.6)	24.0 (14.6)	0.41	<0.05
Atracurium/Althesin	5	74.6 (27.2)	33.4 (10.9)	0.45	<0.01
Vecuronium/others	5	54.9 (13.8)	21.8 (11.6)	0.39	<0.05
Atropine	4	61.7 (34.3)	43.2 (30.2)	0.70	<0.05
Neostigmine/atropine	12	53.3 (21.9)	48.0 (26.7)	0.90	<0.05
Spinal cinchocaine	6	39.4 (13.2)	15.5 (6.7)	0.39	<0.05

* alphaxolone/alphadolone - now withdrawn in U.K.

CONCLUSIONS

The anaesthetic combination producing least disturbance to urethral pressure and function may include halothane induction, atracurium relaxation, maintainance with fentanyl (alfentanyl not yet tested) and 0.5% halothane, nitrous oxide and oxygen. Atropine should be avoided unless specifically indicated and stress tests would be undertaken at the end of surgery during recovery from atracurium and before administration of neostigmine/atropine.

Nevertheless urethral sphincter tests during surgery for stress incontinence must be interpreted with caution. Anaesthetic-induced urethral relaxation renders the sphincter less competent and gives the impression of unsuccessful correction of stress leakage. Attempts to produce a negative result may lead to over correction of the anatomic defect with resultant post-operative voiding dysfunction.

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4

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PEPTIDE, AMINE AND ENZYME-CONTAINING AUTONOMIC GANGLIA AND NERVE FIBRES IN THE HUMAN PROSTATE GLAND.

AIM OF STUDY

A number of putative peptide neurotransmitters have been identified in the mammalian prostate, but to date, few studies have investigated their occurence and distribution in the normal and adenomatous human prostate. The intention of this study was to clarify the situation in man.

PATIENTS AND METHODS

Specimens of prostate gland were obtained from 5 patients mean age 66.2 ± 5.98 years, all of whom were undergoing radical cystourethrectomy as treatment for carcinoma of the bladder. To allow for heterogeneity within the prostate, several regions of the gland were sampled (prostatic capsule, peripheral prostate; proximal, central and distal adenomatous prostate). Standard indirect immunohistochemical techniques were applied to the localisation of vaso-active intestinal polypeptide (VIP), substance P (SP), somatostatin (SOM), met-enkephaline (mEnk), leu-enkephaline (lEnk), neuropeptide Y (NPY) and calcitonin gene-related peptide (CGRP); the amine serotonin (5HT) and the enzyme dopamine beta hydroxylase (DBH).

RESULTS

A variable distribution of staining was evident in all regions of the prostate, which were sampled. The differential distribution of immuno reactivity observed was NPY, VIP, DBH, lEnk, mEnk, CGRP, SP (in order of decreasing concentration). SOM-like immunoactivity was occasionally observed in the prostatic capsule and central adenoma; CGRP and SP immunoactivity were predominantly associated with major nerve fascicles. NPY, BIP, DBH, 5HT, lEnk and mEnk were found around the alveoli and in smooth muscle bundles coursing between individual muscles. NPY, VIP and DBH staining were also observed to be related to blood vessels. Autonomic ganglia were found in all regions of the prostate, with up to 59 nerve cell bodies in a single ganglia and

containing all of the neuro-peptides except SOM and SP. NPY was the most plentiful compound within ganglia (followed in decreasing concentration by) DBH, mEnk, lEnk, CGRP, VIP and NPY. Multiple points of contact were evident between nerve fibres containing the neurotransmitters and accompanying cell bodies within ganglia.

CONCLUSIONS

This is the first report of neuropeptide, DBH and 5HT containing ganglia within the human prostate gland. Although knowledge as to the role of these compounds is at present incomplete, it is likely that they subserve a function as neurotransmitters. On the basis of animal studies, SP and CGRP are known to be specifically localised to sensory neurones and VIP and NPY are known to be co-transmitters with acetylcholine and noradrenaline respectively. A possible hypothesis is that prostatic ganglia act as gating circuits or "filters" to modulate excitatory input to the prostate. The importance of these findings in the light of current knowledge on the neural control of the prostate gland is reviewed.

5

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SPECIFIC AUTORADIOGRAPHIC LOCALISATION OF PROSTATIC ADRENOCEPTORS

AIMS OF STUDY

The principal motor innervation of prostatic smooth muscle is through the sympathetic component of the autonomic nervous system. This acts via the stimulation of alpha-1 adrenoceptors. Although both alpha-1 and alpha-2 adrenoceptors have been characterised in prostatic tissue using radioligand binding techniques; the actual histological localisation of human prostatic adrenoceptors using in vitro autoradiographic techniques has not previously been reported.

PATIENTS AND METHODS

Specimens of adenomatous prostate from 10 patients undergoing surgery for benign prostatic hyperplasia were immediately snap frozen in isopentane cooled with liquid nitrogen, sectioned at 10 microns and transferred to glass microscope slides. Using conventional techniques consecutive tissue sections were then labelled with tritiated quinuclidinyl benzilate (QNB) (muscarinic receptors), prazosin (alpha-1 receptors) and rauwolscine (alpha-2 receptors). In each case adjacent sections were treated to allow for non-specific binding, thus producing "controls". The labelled sections were then placed in apposition to emulsion-coated coverslips for 12-20 weeks (tritiated

prazosin and tritiated rauwolscine) or 5-10 weeks (tritiated QNB). The resulting autoradiographs were examined using a computerised image analysis system by two independant observers and the data was combined at the end of the study.

RESULTS

The differential regional localisation of these receptors within prostatic tissue was clearly demonstrated. Muscarinic cholinergic receptors were predominantly associated with glandular epithelium. Alpha-2 adrenoceptors were found principally in relationship to vascular tissue with only a sparse distribution related to glandular or muscular elements within the prostate. Alpha-1 adrenoceptors were located almost exclusively within muscle. The quantitative analysis of autoradiographs demonstrated a mean % gram occupancy/unit area within prostatic muscular tissue of: 4.5 $\pm$ 0.39 and 1.6 $\pm$ 0.37 for alpha-1 and alpha-2 receptors respectively.

CONCLUSIONS

Receptor autoradiography has substantial advantages over biochemical binding techniques in providing specific anatomical localisation combined with high sensitivity. The three receptor populations studied here were present in all of the prostatic compartments but with markedly different distributions. These results provide the first reported morphological evidence to support the concept of predominantly alpha-1 adrenoceptor mediated stimulation of human prostatic muscle. This work clearly shows that there is an alpha-1 over alpha-2 predominance for adrenoceptors, in prostatic smooth muscle. The muscarinic cholinergic binding sites are exclusively on glandular epithelium, in keeping with their proposed secretomotor function. However, the role of the alpha-2 binding sites observed here is still a matter for speculation. Although it is likely that they are principally involved in the control of vascular tone, they may play a modulatory role in muscular contraction.

6

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HOW RELIABLE IS THE PERCEPTION OF THE SEVERITY OF URINARY INCONTINENCE IN WOMEN?

AIMS OF STUDY

Visual analogue scores have been used in an attempt to quantify the patients subjective perception of her urine loss (Frazer et al 1987). However, the accuracy of this perception has not been previously studied. We compared the results of visual analogue scores with the objective assessment of urine loss using a two hour pad weighing test (Sutherst et al 1981).

METHODS

Women attending a urodynamic clinic were asked to indicate the severity of their incontinence on a 10 cm analogue scale. Each woman underwent a two hour pad weighing test, with the application of a pre-weighed perineal pad and the performance of a standard exercise regimen in the second hour following a 1 litre fluid load. The patients were also asked to indicate whether the urinary loss was less than, the same as or more than their 'usual' loss during the same activities performed in more domestic circumstances. We compared the analogue scores and pad test results of 58 women with genuine stress incontinence and 26 women with detrusor instability.

RESULTS

The results are shown in the figure. Overall, 67 of the 84 patients (80%) felt that the pad test accurately reflected their usual degree of wetness. Statistical comparison was made using Kendall's method of rank correlation for non-parametric data. This gave correlation coefficients of 0.177 and 0.258 for detrusor instability and genuine stress incontinence respectively. Similar degrees of wetness gave rise to large variations in the analogue scores, the tendency usually being for women to overestimate their wetness on the analogue score.

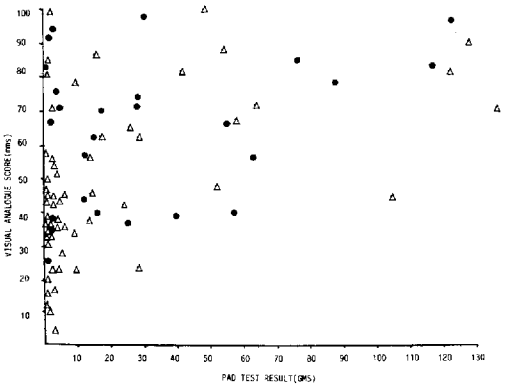

Figure. Visual analogue scores plotted against pad test results.
(● ■ Detrusor instability; ▲ = Genuine stress incontinence

CONCLUSIONS

There seems little apparent relationship between a patient's subjective impressions of the severity of her incontinence and a corresponding objective assessment by a two hour pad test. Even a careful history concerning the volume of urine loss is likely to be inadequate. The two hour pad weighing test overcomes the drawbacks of the subjective assessment of incontinence in women.

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7

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OBJECTIVE ASSESSMENT OF URINARY INCONTINENCE. THE ADVANTAGE OF RELATING 24 HOURS PAD-WEIGHING TEST TO FREQUENCY-VOLUME CHART ("COMBINED TEST")

AIMS OF STUDY

Several methods have been proposed for quantification of urinary incontinence. International Continence Society recommended the one-hour pad-weighing test in 1983 (1). The disadvantage of this method is that the initial volume is not known, and therefore the current diuresis during the test cannot be calculated. Recently, a 40-minutes test has been proposed (2). The initial volume is known because the bladder is filled to 75% of the maximum cystometric capacity. The test is finished with voiding, and the current diuresis can be calculated. Others have proposed 24 and 48 hours tests (3). These tests are probably more representative for urine loss during normal daily life. Furthermore, they can be performed in familiar surroundings and do not require co-operation of hospital staff.

The last 3 years we have in our department used the 24 hours pad-weighing test in combination with frequency-volume chart. The advantages of this "combined test" have been analysed.

PATIENTS AND METHODS

The "combined test" has been used routinely in all in-patients and in selected out-patients. During this test the patient weighs pads and records time and volume for each micturition during 24 hours (4).

RESULTS

The following 4 advantages of the method have been found:

1) The majority of patients with stress incontinence have an approximately normal diuresis of 1 ml/kg/hour as an average value. However, a few patients have a greatly increased 24 hours volume of urine (polyuria). The recorded urine loss can be reduced to an acceptable volume when the diuresis is corrected down to an average of 1 ml/kg/hour or less. This is easily done by asking the patient to reduce fluid intake to 1000 ml in addition to dry food.

Example: $\frac{\text{Leakage}}{\text{24 hrs volume}} = \frac{105\ \text{g}}{3200\ \text{ml}} \quad \frac{12\ \text{g}}{1100\ \text{ml}}$

2) Patients with large fluid intake will usually exhibit periods of high minute diuresis (e.g. 4-5 ml/min). Because urine filling is the specific stimulus for micturition reflex activation, patients with urge incontinence may experience more pronounced urgency with a risk of increased incontinence when the minute diuresis is high.

Example:

Time		Voided	
10.15	-	110 ml	
11.40	-	340 ml	): 340 ml in 85 min = 4 ml/min

3) By calculating incontinence in percentage of 24 hours diuresis it is possible to obtain objective information about the result of treatment when the patient has been improved but not cured.

Example: Before treatment: $\frac{240\ g}{1600\ ml} = 13\%$

After treatment: $\frac{110\ g}{2190\ ml} = 5\%$

4) It is our impression that urge incontinent patients record better that leakage occurs only just before micturition when they make a frequency-volume chart.

CONCLUSION

By combining 24 hours pad-weighing test with frequency-volume chart more functional information related to incontinence is obtained. As will be seen, the "combined test" has three advantages related to therapy and one to diagnosis.

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8

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VIDEOCYSTOURETHROGRAPHY: ITS ROLE IN THE ASSESSMENT OF INCONTINENCE IN THE FEMALE

AIMS OF STUDY

Videocystourethrography has been said to be the gold standard for evaluation of female urinary incontinence and voiding disorders (Turner-Warwick, 1979), but doubt has been expressed that it is necessary for all patients (Shepherd, 1985). We reviewed 200 consecutive VCUs performed in our Unit to evaluate (a) what otherwise undetectable pathology was revealed by the investigation and (b) whether the investigation materially altered our management.

PATIENTS AND METHODS

Radiological assessment was made of the presence of bony pelvic abnormalities; bladder and urethral morphology; presence of ureteric reflux; position, mobility and opening of the bladder neck; the interruption process and milkback; presence of fistula; residual and urethral stenosis.

The indications for evaluation were as follows: 143 for recurrent stress incontinence following bladder neck surgery, 25 for postoperative voiding difficulties or urge incontinence, 10 for total incontinence, five for pain, four for equivocal cystometry, three following artificial sphincter implantation and ten for other reasons.

RESULTS

Two patients were neuropathic (one spina bifida, one Parkinsonism). We observed two bladder diverticula and one megaureter. Ureteric reflux was found in one patient investigated for pain. Three urethrovaginal and one vesicovaginal fistulae already diagnosed clinically were confirmed. However, one each of suspected urethrovaginal and vesicovaginal fistulae were not diagnosed, requiring other tests to confirm their presence. In eighteen cases bladder neck descent was more marked than had been apparent from clinical examination. In 13 cases screening was performed during standing, in five of these permitting differentiation of sphincter incompetence from posture-induced detrusor instability.

CONCLUSIONS

Videocystourethrography is indicated for patients with postmicturition dribble when the diagnosis of diverticulum may be

made, or incontinence on standing. In the patient presenting with pain and lower urinary tract symptoms, the cystometric evaluation and the radiological search for reflux may be made concurrently. It is not necessary as a routine investigation in the non-neuropathic female with incontinence or voiding disorders, for whom cystometry will suffice.

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9

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Distal urethral electric conductance (DUEC) test: a screening test for female urinary incontinence?

AIMS OF STUDY

The standard urodynamic investigation is cystometry. This is an invasive technique. It can positively diagnose detrusor instability but genuine stress incontinence (GSI) is diagnosed by exclusion. Holmes (1985) compared the DUEC test and ICS pad test in 36 incontinent women. He found 100% correlation and further described three patterns of conductance. The aims of this study were to see whether these patterns were diagnostic of the underlying bladder pathology and whether the test was sufficiently sensitive to replace cystometry in certain cases.

PATIENTS AND METHODS

One hundred and four females with urinary incontinence were assessed using the DUEC test and twin channel subtracted cystometry (Plevnik 1985). During the cystometric study, after removal of the filling catheter, the DUEC catheter is inserted into the distal urethra whilst the patient gives a series of coughs, then washes her hands under running water for one minute. The catheter is removed and voiding cystometry is completed thereafter.

RESULTS

Patients complaining of incontinence are significantly more likely to have a positive DUEC test than abnormal cystometry (McNemar's test X^2=11.12,df=1, P 0.001). Three distinct patterns of urinary leakage can be recognised on DUEC testing. I - conductivity rise greater than 8 microamps for 2 secs; II - conductivity rise during

raised intra-abdominal pressure with superimposed spikes of conductivity 8 microamps; III - conductivity rise 8 microamps for 3 secs. A highly significant association between patients with patterns I and II or both and a normal detrusor pressure was noted and pattern III and a raised detrusor pressure (X^2=40.2, contingency coefficient, C =o.51, P 0.001).

SYMPTOMS		CYSTOMETRIC DIAGNOSIS			
	DUEC	GSI	DI	GSI&DI	NORMAL
Pure Stress Incontinence	I/II	6	0	0	3
	III	0	0	0	0
	I/II +III	0	0	0	0
	No leak	0	0	0	5
Pure Urge Incontinence	I/II	2	1	0	1
	III	0	3	0	0
	I/II +III	0	1	0	0
	NO leak	0	2	0	11
Mixed symptoms of urge and stress incontinence	I/II	13	2	2	6
	III	0	4	0	2
	I/II +III	3	7	4	5
	No leak	0	2	0	8

In the group with pure stress incontinence 6 patients had GSI on cystometry. These patients plus three more had DUEC I/II. No DI was found on either test. Thus these 9 patients could be correctly treated using DUEC diagnosis alone. Patients with pure urge incontinence and DUEC III all had DI on cystometry. In the group with mixed symptoms and DUEC III all could be correctly treated for DI without recourse to cystometry. If treatment is not successful cystometry may be appropriate. Thus using symptoms and DUEC patterns only, 53%(55/104) need cystometry to further investigate incontinence.

CONCLUSIONS

A positive DUEC correlates better with patient symptoms of incontinence than abnormal cystometry. DUEC I/II shows a highly significant correlation with normal detrusor pressure whereas DUEC III correlates with a raised detrusor pressure. This allows us to diagnose GSI from DUEC I/II and DI from DUEC III. DUEC gives objective evidence of GSI thus making a positive diagnosis rather than a diagnosis of exclusion as now exists. A combination of symptoms and DUEC patterns allows correct treatment in 47% of patients without recourse to the more invasive and time consuming cystometry.

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Plevnik S, Holmes DM, Janez J et al (1985) Proc. ICS 15th AGM London

10

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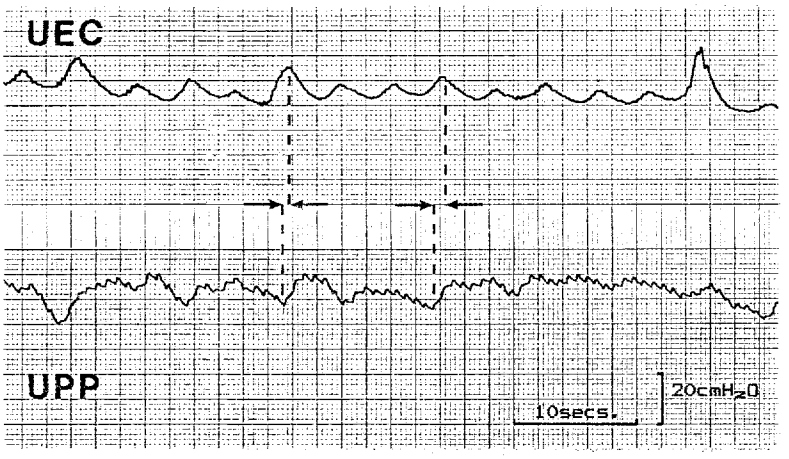
URETHRAL PRESSURE VARIATIONS: THE CORRELATION BETWEEN PRESSURE MEASUREMENT AND ELECTRICAL CONDUCTANCE IN GENUINE STRESS INCONTINENCE

AIMS OF THE STUDY Variations in urethral pressure have been identified in 10-20% of females with lower urinary tract symptoms (Kulseng-Hanssen, 1983). Different amplitudes of variation have been employed as criteria for the diagnosis of 'unstable urethral pressure' in various series, and this has led to confusion over the diagnosis and doubt as to its clinical significance. Hilton (1986) examined pressure variation in symptomatic and assymptomatic women, and showed that using a pressure variation equivalent to 30% of the maximum resting urethral closure pressure was the best discriminator, allowing the identification of a sub-group of stress incontinent women whose urethral pressure variation was likely to be of relevance to their symptomatology. The critical factor determining whether urethral pressure variations lead to, or contribute to, incontinence however, would seem to be whether they are associated with bladder neck opening; this is not readily observed by conventional pressure measurements. The measurement of urethral electrical conductance (U.E.C.) is a simple, recently devised technique for the detection of urine entry into the urethra (Plevnik et al., 1983). It appears to be not only a highly sensitive test of fluid entering the urethra, but also quantitatively reliable (Mayne and Hilton, 1988). It is possible therefore that the use of UEC measurement along with urethral pressure measurement may provide a useful investigative role in patients with unstable urethral pressure.

METHODS Thirteen women were studied; all had urodynamically proven genuine stress incontinence, and had stable bladders. Urethral pressure measurements at rest and on stress were performed using a microtransducer technique. Following the profiles the urethral transducer was placed in the region of maximum resting urethral pressure. A U.E.C. probe was introduced per urethram so as to lie with its electrodes at the level of the so-called 'bladder neck mechanism'. The urethral pressure and conductance were simultaneously recorded for a minimum period of 2 minutes, so that pressure variations could be recorded, and the correlation between them and conductance changes identified.

RESULTS Urethral pressure variations were recorded in absolute terms, in $cm.H_2O$ (delta MUCP-absolute), and in relative terms, as a percentage of the maximum resting urethral closure pressure (delta MUCP-relative); UEC changes were similarly recorded in absolute and relative terms. Of the 13 women, 10 showed pressure variations greater than $15cm.H_2O$ and also greater than 30% of their M.U.C.P., both being suggested as possible criteria for the diagnosis of 'unstable urethral pressure'. None however showed frank 'urethral instability' with a fall in M.U.C.P. to zero. There was no significant correlation between the overall maximal amplitude of variables of urethral pressure variation and those of urethral electrical conductance during the total study period. Individual traces, however, showed a very clear temporal relationship between the 2 variables, reduction in urethral pressure usually being associated with an increase in electrical conductance (see figure). In the majority of recordings the pressure and UEC changes occurred simultaneously, although in 5 the pressure change preceded the UEC change by up to 0.8sec.



CONCLUSIONS In patients with genuine stress incontinence although there is no correlation between the amplitude of urethral pressure variations and electrical conductance changes, there is a clear temporal relationship. Pressure reduction (in mid-urethra) is invariably associated with an increase in conductance (at the bladder neck). These findings suggest that the phenomenon of 'unstable urethral pressure' is associated with urethral opening, at least proximally, even when frank 'urethral instability' is not present. The closeness of the relationship suggests that whatever may be the cause of urethral pressure variations, it either affects the whole of the urethral simultaneously, or is rapidly propagated from the mid-urethra proximally.

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11

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PEAK AND AVERAGE URINE FLOW RATES IN A NORMAL FEMALE POPULATION - THE LIVERPOOL NOMOGRAMS

AIM OF STUDY

The study of voiding in women has been handicapped by the lack of clear guidelines for the normal limits of urinary flow rates. We sought to define such limits in a large normal female population.

METHODS

Three hundred and forty-seven women volunteered to answer a urinary questionnaire. They then voided once in a completely private toilet into a carefully calibrated Dantec Urodyn 1000 mictiograph. Two hundred and forty-nine women aged 16 to 63 were considered normal for the study. These women specifically denied any urinary incontinence, any of 5 symptoms of voiding difficulties and any previous bladder surgery. The peak and average flow rates of the normal women were compared with their respective voided volumes. Forty-six of these women repeated the study. Nomograms were plotted based on statistical transformations of the raw data.

RESULTS

Figures 1 and 2 show the respective nomograms of the peak and average flow rates in centile form.

There was no statistically significant variation in either peak or average flow rate with respect to age, parity or first versus repeated void.

CONCLUSIONS

The use of statistical transformations in the construction of these nomograms overcomes the problem with inaccuracies created by the use of raw standard deviations (SDs) where the excessive scatter of data above the line of the mean will be reflected in excessive SDs below the mean (i.e. the 2SD mark below the mean would be excessively low).

Both flow rates showed an equally strong relationship with voided volume. No deterioration of either flow rate was discernable at higher volumes. No artificial restriction of voided volumes within the nomogram e.g. to above 150 ml was appropriate, i.e. lower or higher volumes appeared just as useful in determining the normality of voiding.

These nomograms are offered as providing clear limits of urinary flow rates in normal women over a wide range of voided volumes (15 ml to 600 ml).

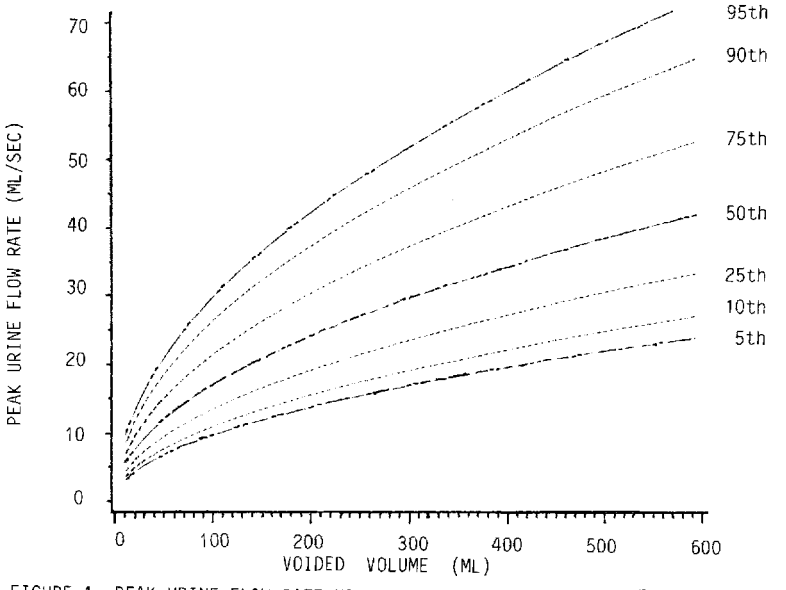

FIGURE 1: PEAK URINE FLOW RATE NOMOGRAM

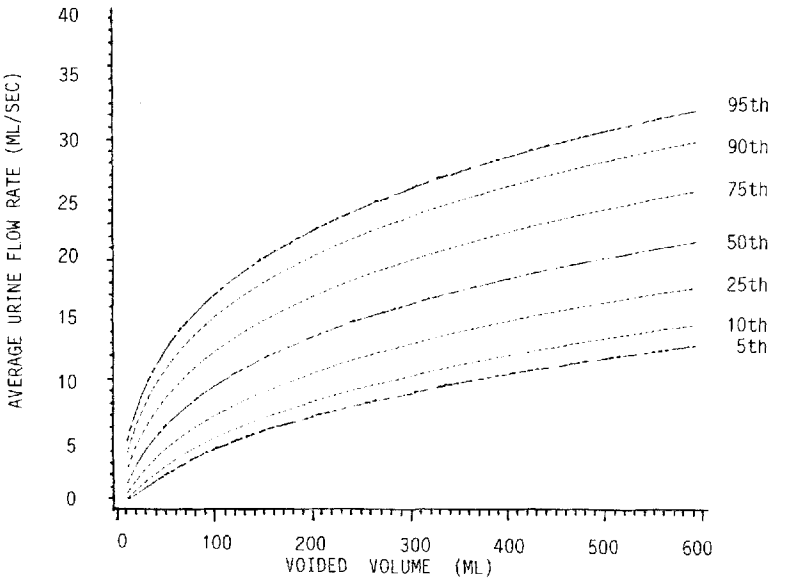

FIGURE 2: AVERAGE URINE FLOW RATE NOMOGRAM

12

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WHAT IS SENSORY URGENCY?

AIM OF STUDY

The term "sensory urgency", although often used, is imprecise. An attempt is made to refine the assessment of the sensation of filling in order to clarify diagnostic criteria used for sensory urgency in standard clinical videocystometrography.

PATIENTS AND METHODS

258 successive patients, referred from mixed gynaecology clinics, were included. Filling cystometry was carried out in the supine position and the patients were catheterised transurethrally to empty the bladder using a 10FG Pennine nelaton catheter. Intravesical pressure was measured by a fluid filled 16G Portex epidural catheter. A fluid filled Avon A63 narrow bore tube was inserted to record rectal pressure. The filling medium was Urografin 150 at 20°C , and the catheters were connected to a Dantec Urodyn 5000 cystometry recorder. The bladder was filled at the rate of 50ml/min.

With the investigator (I.D.V.) by their side, the patients were asked to report, into a hand held tape recorder, their sensations during filling. In addition, they were asked to indicate specifically the time of experiencing their first sensation of desire to void, and when the desire to void became strong. The

vesical pressure, rectal pressure and subtracted detrusor pressure were recorded throughout filling and the pressure trace reviewed with the tape recording to synchronise pressure and volume readings with the patient's remarks.

RESULTS

Despite encouragement, none of the patients expressed any consistent phraseology to describe their bladder sensations, although 56 (21.7%) did comment that their bladder felt cold at the onset of filling.
38 women (14.7%) were ascribed a primary diagnosis of sensory urgency. They had a mean volume at first sensation of 86.7ml, which was 31.9% of their mean cystometric capacity of 271.4ml. A further 45 women (17.4%) had an element of sensory urgency, although their primary diagnosis was one of either genuine stress incontinence or detrusor instability. This group had a mean first sensation at 118.5ml, which was 29.6% of their cystometric capacity of 400ml.
19 women (7.4%) had a diagnosis of detrusor instability, with a first sensation at 217.2ml, 48% of their cystometric capacity of 452.9ml. A further 124 women (48%) were diagnosed as having genuine stress incontinence with a first sensation at 263.9ml, 54.7% of their cystometric capacity of 482.2ml.
Those women with sensory urgency as their primary diagnosis show a smaller volume at first sensation ($p<0.001$) and a smaller cystometric capacity ($p<0.001$) compared with those women with either genuine stress incontinence or detrusor instability. They also develop the first desire to void at a lower percentage of their cystometric capacity ($p<0.05$).

CONCLUSIONS

We conclude that however imprecise the routine ascertainment of volume and pressure at first sensation and at strong desire to void might seem, we didn't find anything further was added by encouraging patients to be more vocal about their cognitive bladder function.
The standard two requests of time of first sensation and of strong desire to void do indeed, therefore, differentiate sensory urgency very accurately from other diagnoses. These patients experience first sensation at a significantly lower volume, and at a significantly smaller percentage of their cystometric capacity.

13

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THE EFFECT OF URETHRAL CATHETERISATION ON THE URETHRAL SPHINCTER EMG AND THE URETHRAL CLOSURE PRESSURE.

AIMS OF STUDY

It has been held by many investigators that the introduction of a catheter per urethram may stimulate muscular activity and hence alter the actual urethral pressure. Electromyographic studies in the rabbit support this assumption (Koraitim, 1982). However, there is a remarkable lack of knowledge about such an effect in humans. The aim of the

present study was to assess the effect of introducing a catheter into the urethra on the urethral sphincter EMG and the urethral pressure.

PATIENTS AND METHODS

Fortyeight female patients with various voiding dysfunctions admitted for urodynamic study participated. All patients were investigated in the supine position with an empty bladder. Before insertion of the urethral catheter a urethral sphincter EMG was obtained using a disposable vaginal surface electrode placed just behind the midurethra (Lose et al, 1987). During continuous EMG registration a urethral pressure profile catheter was inserted into the bladder and a urethral pressure profile was recorded after about 1 min. The catheter was then left in place and the profilometry was repeated 2 min and 5 min later. Continuous EMG registration was performed until the activity was identical with the initial activity before the urethral catheterisation.

The study population was divided into 3 groups as to the size of the profile catheter: Group I (n=13, mean age 59 years) had urethral profilometry performed with a 5F micro-tip transducer, Group II (n=23, mean age 54 years) with a 8F perfusion catheter with 2 sideholes and Group III (n=12, mean age 57 years) with a 10F perfusion catheter with 1 sidehole.

The EMG obtained was registrated, processed and displayed on a 6 channel recording system (DISA Uro-system 21F 2100). EMG activity was recorded in the range 4-10 μV.

RESULTS

The results are listed in the table. In all 3 groups a statistically significant increased EMG activity was observed after the introduction of a urethral catheter while the maximum urethral closure pressure (MUCP) was unchanged. The EMG activity returned to the initial level after a median time of 3 min, 3 min and 5 min respectively in the three groups. No correlation between changes in EMG activity and changes in MUCP could be established in the individual patient in any of the three groups.

Table

Median values of MUCP and integrated urethral EMG before and after insertion of urethral catheter.

	URETHRAL EMG (arbitrary units)					MUCP cm H_2O		
	resting state	insertion of catheter	1 min	3 min	6 min	1 min	3 min	6 min
Group I (n=13) (5F)	4.0	7.0	7.0	5.0	4.0	32	40	36
Group II (n=23) (8F)	4.0	6.0	5.0	4.5	3.5	56	50	55
Group III (n=12) (10F)	4.0	7.0	8.5	6.5	5.0	68	68	66

CONCLUSIONS

Introduction of a urethral catheter causes a temporary increase in urethral EMG activity in female patients. However, this increase in EMG activity cannot be correlated to corresponding changes in urethral pressure. Consequently, this phenomenon seems to be of minor importance in daily urodynamic work up.

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14

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THE EFFECT OF FILLING RATE ON BLADDER COMPLIANCE

INTRODUCTION

Bladder compliance is defined as the change in bladder volume per unit change in pressure during bladder filling (dV/dP). The normal bladder is highly compliant, the detrusor pressure rising little, if at all, during filling ($dV/dP \to \infty$). This phenomenon is the product of a combination of factors, including bladder geometry, Laplace's Law and the visco-elastic properties of the bladder wall.

Low bladder compliance is often seen in patients with neuropathic bladders and is an important cause of upper tract complications in these patients. However, the mechanisms causing low compliance are incompletely understood. Low compliance may reflect an increase in the connective tissue elements of the bladder wall or could be a neurally mediated phenomenon.

We have studied the effect of bladder filling rate on observed compliance in patients with neuropathic bladders in order to assess the importance of the filling rate in the diagnosis of low compliance and to examine the causes of low compliance.

METHODS

56 patients have been studied: 34 with spina bifida and 22 with other neuropathic vesico-urethral dysfunction.

All patients have undergone water filling cystometry recording bladder, rectal and subtracted pressures and filling on top of a residual urine where present. Patients were filled to capacity at 10 ml/min, the bladder then drained to the original volume, and the bladder refilled at 60 ml/min. The order of filling (ie 10 then 60 or 60 then 10) was varied at random to eliminate any potential effect of the order of filling on compliance. In patients with sphincter weakness where filling in the erect position led to continuous leakage and failure to fill the bladder, the bladder was filled in the supine position. In 2 patients a penile clamp was used to facilitate bladder filling.

The bladder compliance was calculated from the pressures and volume at the limits of the filling cystometrogram. Low compliance was defined as below 30 ml/cm H_2O .

RESULTS

Compliance was significantly improved when filling at 10 ml/min as compared with 60 ml/min. At 10 ml/min the median compliance was 11.0 ml/cm H_2O (range 2.6 - 183) compared to a median compliance of 5.8 ml/cm H_2O (range 1.3 - 28) at a filling rate of 60 ml/min ($p<0.05$ Wilcoxon rank sum test). 11 patients had low compliance at 60 ml/min but were normally compliant at 10 ml/min.

In all patients there was a predominantly linear relationship between pressure and volume during filling. Two patients showed particularly reduced compliance at low volumes, whilst 14 patients had a mild, progressive reduction in compliance as the bladder filled.

DISCUSSION

These results suggest that the diagnosis of low bladder compliance is only conclusive if assessed at low filling rates. Thus it may be wrong to assume that dilated upper tracts in a neuropathic patient are due to low compliance if this has only been demonstrated at high filling rates. This does not imply that low compliance demonstrated at high filling rates can be accepted as entirely normal as the vast majority of bladders demonstrate normal compliance at filling rates up to 100 ml/min.

The rate dependance of compliance and the predominantly linear relationship between pressures and volume during bladder filling in these patients are not compatible with simple mechanical models of bladder wall behaviour (elastic, visco-elastic, elastomeric). Thus, neural mechanisms would seem to be implicated in the causation of low bladder compliance in neuropathic patients.

15

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URODYNAMICS: WHICH TESTS AND EQUIPMENT ARE USED?

INTRODUCTION

Urodynamics have achieved considerable acceptance amongst clinicians working with patients who are suffering vesico-urethral dysfunction. However there has never been a survey which attempted to quantify the use and distribution of urodynamic services in a so called "developed" country with a sophisticated health service. In addition, the attitudes of clinicians as to the value of urodynamics in various patient groups and to their equipment have never been assessed. In particular, the views of clinicians as to the desirability of computerising urodynamic investigations is unknown.

We have conducted a postal survey of clinicians (of all specialties with a bias towards Urologists) in order to collect data on : the groups of patients investigated, the urodynamic tests performed, the equipment used and equipment design.

METHODS

Questionnaires were sent to 261 clinicians in the U.K. The questionnaires were directed to those known to have an interest in urodynamics. In addition, a questionnaire was sent to at least one clinician, (urologist, gynaecologist or general surgeon), in each of the 218 Health Districts in the U.K.

RESULTS

214 clinicians replied; from these replies 140 urodynamic investigation units were identified.

Patients: 71% of units investigated more women than men (median: 27% male patients to 73% female patients). Most patients were referred by urologists (median: 60% urology, 35% gynaecology, 5% other). Units also investigated patients from other specialties: 50% saw geriatric patients, 42% neurological and 21% investigated paediatric referrals. In most units patients other than urological or gynaecological referrals accounted for less than 10% of all patients seen.

Investigations: All units performed filling and voiding cystometrograms: 95% used slow fill (10 - 100 ml/min). 50% of departments performed urethral pressure profilometry (UPP): Brown Wickham 38%, catheter tip transducers 18%. 45% of all units had video: 15% for all investigations and 30% for selected patients only. 13% had the facilities for performing electromyography (EMG).

Equipment: 75% of units used only external pressure transducers, 20% used exclusively catheter tip transducers and 5% used both types.

96% of units used the traditional multichannel chart-paper recorder. However, 12% of units stored data (either raw of abstracted) on either floppy disc (10%) or hard disc (40%).

28% of clinicians had used a computer based system at some time. Of these, 60% felt these systems showed sufficient flexibility of use but only 50% thought they saved time.

82% of units thought their equipment was reliable whilst 16% had reservations and only 2% thought their equipment was unreliable.

CONCLUSIONS

The overall response rate was excellent and the number of units undertaking urodynamic studies was much greater than we expected. The survey gave encouraging evidence of doctors of different disciplines investigating patients referred from a variety of specialties. We feel this will lead to improved patient care because of the interchange of information and ideas.

Despite the adverse criticism that urethral profilometry has received half of all the responders found these tests helpful. Few units were using EMG. We were interested in the views of the clinicians on equipment design. There was less satisfaction with the computer systems, but this may be a reflection of their more recent introduction.

16

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WATER METABOLISM AND BLADDER INSTABILITY IN CHILDREN

AIMS OF STUDY

Unstable bladder contractions in children have been related to several factors or circumstances but its pathophysiology and etiology are obscure. The aim of this study was to correlate maximum capacity of urinary concentration with urodynamics findings of bladder instability in children with symtoms of unstable bladder.

PATIENTS AND METHODS

We have studied water metabolism in 100 children who had urodynamics findings of bladder instability. Maximum capacity of urinary concentration was determined in all of them with an exent liquid diet for 15 hours or dry diet plus intranasal DDVAP (Hendricks tedt modified). As a control group, 91 children with mild glomerular affectation which had not shown alterations of the tubular water physiology were used.

RESULTS

65 of children with bladder instability had normal osmolarity. 20 of them had concentration defect due to several causes and 15 were diagnosed with primary polydipsia (Total polyuries=35%). In the control group 1 case of polyuria and 4 of primary polydipsia were found (Total polyuries=5.4%). This difference is statistically significant. Of the 35 children with polyuria, 23 had instability, however there wasn't found any cause of the same in the remaining 12. Nevertheless in the control group, instability was found in 1 case. On the other hand in 17 children of the instability group without polyuria there wasn't found infection or any other cause of uninhibited bladder contractions.

CONCLUSION

Analizyng these results we conclude that uninhibited bladder contractions could be stimulated by excessive intake of water.

17

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LONG RANGE DOUBLE BLIND CROSS OVER STUDY OF DDAVP INTRANASAL SPRAY IN THE MANAGEMENT OF NOCTURNAL ENURESIS

AIMS OF STUDY

The lack of abnormal urodynamic findings in children with monosymptomatic nocturnal enuresis and the demonstration of the relation between bladder capacity/overnight urinary production and enuresis (Nørgaard, 1987) led to another approachto this condition. Re-

cently nocturnal enuresis was shown to be associated with abnormally low nocturnal secretion of vasopressin explaining the nocturnal polyuria found in these patients (Nørgaard, 1985 & Rittig, 1987). Accordingly encouraging results have been reported in both children and adult enuretics with short-time administration of desmopressin(DDAVP) (Dimson, 1986). The aim of this study was to study the effect of long-term treatment with DDAVP intranasal spray preceeded by individually dose-titration.

METHODS

The study comprised two parts - a dose titration period and a 24 weeks double blind treatment period of which a 3 weeks period was placebo. The dose titration period was proceeded by an observation period of two weeks where bed wetting frequency was recorded. During the following four weeks the dose to full effect was found by titration from 20 to 40 ug/day.

Thirty-one patients (aged 8-45, mean 17 years) were included in the dose titration study. All had 3 or more wet nights per week and were without diurnal symptoms or signs of any other disease.

RESULTS

Dose titration period:

Of the 31 patients studied 14 patients stayed on 20 µg/day, 3 patients on 30 µg/day, and 14 patients on 40 µg/day. During this period all but 7 patients obtained full effect. Three patients had some but not full effect on 40 µg/day and four patients showed no response on 40 µg/day.

Treatment period:

Twenty-one of the patients in the dose titration study have now completed the treatment period. The number of dry nights per week increased from an average of 2.2 during the observation period to 6.0 during the treatment period. In total 415 episodes of enuresis were recorded during the treatment period which was 78% lower than expected according to the observation period ($p<0.01$). The patients on 20 µg/day (9/21) showed a reduced incidence of enuresis of 91% compared to 84% in the patients on 30 µg/day (3/21) and 64% in the patients on 40 µg/day (9/21). Of the nine patients on 40 µg/day three patients showed results similar to the other groups(app.90%), while the remaining six patients had considerable less effect.

Placebo period:

A significant fall in the number of dry nights per week was found during the placebo period compared to the preceeding three weeks ($p<0.01$). No significant difference was found between the placebo period and the observation period. The number of dry nights per week increased promptly during the three weeks following the placebo period to a level similar to the period preceeding the placebo period.

CONCLUSIONS

In the majority of the patients (15/21) DDAVP significantly decreased the number of wet nights per week during 24 weeks treatment with app. 90% thus reducing the risk of bedwetting to a minimum. The study em-

phasizes the importance of titrating the dose needed for maximum response before initiating a treatment. No side effects were found.

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18

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DETRUSOR INSTABILITY: IS THE BLADDER THE CAUSE OR THE EFFECT?

AIMS OF STUDY

Detrusor Instability is believed to be a pathological condition of the detrusor muscle, the aetiology of which is unknown. Many treatment modalities (e.g. anticholinergies, antiprostaglandins, calcium channel blockers, etc.) have been used, all of which are less than optional. The present work was undertaken in order to study prospectively the urethral pattern in women with primary detrusor instability, including whether urethral pressure change may be the cause of the bladder contraction, and if preventing these pressure changes can affect detrusor patterns.

PATIENTS AND METHODS

Eighty-one patients with clinical and cystometric findings of detrusor instability were enrolled in the study. Patients received ditropan. 5 mg p.o. tid for 4 weeks and then
urodynamics were repeated. Those patients who failed treatment had ditropan discontinued and were placed or phenylpropanolamine 25 mg p.o. bid for 4 weeks and then re-evaluated. All patients who responded favorably were re-evaluated 4 weeks later. Seven patients were lost to follow-up and two patients discontinued their medication secondary to side effects.

RESULTS

Two patterns of urethral pressure changes with detrusor instability were identified. The 1st pattern of which 44(61%) of the patients demonstrated inhibited bladder contractions which preceded any change in urethral pressure. Thirty-eight (93%) of these patients responded to anticholinergics. The 2nd pattern had a urethral drop (≥20 cms H_2O) prior to a detrusor contraction (2-5 sec.) and 28 women demonstrated this pattern. Of the 31 patients who failed anticholinergics, 20 patients demonstrated this pattern, of which 19 (95%) responded to sympathomimetics.

CONCLUSION

These results suggest, although, both groups have clinical and urodynamic findings of detrusor instability, they represent two different entities. One third of the women in this study had urethral relaxation preceding detrusor contraction. This may explain why some patients respond to anticholinergics and others to sympathomimetics as demonstrated in this study.

19

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THE NATURAL HISTORY OF IDIOPATHIC DETRUSOR INSTABILITY A 12-YEAR FOLLOW-UP

AIMS OF STUDY

The natural history of idiopathic (non-neuropathic) detrusor instability is unknown and the clinical severity of most cases appears to wax and wane with time. This paper reports on a clinical and objective follow-up extending up to 13 years.

PATIENTS AND METHODS

Between 1974-1976, 75 female patients attending the Urodynamic Unit were diagnosed as having idiopathic detrusor instability. In 1987 these patients were traced and 40 agreed to clinical review, of whom 20 consented to cystometry. One other patient had developed multiple sclerosis and one patient refused. Their average age at review was 55 years (range 29-82). Data was reviewed according to symptoms, subjective perception of the condition, urodynamic measures and precipitating factors.

RESULTS

Urgency, urge incontinence and nocturia persisted in over 62% of patients. Stress incontinence only persisted in 5%. Mean scores of patients' subjective perception of their symptoms showed improvement for up to eight years followed by deterioration. No one particular symptom was responsible for this. Fourteen patients had a symptom-free interval from six months to five years and only in three patients was it related to treatment. Urodynamic studies showed a significant mean decrease in first desire to void ($p < 0.002$), bladder capacity ($p < 0.001$) and in bladder pressure rise during filling ($p < 0.007$). There was no change in peak flow rate or maximum voiding pressure. There was an increase in prevalence of systolic instability compared to low compliance but this did not reach statistical significance. One patient was asymptomatic and had normal cystometry. Eight patients had not received any treatment. The mean number of treatments for the remainder was 2.5 (range 1-5) and included drugs, electronic and behavioural therapies, physiotherapy and phenolisation. None of these made any difference to outcome or to persistence or severity of symptoms, except that the severity and number of symptoms seemed proportional to the number of treatments. The one asymptomatic patient (with normal cystometry) dated her cure from a cystodistension.

Multivariate analysis to identify factors implicated in the natural history of IDI showed no association for age, menopause,

educational background, previous surgery, parity or weight. However, a group of patients whose symptoms deteriorated and had no symptom-free interval were older, had a later onset of IDI and a greater latency between onset and seeking treatment. Twenty-eight patients found "trigger causes" for IDI and avoided them and their perception of the severity of IDI was less than the remainder ($p < 0.01$). No trigger cause was found in the remaining 12 patients.

CONCLUSIONS

Our analysis suggests that there may be several patterns to the course of idiopathic detrusor instability over time. The likely course of an individual's disease may be predictable to some degree based on various parameters at initial presentation. Currently available treatments do not appear to alter the patient's perception of the severity of her condition.

20

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DOXAPINE IN THE TREATMENT OF SEVERE FEMALE DETRUSOR INSTABILITY. A RANDOMIZED, DOUBLE-BLIND CROSS-OVER STUDY.

AIMS OF STUDY

Tricyclic antidepressants, particularly imipramine, have been demonstrated to have in vitro and in vivo effects on the lower urinary tract. In a recent in vitro study, comparing the potency of 5 tricyclic compounds including imipramine, doxapine was found to be more potent than the other agents with respect to antimuscarinic and musculotropic relaxant activity (Levin and Wein, 1984). This observation initiated the present double-blind cross-over study comparing doxapine with placebo in the treatment of detrusor instability.

PATIENTS AND METHODS

Twenty female out-patients (median age 53 years, range 29-78) with urge incontinence and detrusor instability during sitting medium-fill (50 ml/min) water cystometry entered the trial after giving their informed consent. All patients included had been treated unsuccessfully in the past with anticholinergic agents. Sixteen patients had previously undergone urogenital surgery: 12 had had a suprapubic anti-incontinence procedure, 9 vaginal repair and 7 hysterectomy. One patient had a neurogenic bladder dysfunction secondary to myelitis of the spinal cord.

After an initial run-in period of one week, the patients were randomized to recieve either doxapine or placebo in 3 weeks periods with 2 weeks wash-out before cross-over. The two first weeks of treatment 2

tablets (50 mg or placebo) were given 1 hour before bedtime. If the effect was unsatisfactory and the patient was free of side effects, the dose was increased in the last week of treatment to 1 tablet in the morning and 2 in the evening. The patients were evaluated initially and at the end of each period with interview, 3-days voiding and incontinence chart, cystometry, 1-hour pad test, ECG, blood pressure, heart rate and urine culture.

RESULTS

One patient was withdrawn from the study for personal reasons. Treatment with doxapine was prefered by 14 patients while 2 prefered pla cebo compared with the run in period. This difference was statistically significant ($p < 0.01$). Three patients had no preference. The median number of micturitions and incontinence episodes decreased significantly ($p<0.01$) during doxapine treatment compared to the run in period. During the placebo treatment the number of incontinence episode decreased significantly ($p<0.001$) while the decrease in frequency was not significant. There was a trend suggestive of a reduction in urine loss at the 1-hour pad test during treatment with doxapine ($p=0.07$). The median first sensation increased with 117% ($p<0.05$) and the cystometric capacity increased with 58% ($p=0.08$) during doxapine treatment while the corresponding values were 33% and 21% respectively during placebo treatment which was not statistically significant ($p=0.79$ and $p=0.84$).

Side effects were most frequent during treatment with doxapine (8 had dryness of the mouth, 9 fatique, 4 felt dizziness and 1 blurred vision). These side effects were well tolerated and did not deter 17 patients from asking for continued treatment with doxapine after the randomization code was broken. No significant changes were seen in the blood pressure, heart rate and ECG.

CONCLUSION

The population studied includes a number of patients who had been difficult to improve by conventional anticholinergic treatment. This study has proved doxapine to be significantly better than placebo in females with detrusor instability. Despite side effects doxapine seems to be useful even in severe cases of detrusor overactivity.

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21

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PRESSURE-FLOW DYNAMICS IN SPINAL CORD INJURED PATIENTS

AIMS: The dynamics of the lower urinary tract depend on the capabilities of the pump (bladder) and the outflow resistance (urethra) (Coolsaet, 1983). For a given detrusor at a given volume, the detrusor pressure is related to the flow rate by the "bladder output relation" (Coolsaet, 1986). We attempted to characterize the pressure-flow dynamics in spinal cord injured patients by using progressively increasing outflow resistance.

METHODS: We evaluated 15 spinal cord injured (SCI) patients aged 18 to 32 (mean 23.4 years) using pressure flow studies. Patients underwent filling cystometry using water at an infusion rate of 50 cc/min through a single lumen 22 French catheter. At the peak of the isometric detrusor contraction (DC), outflow from the bladder through the catheter was permitted and the flow rate was measured using a Life Tech flowmeter. The pressure was measured simultaneously through a side port located at the catheter outlet. This was repeated three times in each patient using three different standardized outflow resistances.

RESULTS:

Table 1. Characteristics of prevoiding detrusor contraction

(R=resistance)			R1	R2	R3
Volume at DC	(ml)	mean	161.4	170.2	183.9
		SEM	22.0	27.8	29.7
PO: peak pressure	(cm H2O)	mean	71.9	75.5	75.9
during DC		SEM	4.4	4.2	4.3
Duration of DC	(sec)	mean	28.8	29.6	29.4
		SEM	2.6	2.8	2.6

Table 2. Characteristics of diabetic patients

age	(years)	62.3	67.4	62.1±1.74	65.6	61.6	61.3 ± 4.7
duration DM	(yrs)	14.6	9.3	12.3±1.13 (**)	5.7	4.8	5.1 ± 0.9
(+)neuropathy	(n)	15	10	25 (31%)	2	1	3 (14%)
Abn. EMG	(n)	16	10	26 (33%)	1	1	2 (10%)
(+) insulin	(n)	23	20	43 (69%)	0	2	2 (10%)

(**)...p< 0.05 (NS)...not significant

Table 3. Urodynamic results

DH	(n)	23	16	39 (49%)	(NS)	7	8	15 (71%)
DA	(n)	12	14	26 (32%)	(NS)	0	3	3 (14%)
normal	(n)	10	5	15 (19%)	(NS)	1	1	3 (15%)
(+) BST (n=25)				16 (64%)		not done		
peak flow in cc/sec (n)								
		13.6 (23)	15.1 (17)	14.2 (40)		12 (1)	30 (1)	21 (2)

Discussion: In symptomatic diabetic patients, we found detrusor hyperreflexia (DH) in 53%, detrusor areflexia in 29% and normal cystometrics in 19%. As expected, the incidence of DH in patients with CVA was higher (71% vs. 49%) but the difference did not reach statistical significance. Obstruction is unlikely to be a factor for two reasons: 1) the prevalence of DH in females (46%) and males (51%) in Group 1 was the same, and 2) the uroflow values were only slightly impaired. In Group 1 patients, peripheral neuropathy occured in about one third of patients and was correlated with abnormal sphincter EMG ($p<.01$) and with insulin dependence ($p<.01$). However, the presence of peripheral neuropathy could not be used to predict which patients will have detrusor areflexia. A positive bethanechol supersensitivity test was demonstrated in 64% but there was no statistical correlation with EMG abnormality, peripheral neuropathy or insulin dependence. We conclude that in diabetic patients, although detrusor areflexia is an expected finding, it is not the most common abnormality. The higher than expected incidence of detrusor hyperreflexia in our series remains unexplained.

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22

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EXTENDED BLADDER PRESSURE MONITORING IN SPINAL CORD INJURED PATIENTS

AIMS: Little information is available on the nature and extent of bladder activity during physiologic filling with the patient's own urine production. We developed a technique that permits long term monitoring of intravesical pressure and applied it to a group of spinal cord injured patients. We present our initial findings with respect to detrusor activity using overnight bladder pressure monitoring (OBPM).

METHODS: Twenty two (22) male spinal cord injured patients (post spinal shock) with vesico-sphincter dyssynergia (VSD) were studied. The group consisted of 20 quadriplegics and 2 paraplegics; duration of injury ranged from 4 months to 5 years. Twelve patients were being managed with condom drainage, 5 patients with

intermittent catheterization, 3 with urethral catheters and 2 with suprapubic catheters. None of the patients had undergone sphincterotomy prior to OBPM. After emptying the bladder by catheterization, a 4 French single lumen catheter is inserted per urethra for OBPM. Bladder pressure is monitored by a single channel electronic manometer (Life-Tech 1101M). A condom catheter is placed and the patient is permitted to void around the catheter.

RESULTS: The results are summarized in Table 1 and sample tracings are shown in Figs. 1 and 2.

Table 1. Parameters of overnight bladder pressure monitoring

Mean no. contractions/hour	2.75
Mean peak amplitude above baseline (cm H2O)	56.7
Mean inter-contraction pressure (cm H2O)	4.8
Mean change in baseline pressure (cm H2O)	+7.8
Mean contraction time/ total time (%)	16.6
Mean contraction time with pressure > 40 cm H2O/ each contraction (%)	88.4

Conclusion: Long term monitoring of bladder pressure in spinal cord injured patients revealed that the patients had approximately three detrusor contractions per hour. Detrusor activity occupied 16.6% of total time monitored. Perhaps more importantly, during 88.4% of each contraction episode, the pressure was greater than 40 cm H2O. Thus, high intravesical pressure was present approximately 15% of the time monitored. Finally, we noted a tendency for the baseline pressure to rise during monitoring.

The effect of external sphincterotomy in lowering intravesical pressure is shown in Fig. 1 (pre-sphincterotomy) and Fig 2. (post-sphincterotomy) taken from OBPM in a 27 year old C-4 quadriplegic. Note the markedly decreased intravesical pressure after sphincterotomy. We expect OBPM may prove valuable in selecting patients at risk of upper urinary tract deterioration as well as demonstrating the efficacy of sphincterotomy.

Fig. 1

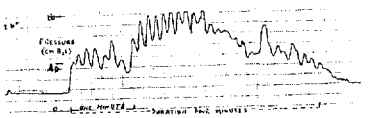

Fig. 2

23

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DETRUSOR BLADDER NECK DYSSYNERGIA REVISITED

AIMS OF STUDY. Although detrusor bladder neck dyssynergia(DBND) is a known cause of bladder outflow obstruction in patients with neurogenic and non-neurogenic bladder dysfunctions there have yet been no reports demonstrating bladder neck activity concomitant to detrusor contractions.The purpose of this study has been to investigate the pattern of DBND in neurogenic bladder.

PATIENTS AND METHODS. Twenty-two patients with spinal cord lesions -18 traumatic and 4 non-traumatic- were examined urodynamically with a 5 and a 3 microtransducer catheter for urethrovesical and anorectal recordings,respectively.During slow bladder filling (5ml/min) with a 25% dye solution proper localization of the transducers within the bladder neck and the membranous urethra was carried out under image intensifier. 100 mm spot films were taken as to allow a correlative analysis of simultaneous pressure measurements at various locations in the urethrovesical complex (bladder,bladder neck,membranous and bulbar urethra).Bilateral pudendal blocks and phentolamine injections were utilized in order to evaluate the potential role of the striated and smooth muscles on the activity of the bladder neck.

RESULTS. Four traumatic and 2 non-traumatic male patients displayed active bladder neck dyssynergia during uninhibited bladder contractions.Pressure measurements within the closed bladder neck consistently exceeded those recorded in the bladder. All six cases also had concomitant detrusor sphincter dyssynergia(DSD).Although pudendal blocks abolished DSD it did not extinguish DBND.Additional phentolamine decreased DBND but only in those patients where DBND did occur at the same time as dysreflexia (lesions above Th5).

CONCLUSIONS. Beside the known bladder neck dyssynergia which can be labelled "passive" because the neck remains closed during bladder activity with neck pressures lower than those recorded in the bladder there appears to be 2 other types of DBND which could be coined "active".The first one is to be found in lesions above Th5 during dysreflexia.It may be part of the dysreflexic syndrome.It will be influenced by phentolamine.The second one takes place in lesions below Th5 and may represent a viscero-visceral reflex -bladder-bladder neck- which does not seem to respond to phentolamine.Selective blocks of the striated urethral muscle component have shown that DBND is independant from DSD.These urodynamic studies have revealed for the first time the existence of an active type of bladder neck dyssynergia.

24

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SUBCUTANEOUS APOMORPHINE, A POTENTIAL TREATMENT FOR VOIDING DYSFUNCTION IN PARKINSON'S DISEASE.

AIMS OF STUDY

Urinary symptoms often occur in patients with Parkinson's disease. Detrusor instability and failure of urethral sphincter relaxation represents a common problem in these patients (Pavlakis et al, 1983). Previous studies have not revealed a consistent relationship between oral L-dopa medication and bladder function (Fitzmaurice et al, 1985). In patients with fluctuation of motor function in relation to L-dopa doses, subcutaneous administration of the dopamine receptor agonist apomorphine has been shown to produce a rapid and reliable improvement (Stibe et al, 1988). A study was initiated to determine the effect of apomorphine on micturition disturbance in patients with Parkinson's disease complicated by motor fluctuations.

PATIENTS AND METHODS

Five patients with Parkinson's disease and fluctuating response to L-dopa medication were investigated. All complained of urinary symptoms. Four were male and one female with a mean age of 62 years and mean duration of disease of 12.6 years. One male patient had previously undergone a bladder neck incision. An oral dose of the peripherally active dopamine receptor antagonist domperidone was administered two hours prior to investigation. Videocystometrography was performed while patients were in "off" phases following discontinuation of oral anti-Parkinsonian medication. The videocystometrogram was then repeated 20 minutes after a subcutaneous injection of apomorphine.

RESULTS

All five patients showed objective reversal of the extrapyramidal motor deficit following apomorphine injection. The bladder capacity was not significantly different between studies in individual patients. All but one patient had detrusor instability off treatment and the same patient was stable after apomorphine. One case had gross instability off treatment (maximum filling pressure 63 cms water) but was stable after apomorphine with the same capacity, but this was not the case in other patients. Each patient was able to void with an increased flow rate after apomorphine. The mean off treatment flow rate was 15.7 mls/sec (two were unable to void), while the mean post-apomorphine flow rate was 28.6 mls/sec (all were able to void). A single case with recurrent retention of urine was

regularly able to void to completion after apomorphine. No side effects were observed in any of these patients.

CONCLUSION

These studies of patients in "on and off" states show that a reversible bladder outflow obstruction due to disturbance of relaxation of the urethral sphincter mechanism is present in Parkinson's disease. Changes in bladder function following administration of apomorphine in conjunction with blockade of peripheral dopamine receptors imply that these effects are mediated centrally. It is suggested that assessment of voiding function by this method can help to distinguish between neural and mechanical influences in Parkinson's patients. The subcutaneous injection of apomorphine, by virtue of its rapid and reliable action, may therefore be beneficial in the treatment of patients with "off" period voiding dysfunction.

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25

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A COMPARISON BETWEEN OXYBUTININ AND TERODILINE IN PATIENTS WITH MULTIPLE SCLEROSIS

AIMS OF STUDY

A single blind cross over trial was undertaken to compare oxybutinin chloride and Terodiline hydrochloride in the treatment of multiple sclerosis patients with hyperreflexia.

PATIENTS AND METHODS

40 patients were entered into the trial. Each patient was studied subjectively by interview and objectively by urodynamics initially. They were entered into the trial if symptomatic hyperreflexic contractions were demonstrated. The first randomised course was given for 8 weeks (either oxybutinin 5mg t.d.s. or Terodiline 25mg b.d.) at the end of which repeat subjective and urodynamic assessment was performed. After an eight week

washout period, the patients were reassessed and the second course commenced and a final assessment carried out at the end of this 8 week treatment period.

RESULTS

7 patients dropped out of the trial - 5 because of cholinergic side effects, one because of retention and one with septicaemia after urodynamics. Of the remainder, all but 6 had improvement in the filling phase on both drugs which varied from marginal - usually the ability to reach the toilet to avoid urge incontinence, to marked improvement with suppression of frequency and urgency. However in all but 8 patients there was an increase in residual urine while on treatment which was usually demonstrated urodynamically but was clinically significant in 10 patients with residuals between 300 and 800cc. These were usually but not always in patients who had residuals of over 100cc initially. Two of them required self intermittent catheterisation and 3 developed severe urinary tract infection, requiring hospitalisation in one. There were greater side effects on oxybutinin.

CONCLUSION

Both oxybutinin and Terodiline are effective in suppressing or controlling hyperreflexia in multiple sclerosis patients, but usually at the expense of further compromising voiding efficiency. However long term treatment and self intermittent catheterisation would be acceptable if hand function was adequate. Though both drugs were equally effective, Terodiline had less side effects.

26

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TERODILINE FOR PATIENTS WITH URINARY INCONTINENCE IN NEUROGENIC BLADDER DISORDERS - EFFICACY AND TOLERANCE

AIM OF STUDY

Urinary leakage in patients with upper motor neuron lesions is often voluminous and occurs unexpectedly. Incontinence means a great problem to these patients who have difficulties to reach a toilet in time because of spasticity and coordination defects. In addition, these patients often have urinary frequency. Their detrusor hyperreflexia results in a high intravesical pressure, which has been difficult to affect by earlier mainly anticholinergic treatment. Terodiline - a drug with combined anticholinergic and calcium inhibiting properties - has been shown to be useful in treatment of urge incontinence associated with detrusor hyperactivity. The aim of the present study was to evaluate efficacy and tolerance of terodiline and placebo in patients with neurogenic bladder hyperreflexia.

PATIENTS AND METHODS

53 patients from 6 clinical departments (mean age 50 years) with upper motor neuron diseases took part in a randomized, double-blind, cross-over study. 39 patients (mean age 49, range 28-79 years - 16 men and 23 women) completed the study. The majority had a duration of more than 5 years of multiple sclerosis (26 pts), spinal traumatic injuries (2 pts) or other myelopathies (11 pts). 29 patients used technical walking aids, 14 patients were in need of wheel-chair. All patients had urinary frequency (>8 micturitions/day) and/or incontinence (>1/day). Hyperreflexia was verified by CMG in all patients. A run-in period of 2 weeks was followed by 2 treatment periods of 4 weeks with either terodiline tablets (25 mg twice a day) or placebo. There was a washout interval of 2 weeks between the treatments. Efficacy was evaluated by use of micturition charts of voiding frequency and leakage episodes. The patients' subjective evaluation was asked for at the end of each period.

RESULTS

In the 39 patients, who completed the study, the number of daytime micturitions and daytime leaking episodes were significantly lower during treatment with terodiline in comparison with placebo treatment. Considering the nighttime frequency and nighttime incontinence there was no difference (see Table).

Table. Frequency of micturitions and leaking episodes (mean values). The conventional significance level of 5% was used.

	Terodiline	Placebo	p-value
Micturitions daytime/day	8.1	9.5	$p<0.001$
Incontinence episodes/day	1.4	2.0	$p<0.01$
Micturitions/night	1.7	1.8	n.s.
Incontinence episodes/night	0.2	0.3	n.s.

30 patients expressed preference for one of the treatments. 23 patients (77%) preferred terodiline and 7 patients (23%) preferred placebo. 14 patients did not complete the study, 6 due to side-effects (5 on terodiline, main symptoms being depression, tiredness and vertigo). In 8 patients (3 terodiline and 5 placebo) deterioration of the primary disease demanding hospitalization, or social changes such as migration and insufficient compliance caused withdrawal. Incidence of side-effects in patients completing the study was 13/39 (33%) on terodiline and 7/39 (18%) on placebo. Dry mouth, slight nausea and blurred vision were complaints in 5 patients. No changes in blood pressure were seen and residual urine remained fairly constant during the study with no significant differences between treatments. 50 mg of terodiline was used for all patients, although 25 mg is recommended for elderly patients. The relatively high dosage also caused quite high serum levels of terodiline in some patients.

CONCLUSION

Although urge incontinence in patients with hyperreflexia is mostly hard to overcome, terodiline treatment resulted in a statistically significant reduction of urinary frequency and leakage. These patients often are delicate and multisymptomatic and previous treatment with anticholinergic agents has been less successful. The results indicate that the strong contractions in neurogenic bladders could be reduced by use of terodiline. The beneficial results might be explained by the combined calcium antagonistic and anticholinergic effects and the long half-life leading to smooth serum levels.

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27

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ORAL DESMOPRESSIN AS SYMPTOMATIC TREATMENT OF URGE AND INCONTINENCE IN PATIENTS WITH DETRUSOR HYPERREFLEXIA - preliminary results

AIMS OF STUDY

Urge and urinary leakage often are the most disabling symptoms in patients with upper motor neuron lesions, specially if there are coexisting walking difficulties. Anticholinergic drugs are usually tried as a primary treatment but are sometimes difficult to use in effective doses because of side effects. In patients with detrusor sphincter dyssynergia and outlet obstruction anticholinergic therapy may be unfavourable because of risk of urine retention. In this study, instead, desmopressin (DDAVP) - a synthetic antidiuretic hormone analogue - was given orally to patients with advanced urge and urine leakage due to detrusor hyperreflexia. DDAVP has no known effects on the bladder itself but leads to an increased osmotic tubular permeability and thus to a low diuresis. In patients with low functional bladder capacity the slower bladder filling rate may result in longer micturition intervals and continence. The fact that DDAVP can now be supplied in tablets is advantageous for patients with incoordination difficulties and visual defects. Oral administration has earlier had a good effect in treatment of diabetes insipidus.

PATIENTS AND METHODS

8 female and 2 male patients (mean age 50 years) with a duration of more than 5 years of multiple sclerosis (9 pts) and recurrent intramedullar cysts (1 pat) were studied. All patients kept a diary of voiding times during 7 control days and measured voided volumes during 24 hours before start of the study. At cystometry all patients had a hyperactive detrusor with early first sensation, low volume at first uninhibited contraction and a low functional bladder capacity. (Table I) Detrusor sphincter dyssynergia was found in 4 patients. Serum creatinine was normal as well as renal tubular concentration ability tested as the maximum urine osmolality after an intranasal dose of 20 µg desmopressin.

During the dose titration part of the study DDAVP was given in tablets in increasing doses during 3 days of each 100, 200, 400 and 800µg resp. The frequency of micturitions was determined daily and urine volumes were measured during the last day of every 3-days period. Weight and blood pressure were regularly controlled every third day. For the double blind part of the study the lowest dose was chosen, which according to the patients diary led to improvement. This part was performed as a randomized cross-over study with DDAVP and placebo during two consecutive periods, each of 3 weeks. The tablets were taken at the same time every day. Records were kept over micturition frequency and volumes during the last week of each medication period.

Table I. URODYNAMIC DATA BEFORE MEDICATION (mean ±SEM)

Volume at first bladder sensation (ml)	156	± 11
Volume at first uninhibited contraction (ml)	204	± 33
Flow rate ml/s	17	± 4
Subj max bladder capacity (ml)	293	± 45
Residual urine (ml)	56	± 15

RESULTS

A dose of 800 µg DDAVP was chosen as a therapeutic dose in 8 patients and 400 µg in 2. The micturition frequency during 6 hours from tablet intake decreased during the DDAVP compared to the placebo period. (Table II) The voided volumes were also lower during DDAVP treatment than in the placebo period but were not significantly reduced. 7 patients considered DDAVP superior to placebo because of less urinary leakage, 3 preferred placebo.

Table II. MICTURITION FREQUENCY (mean numbers and SD)

	Micturition frequency	Run-in period	DDAVP	Placebo	*Significance* DDAVP compared to placebo (p-value)
a)	0-6 hours after tablet intake	4.3±3.5	2.6±0.8	3.3±1.2	0.039
b)	during 24 hours	11.1±3.5	10.2±4.6	10.9±4.5	0.418

One patient was withdrawn from the trial because of pruritus and tachycardia during desmopressin treatment and is not included in the analysis. In all other patients no side effects were reported. No changes in blood pressure or body weight occurred. Serum electrolytes, creatinine or liver enzymes were not altered.

CONCLUSION

In this study it is demonstrated that DDAVP significantly can reduce the number of micturition episodes during a 6 hours period after tablet intake. DDAVP was well tolerated and no signs or symptoms of water retention were observed. DDAVP which means a new therapeutic principle can therefore be recommended as treatment of urge symptoms and urinary frequency in patients with neurogenic bladder disturbance. However, it is an expensive treatment and should at the moment be used when other therapies have failed. Even if DDAVP is only a symptomatic treatment it is often valuable for these patients to postpone leakage and reduce voiding episodes for a few hours during socially trying events. A combined treatment with DDAVP and a drug that increases bladder capacity seems tempting to try in the near future.

28

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EFFECTS OF CHRONIC ADMINISTRATION OF ESTROGEN AND PROGESTERON ON THE RABBIT LOWER URINARY TRACT

AIMS OF STUDY

In the urethra the presence of estrogen receptors together with a growth promoting effect of estrogen show that the tissue is a target organ for this hormone (Iosif 1981, Batra 1983). Animal experiments on the effects of sex steroids on the lower urinary tract have usually covered only a short period of time (Levin 1980, Larsson 1984). In the present study weights and motor responses of the bladder and urethra in rabbits were examined after treatment with either estrogen or progesteron for 4-6 months.

METHODS

Mature virginal rabbits were ovariectomized. The treatment started one week post-operatively and then, the steroids were injected every 10th day. The experimental groups were: (a) castrated (n=5), (b) castrated+estrogen-treated (polyestradiol phosphate, 1 mg/kg i.m., n=9), (c) castrated+progesteron-treated (medroxyprogesteron acetate 4 mg/kg i.m., n=7) and (d) intact (normal) rabbits (n=9). The bladders and urethrae were weighed. Muscle strips (2x4 mm), longitudinally orientated from the detrusor and circularly orientated from the mid-urethra, were mounted in organ baths. The tension of the preparations was adjusted to 10 mN. Muscle activity in response to drugs and electrical transmural nerve stimulation (supramaximal voltage, 0.7 ms, 0.2-40 Hz) was isometrically recorded.

RESULTS

Bladders and urethrae in estrogen-treated rabbits were 50-70 % and 100 %, respectively, heavier ($p<0.05$) than in the other groups of rabbits. After castration the detrusors were significantly ($p<0.05$) less sensitive to the parasympathomimetic betanechol, evoking contractions. The order of rank of sensitivity was (mean EC_{50} in μM): castrate (37) < estrogen-treated (23) < normal (14) < progesteron-treated (8) rabbits. The maximal contractile response (mN/mg tissue) to betanechol was the same in the different groups. In estrogen-treated rabbits, but not in the other ones, noradrenaline and the $alpha_1$-agonist phenylephrine evoked weak dose-dependent detrusor contractions. In the urethra, the sensitivity to noradrenaline, evoking contractions, was in the same range in all the groups (mean EC_{50} in normal rabbits: 30 μM) but for the estrogen-treated one where it was increased (mean EC_{50} : 9 μM, $p<0.05$). There were no differences in the sensitivity to phenylephrine. The maximal contractile responses of the urethrae to sympathomimetics were not changed in the different groups. In all the groups, but for the estrogen-treated one, the nerve evoked response of the urethra was at low frequencies (0.2-2 Hz) relaxation, at intermediate frequencies (5-10 Hz) relaxation followed by contraction and at high frequencies (20-40 Hz) contraction only. In the estrogen-treated urethra the relaxatory response had disappeared at low frequencies; at 2-40 Hz the response was contraction only. Parasympatho- and sympatholytic drugs were without effect on

urethral relaxation, while sympatholytic drugs almost abolished urethral contraction. Tetrodotoxin abolished the muscle responses to the electrical stimulation.

CONCLUSION

Long-term treatment with estrogen, but not with progesteron, increased markedly the weight of both the bladder and the urethra. Estrogen and progesteron increased the sensitivity of the detrusor to parasympathomimetics. Estrogen caused the detrusor to contract in response to sympathomimetics. In the urethra estrogen increased the sensitivity to noradrenaline but not to phenylephrine. The nerve-evoked relaxation of the urethra at low frequencies did not occur after estrogen-treatment.
The present results give further support for the rationale of treating women suffering from urinary disorders with estrogen.

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29

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INFLUENCE OF LONG-TERM ESTROGEN ADMINISTRATION ON ATROPIN SENSITIVITY IN THE RAT BLADDER.

AIMS OF STUDY

Studies of the effect of estrogen on the bladder indicate that estrogen have a syncholinergic action. The effects of a four-day-long estrogen administration on the cholinergic innervation of the immature rabbit bladder was studied by Levin et al. (1980 and 1981). No histologic evidence of induction of cholinergic receptors was found. Levin et al. demonstrated cholinergic agonists to be significantly more potent in stimulating contraction in the bladder strips from estrogen treated rabbits.
By administrating estrogen to one year old rats for a period of half a year the influence of a long term estrogen treatment on atropin sensitivity was investigated. Detrusor muscle strips from estrogen treated rats were compared to similar strips from ovariectomized-, ovariectomized- and estrogentreated- and control

rats, and the reversibility of estrogens influence on cholinerg innervation was studied.

MATERIALS AND METHODS

Fourtyfive one year-old white female rats were divided into 4 groups. One group (no 11 rats) was ovariectomized. Another (no 11 rats) was ovariectomized and estrogen substituted. The third group (no 10 rats) was only estrogen treated and the last group (no 14 rats) served as control. After half a year of estrogen administration the rats were sacrifized by an overdose of mebumale given intraabdominally. The bladders were isolated and removed. Each bladder was divided into two equal parts. The detrusor strips were mounted in a muscle bath containing a Krebs Ringer solution, glucose and an equilibrium of O_2 and CO_2. Isometric contractile measurements were made. Once equilibrium was reached scopolamine was added to one of a pair of detrusorstrips. The other strip served as a control.

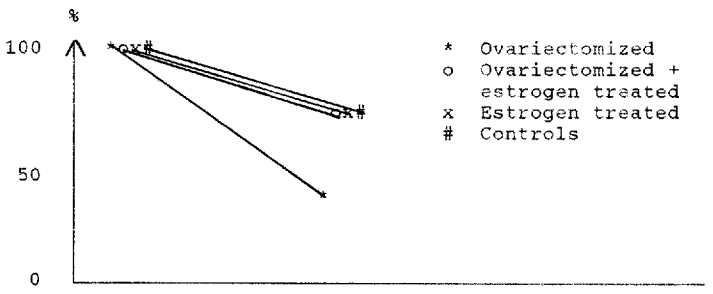
RESULTS

A significantly ($p < 0,05$) increased sensitivity to scopolamin was found in the group of ovariectomized rats as opposed to controls, the purely estrogen treated and the ovariectomized- and estrogen treated rats among which there was no variability.

CONCLUSION

We found that lack of estrogen increased the atropin sensitivity significantly suggesting that the cholinergic receptors become relatively more important in the detrusor of the estrogen insufficient rat. Substitution of estrogen was able to reverse the atropin response in the ovariectomized rat whereas supply of estrogen to the rat with an estrogen level within normal range did not alter the atropin response. We found a relatively greater importance of the cholinergic system in the ovariectomized rat. Further studies will investigate if this is the result of greater importance of the non-cholinergic innervation of the detrusor or the result of more cholinergic receptors in the ovariectomized.

Figure



The figure shows the percentage of decrease in contractility after administration of scopolamine.

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30

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THE EFFECT OF CONTRACTILE ACTIVITY ON MUSCARINIC RECEPTOR DENSITY AND THE RESPONSE TO MUSCARINIC AGONISTS

AIMS OF STUDY

Autonomic receptor density can be modulated by the level of neuronal activity. The best model for this is the response of the pineal gland to light and dark (in the rat). In the light, sympathetic activity to the gland is reduced and beta receptor density increases; whereas, in the dark sympathetic activity increases and beta adrenergic receptor density decrease. Thus, receptor density can be modulated by alterations in neuronal activity over a relatively short period of times (hours). The current study investigates whether increased *in-vivo* stimulation of urinary bladder smooth muscle can alter muscarinic receptor density and response to muscarinic stimulation.

METHODS

IN-VIVO STUDY: Male New Zealand White rabbits (2.5 kg) were sedated with ketamine/xylazine (25mg. ketamine, 6mg. xylazine/kg., i.m.). A one channel, transducer-tipped catheter was placed into bladder through the urethra and the bladder was emptied. A 4-0 silk suture was tied tightly at the proximal portion of the penis. Intravesical pressure was continuously monitored by the transducer-tipped catheter and recorded on a 6-channel Grass Polygraph. Intra-abdominal pressure was monitored by a second transducer-tipped catheter with a balloon fitted around the transducer and placed in the rectum. Control rabbits were sedated and a pressure transducer placed in the bladder and rectum but without the external urethral tie.

Each rabbit remained sedated for 4 hours at which time the animal was surgically anesthetized with nembutal (25 mg/kg). The bladder was excised as low on the urethra as possible. Intravesical volume was measured and the bladder was weighed and rapidly separated between base and body at the ureteral orifices. The bladder body was divided longitudinally in half. One half was placed into Tyrode's solution for muscle bath study; the second half was frozen and stored under liquid nitrogen for muscarinic receptor assay.

IN-VITRO STUDY: The effect of repeditive intermittent field stimulation on the contractile response and muscarinic receptor density of isolated strips was also investigated.

RESULTS

Stricture of the external urethra induced a condition of continuous uninhibited bladder contractions. It was clearly observed that there was no relationship between relationship between intra-abdominal and intravesical pressure. The average volume of the bladder at 4 hours was 35 ml, thus the bladders were not overdistended. The contactile activity of the bladder could be completely eliminated by iv hexamethonium.

Urethral stricure reduced the maximal response to field stimulation and bethanechol to 45 +/- 5% and 46 +/- 3% of the response of strips from control animals. There was no reduction in the contractile response to KCl. Urethral stricture reduced the muscarinic receptor density significantly from 34 +/- 3 fmole/mg protein to 22 +/- 3 fmole/mg protein. In a similar mannor, intermittent field stimulation (30 seconds on, 30 seconds off for 2 hours) resulted in a moderate (25%) reduction in the contractile response to field stimulation and bethanechol, and also resulted in a significant decrease in the muscarinic receptor density from control values of 29 +/- 2 fmol/mg protein to 18 +/- 2 fmol/mg protein.

CONCLUSIONS

Muscarinic receptor function and density is directly controled by the level of neuronal stimulation. In rabbits in which a high level of spontaneous activity was induced by urethral stricture, over a four hour period, a time when no overdistension was present, there was a marked and significant reduction in both the contractile response to muscarinic stimulation and in the muscarinic receptor density. Similar decreases in the contractile response and muscarinic density was induced by intermittent stimulation of isolated bladder strips. In both cases, there was no change in the contractile response to KCl, indicating that there was no defect in the contractile apparatus over the course of our experiments.

Clinically, This process of downregulation may help explain the presence of voiding disfunctions in patients showing a high degree of uninhibited bladder contractions.

31

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EFFECTS OF BRL 34915 AND PINACIDIL ON NORMAL AND HYPERTROPHIED RAT DETRUSOR MUSCLE.

AIMS OF STUDY

BRL 34915 and pinacidil are substances reported to act by opening of potassium channels in the membrane of smooth muscle cells. This leads to a hyperpolarization of the cell (Hamilton, 1986). In detrusor muscle from the pig, but not the guinea-pig, BRL 34915 has been shown to inhibit the contractile responses to carbachol, potassium and to electrical stimulation. Further, in pigs with detrusor instability BRL 34915 was reported to abolish the spontaneous activity (Foster, 1987).

In view of the reported species differences, it was of interest to investigate the effects of BRL 34915 and pinacidil on another species, the rat, comparing normal and hyperactive detrusor muscle.

METHODS

Bladder strip preparations from normal female Sprague Dawley rats as well as from rats with bladder hyperactivity due to outflow obstruction (Malmgren et al., 1987) were dissected and mounted in organ baths containing Krebs solution (37°C) continuously bubbled with CO_2 (5%) and O_2 (95%). Isometric tension was recorded on exposure to carbachol (cumulative addition), potassium (non-cumulative addition) and during electrical field stimulation. Electrical

stimulation was performed at supra-maximal voltage with a pulse duration of 0.8 ms. The stimulation frequency was varied between 0.5 and 80 Hz.

RESULTS

Both BRL 34915 and pinacidil (10^{-5}M) depressed the contractile responses to low concentrations (40 mM) of potassium. The effect was more pronounced in the hypertrophied detrusor. In normal detrusor pinacidil and BRL 34915 shifted the concentration-response curve to carbachol to the right. Moreover, BRL 34915 decreased the maximal response to carbachol in normal detrusor. The concentration-response curve to carbachol was also shifted to the right in hypertrophied detrusor after addition of BRL 34915 and pinacidil, whereas no effects were noted on the maximal response. The response to electrical stimulation was lower in the hypertrophied detrusor than in the normal one. Addition of BRL 34915 and pinacidil shifted the frequency-response curve to the right in both normal and hypertrophied detrusor. The maximal response to stimulation was also depressed after addition of BRL 34915 and pinacidil. However, the inhibiting effect of BRL 34915 and pinacidil on the maximal response was significantly larger in the hypertrophied detrusor than in the normal one. Pinacidil seemed to reduce the maximal response to stimulation to a greater extent than BRL 34915 in the hypertrophied detrusor muscle.

CONCLUSION

Pinacidil and BRL 34915 induced a rightward shift in the concentration-response relation to carbachol and potassium in both normal and hypertrophied rat detrusor. Further, in both normal and hypertrophied detrusor the response to electrical stimulation was also depressed by BRL 34915 and pinacidil. However, the hypertrophied detrusor seemed to be more sensitive to the potassium channel openers than the normal detrusor.

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32

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THE ACTION OF PINACIDIL IN THE ISOLATED HUMAN BLADDER

AIMS OF STUDY

The need for effective symptomatic treatment of patients with detrusor hyperactivity is widely recognized. Many drugs have been used in an attempt to treat storage failure by decreasing bladder contractility, among which the anticholinergic agents and calcium antagonists have defined mechanisms of action.

Pinacidil is a newly developed, anti-hypertensive agent. Its exact mechanism of action has been undetermined until recently. Pinacidil is now considered to produce its inhibitory effect by the opening of K^+-channels in the vascular smooth muscle, thereby hyperpolarizing the cells and

reducing the effects of excitatory agents.[1] Theoretically, this new therapeutic principle may be of interest in the treatment of detrusor hyperactivity.

METHODS

Specimens of normal detrusor were obtained from 24 male and 7 female patients, aged between 48 and 75 years, who were undergoing cystourethrectomy because of bladder malignancy. Strips of bladder were mounted in thermostatically controlled organ baths for isometric tension recordings. Efflux experiments, using ^{86}Rb as a marker for K^+, were also performed. Tissues were loaded with ^{86}Rb for 150 min following which efflux measurements were made using 2 min fraction collections.

RESULTS

Pinacidil (0.1-10 uM) concentration-dependently inhibited spontaneous, myogenic activity and caused a small decrease in basal tension. Concentration-response curves for carbachol and KCl and frequency-response curves for electrical field stimulation of nerves were constructed. Pinacidil at concentrations of 1 and 3 uM reduced the responses to $10^{-6}M$ and $10^{-5}M$ carbachol, but not to the highest concentrations used. Pinacidil at concentrations of 10 and 30 uM depressed the maximum of the concentration-response curve for carbachol.

Pinacidil (1-30 uM) applied 15 min prior to electrical stimulation, produced a concentration-related inhibition of the induced contraction at all frequencies. At the highest concentration used, 30 uM, maximum was reduced by 50%.

Pinacidil (1-30 uM) also produced a concentration-dependent reduction of responses to isotonic K^+ solutions containing less than 60 mM K^+. The responses induced by the highest K^+-concentrations used, 90 and 120 mM, were not changed.

After an initial rapid decline, the ^{86}Rb efflux rate constant quickly attained a low and stable value that remained constant throughout the experimental period. Pinacidil (1-30 uM) caused a concentration related increase of the ^{86}Rb efflux. At a concentration of 3 uM the increase was statistically significant. The increase in ^{86}Rb efflux caused by pinacidil (10 uM) was unaffected by apamin whereas TEA and procaine completely blocked the effect of the drug.

CONCLUSION

It may be concluded that pinacidil effectively inhibits spontaneous mechanical activity and contractions induced by activation of muscarinic receptors in the human bladder, probably by opening of K^+-channels permeable to ^{86}Rb. It is reasonable to assume that the opening of K^+-channnels is associated with a hyperpolarization of the membrane potential also in the human bladder. If so, pinacidil would have a mechanism of action that includes a lowering of the bladder smooth muscle excitability. This has relevance for the findings of Sibley,[2] who suggested that the morphological changes in the obstructed bladder is associated with a non-specific increase in membrane excitability leading to an increased sensitivity to contractile agents. Such supersensitivity may explain detrusor hyperactivity associated with infravesical outflow obstruction which may involve the normal reflex pathways and the normal efferent transmitter substances but may be triggered by a lower stimulus intensity than normal. In bladder hyperactivity caused by altered membrane properties of the smooth muscle cells a drug like pinacidil might prove useful as a therapeutic agent and clinical trials with the drug seem motivated.

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33

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THE EFFECT OF CROMAKALIM ON HUMAN DETRUSOR. AN IN VITRO AND IN VIVO STUDY.

AIMS OF STUDY

Cromakalim (BRL 34915) is a member of a novel group of benzopyran derivitives. It has been found to produce smooth muscle relaxation which is believed to be due to the opening of potassium channels. The effect of cromakalim on human bladder smooth muscle was investigated.

MATERIALS AND METHODS

Detrusor muscle was obtained from 10 patients with urodynamically normal bladders and from 10 patients with hyperreflexic bladders. The effect of cromakalim on the detrusor was investigated using standard isometric organ bath methods. In particular, the effect on spontaneous activity, on response to electrical stimulation and to stimulation with acetylcholine was evaluated.

RESULTS

Spontaneous activity in both normal and hyperreflexic detrusor strips was abolished 2 - 4 minutes after addition of 10-8M - 10-5M cromakalim to the bath. The effect lasted for 30 - 40 minutes. There was little effect on acetylcholine induced contractions with a more marked inhibition of electrically evoked contractions. These results were encouraging as previous studies in our laboratory have shown that increased spontaneous activity is one of the cardinal features of the unstable and hyperreflexic detrusor.

As a result 20 patients aged 18 to 65 with detrusor instability who had either failed to respond to other treatments or were unable to tolerate the side effects of these drugs were enrolled in a single blind trial.

Patients and Methods

3 patients had neuropathic bladder disorders and 17 had detrusor instability. The trial lasted 8 weeks with an initial 2 week "washout" period off all medication, 2 weeks on placebo, 2 weeks on 0.5mg Cromakalim and 2 weeks on 1mg Cromakalim. Patients were required to keep diaries of urinary frequency and voided volume charts throughout the study.

Results

Three patients failed to complete the study. Six patients (30%) responded to Cromakalim with an improvement in symptoms of urinary frequency. One of these withdrew at 6 weeks because of side effects. One failed to attend follow up. Four continued on treatment after the initial trial period, three of those had idiopathic detrusor instability and one neuropathic instability secondary to multiple sclerosis.

The main side effects were headache and skin rash. There were no haematological or ECG changes noted.

CONCLUSIONS

Cromakalim was shown to inhibit spontaneous activity whilst having an insignificant affect on response to acetylcholine and on the response to electrical field stimulation. This suggests that it may be useful in inhibiting the greater intrinsic contractile activity as seen in detrusor instability and detrusor hyperreflexia, leaving the cholinergic mechanisms of the bladder unaffected.

The results of the preliminary trials on patients with drug-resistant detrusor instability were encouraging and further studies will be carried out.

34

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ANTISPASMODIC EFFECT OF THE FLAVONE COMPOUNDS FLAVOXATE AND REC 15/2053 ON THE SMOOTH MUSCLE OF THE HUMAN PROSTATE AND URINARY BLADDER

AIMS OF THE STUDY

Previous studies on the mode of action of flavoxate have shown the drug to display a relaxant activity on rat urinary bladder strips depolarized by KCl, whereas anticholinergic compounds such as atropine or emepronium bromide were inactive (Cazzulani et al., 1985). In order to investigate flavoxate's musculotropic activity on human specimens, its effect on the contractions produced by the exposure to high K^+ in muscular tissue derived from the prostate (the adenomatous portion and the surgical capsule), bladder neck and the detrusor muscle was studied. Flavoxate was compared to its main metabolite MFCA, to a new flavone derivative endowed with antispasmodic activity namely REC 15/2053 (Nardi et al. 1981) and, in the bladder tissue, to oxybutynin.

MATERIALS AND METHODS

Strips approximately of 3*10-20 mm long were removed in patients at the time of open prostatectomy. Specimens of detrusor muscle, bladder neck, prostatic adenoma and capsule were obtained, as described previously (Caine et al., 1975). Strips were immediately placed in Krebs solution at 5°C and subsequently transferred to an organ bath containing the same solution at 37°C, gassed with a mixture of 95% O_2 and 5% CO_2, where they were examined by an isometric technique. A tension of 0.5-1 g was applied and the strips were allowed to relax for at least 1h.

Following stabilization, dose-response curves to increasing concentrations of KCl (10-100 mM) were obtained. After washing, a given concentration of drug was added and after at least 10 min contact a new dose-response curve to KCl was obtained . In the case of detrusor strips, the antagonistic effect of the tested drugs was evaluated after addition to the organ bath of a single dose of KCl (80 mM).

RESULTS

Flavoxate (10^{-4}-10^{-3}M) inhibited K^+-induced contractions in a dose-dependent manner on the prostatic adenoma, capsule and bladder neck tissue, IC50 values being 6.0 (3.1-11.5), 4.2 (3.0-5.9) and 4.5 (2.3-8.8) *10^{-4}M respectively.

MFCA (10^{-4}-10^{-3}M) also induced an evident inhibition in the prostatic capsule (IC50 = 7.8 (5.9-10.1) *10^{-4}M). In the prostatic adenoma (IC50 10^{-3}M) and bladder neck (11.6% of inhibition at 10^{-3} M) it was slightly active . Rec 15/2053 (preliminary results) tested at 10^{-4}M induced an inhibition of 29.2, 48.3 and 32.0% on prostatic adenoma, capsule and bladder neck respectively. In the detrusor muscle REC 15/2053 (10^{-6}-10^{-4}M) and oxybutynin (10^{-6}-10^{-4}M) were almost equiactive, the IC50 values being 8.9 (5.0-15.8)*10^{-6}M and 1.5 (0.7-3.4)*10^{-5}M respectively. Both were more active than flavoxate (IC50= 1.5 (1.2-11.9) *10^{-4}M) and MFCA (IC50 = 7.6 (4.5-12.6)*10^{-4}M).

CONCLUSIONS

Regardless of the receptor types distributed predominantly in the different tissues considered, ie. detrusor, bladder neck, capsule or prostate, K^+ exerts its contractile action by a myotropic mechanism involving an inflow of extracellular Ca^{++} after depolarization of the muscle membrane (Van Bremen et al., 1972), through voltage dependent Ca^{++} channels (Bolton, 1979). In view of this, the results reveal that all tested drugs are endowed with direct muscle relaxant activity, although in differing orders of potency.

REC 15-2053, unlike flavoxate, in this preliminary setting displays more activity at detrusor level than in the prostatic tissues.

In the prostatic capsule MFCA and flavoxate generated similar activities, whereas in prostatic adenoma and bladder neck the results so far indicate superior effects for flavoxate.

Of particular relevance is the fact that flavone derivates have shown musculotropic activity also in the prostatic tissues. Such findings indicate advantages for these compounds in the symptomatic treatment of micturition disorders associated with benign prostate hypertrophy.

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INTRAVESICAL INSTILLATION OF ANTISPASMODIC AGENTS

AIMS OF STUDY

Intermittent catheterization and oral pharmacotherapy with antispasmodic agents have improved the management of voiding dysfunction, such as is seen in neurogenic and augmented bladders. However, side effects of oral medication are often distressing to the patients. The aim of this study is to investigate the possibility whether intravesical instillation might be an effective route of administration of antispasmodic agents in both normal and cystoplastic bladders using in-vitro and in-vivo methodology.

MATERIALS AND METHODS

IN-VITRO STUDIES: The bladder of mature male NZW rabbits was excised and mounted in a 300 ml isolated bath as an intact whole bladder preparation. The bladder was instilled with 20 ml of saline and intravesical pressure was recorded on a Grass Polygraph. After 30 minutes of accomodation time, it was stimulated by field stimulation (80 Volts, 30 Hz, 1 msec). Five minutes later, the bladder was stimulated by 500 uM of bethanechol added to the extravesical fluid. The bladder was emptied and instilled with 20 ml of saline containing 100 uM of the following agents: atropine, oxybutynin, imipramine, verapamil and diltiazem. Field electrical and bethanechol stimulation were administered at 30, 60, 90 and 120 minutes following the intravesical instilation of drugs. At 120 minutes, the bladder was irrigated with saline several times and instilled with 20 ml of saline. The same stimulation procedures were performed 30, 60, 90 and 120 minutes after the removal of the drug.

IN-VIVO STUDIES: Cystoplasty with detubularized ileum was performed on adult NZW male rabbits. Cystometrograms were done under Ketamine/Xylazine anesthesia with infusion of saline at a constant rate of 2.0 ml per minute. Pressure was continuously monitored using a Statham pressure transducer and recorded on a Grass polygraph. 10 ml. of commercially available liquid preparations of the appropriate drug (Atropine Sulfate (0.5 mg), Lomotil (Diphenoxylate Hydrochloride and Atropine Sulfate, 10 ml of liquid preparation), Verapmil (7.5 mg), Lidocaine 1% (250 mg) solution (w/v) in sodium bicarbonate and Imipramine (25 mg) was instilled into an empty bladder through a Foley catheter. CMG was then repeated 60 minutes after drug instillation. This study was carried out on controls and at 2 months following ileocystoplasty.

RESULTS

The results of the in-vitro study are shown in Tables 1 and 2 and the in-vivo study in Table 3.

Table 1. MAXIMUM RESPONSE TO FIELD STIMULATION (% of control)

	TIME AFTER INSTILLATION (min)				TIME AFTER REMOVAL (min)			
	30	60	90	120	30	60	90	120
Atropine	85.0	73.2	77.3	75.5	88.5	90.1	85.9	89.3
Oxybutynin	45.4	41.9	39.0	36.0	45.7	52.2	59.3	63.0
Imipramine	80.1	63.4	52.9	52.9	54.7	72.5	82.6	67.5
Verapamil	80.1	40.6	23.6	18.9	28.1	35.2	40.0	42.6
Diltiazem	88.9	82.4	68.6	69.0	59.3	57.4	63.0	70.4

Table 2 MAXIMUM RESPONSE TO BETHANECHOL (% of control)

	TIME AFTER INSTILLATION (min)				TIME AFTER REMOVAL (min)			
	30	60	90	120	30	60	90	120
Atropine	60.1	50.1	45.4	38.0	58.7	80.3	76.0	81.2
Oxybutynin	12.3	6.6	4.8	4.8	17.3	15.0	19.9	20.0
Imipramine	89.2	68.4	63.7	56.0	67.9	76.7	90.9	80.7
Verapamil	40.2	22.0	19.9	14.5	13.7	19.0	24.8	24.0
Diltiazem	83.7	76.7	64.2	58.3	65.2	76.1	67.4	82.6

Table 3 CYSTOMETRIC PARAMETERS

	CONTROL	CYSTOPLASTY
Capacity (ml)	66.0 (10)	80.1 (16)
Plateau Pressure (cm water)	1.6 (0.2)	3.0 (0.1)
Frequency of spont. contractions	0	3.2 /10 min
Amplitude of spont. contractions (cm)	0	5.0 (1.2)
Volume at first contraction (ml)	66 (10)	42.2 (5.4)
Pressure of first contraction (cm)	2.1 (0.2)	3.2 (0.8)
Pressure of maximal contraction (cm)	14 (1.7)	13.2 (2.1)

The cystoplasty bladders showed an increased capacity, a high degree of spontaneous activity, and a reduced volume at evoked contraction as compared to the control bladders. Additionally, the plateau pressure was only slightly elevated from that of the control bladders, and the compliance of the cystoplasty bladders was only mildly reduced.

The intravesical administration of commercially available preparations only had mild effects on the urodynamics of the cystoplasty and normal animals. In the control rabbits Imipramine increased the capacity by 20%. There were no effects of the other drugs on any of the parameters in this group. In cystoplasty rabbits Lidocaine increased the volume at first contraction by 30%; decreased the frequency of spontaneous contractions by 18%; and increased the volume at maximal contraction by 21%. None of the other drugs had any reproducible effects in the cystoplasty bladders.

CONCLUSIONS

IN-VITRO STUDIES

1. Intravesical instillation of the all antispasmodic agents inhibited the contractions of the *in vitro* whole bladder induced both by bethanechol and field stimulation in a time-dependent manner.
2. The anticholinergics atropine and oxybutynin inhibited the response to bethanechol to a greater extent than the response to field stimulation.
3. Imipramine, diltiazem, and verapamil inhibited bethanechol and field stimulation to approximately the same extent.
4. Recovery from the inhibition was slow and incomplete. This factor may limit the usefulness of this method of administration in the non-catheterized patient.
5. Self intravesical instillation of antispasmodic agents might be a good therapy for patients with neurogenic bladder, especially who are already managed by intermittent catheterization.

IN-VIVO STUDIES

The local application of drugs in the bladder for the control of spontaneous contractions is a feasible and attractive alternative to oral medication. The lack of effect of some of the drugs on the filling CMG pressures may be due to a number of reasons: the dose used may be sub therapeutic; the drug may not be in its biologically active form; the pH in the urine may render it inactive; or the drug may not be able to penentrate the mucosa. Systemic absorption of the drug, especially if used at higher doses, is an obvious concern. Further work needs to be done to establish the optimal therapeutic dose and monitoring of serum levels to evaluate systemic absorbtion.

36

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THE RESPONSE TO ELECTRICAL FIELD STIMULATION OF DETRUSOR STRIPS FROM MEN WITH CHRONIC RETENTION.

AIMS OF STUDY

Animal studies (Speakman et al, 1987) suggest a link between bladder outflow obstruction, denervation and instability. Harrison et al (1987) demonstrated, pharmacologically, denervation and supersensitivity in men with instability secondary to obstruction. Men with chronic retention of urine share many symptoms with those suffering from simple 'prostatism', but they represent a very different clinical problem: they retain large volumes of urine and are

particularly at risk from upper tract dilatation and renal failure. The aims of this study were to investigate urodynamic function and responses of detrusor smooth muscle samples from men who presented with painless retention.

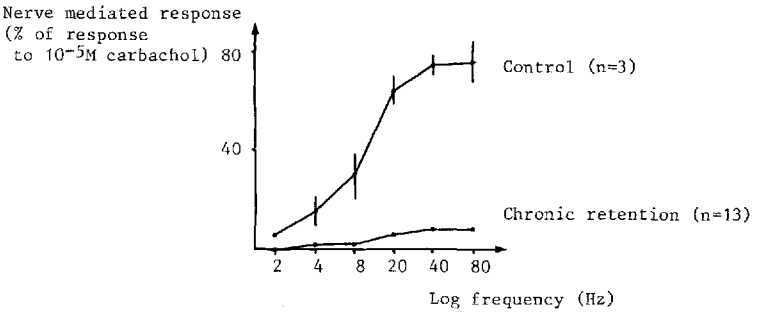
PATIENTS AND METHODS

Men with painless retention of urine of more than 300 ml were considered for the study. If the serum creatinine was less than 240 mM L^{-1}, they underwent urodynamic investigation: free flow rates were measured and cystometrograms performed without draining the residual. If the serum creatinine was higher, the bladder was immediately decompressed. At surgery transurethral specimens of detrusor were taken with the diathermy loop and placed immediately in cold oxygenated Krebs solution. In the laboratory 5 x 1 x 1 mm strips were dissected (mucosa removed) and mounted between parallel platinum electrodes in a standard 20 ml oxygen bath at 37°C. Contractile responses to carbachol and electrical field stimulation were recorded isometrically. That electrical field stimulation produced nerve mediated responses was demonstrated by their abolition by tetrodotoxin (10^{-6}M). Nerve mediated responses were expressed as a percentage of the maximal response to carbachol (10^{-5}M). For comparison, samples were also taken from asymptomatic subjects and men with 'acute' outflow obstruction.

RESULTS

21 men with painless retention have been studied to date. 16 have been assessed urodynamically: 13 of these were considered to be definitely obstructed (high voiding pressure and low flow rate, mean 9 ml/sec) while 3 had low (<60 cmH_2O) voiding pressures and low flow rates (mean 10 ml/sec). The 13 with obstruction had phasic rises in detrusor pressure on filling and/or a further sustained rise on standing; 12 had a raised end-fill pressure (>20 cm H_2O). The 3 with low voiding pressures did not exhibit contractions and had normal end-fill pressures on standing. Three asymptomatic controls (2 patients undergoing TUR(T) for localised transitional cell cancer and 1 organ donor) have also been studied.

In samples from both controls and chronic retention, carbachol (10^{-8}-10^{-5}M) produced a dose-related response that was antagonised by a small concentration of atropine (10^{-8}M). 10^{-5}M carbachol always produced maximal or near maximal contraction. Nerve mediated responses could be elicited from all three control specimens, 7 of the 13 with obstruction, and none of the 3 with low voiding pressures. These responses have been expressed as a percentage of the maximal response to carbachol.



CONCLUSIONS

In this ongoing study, it was found that a small proportion of men with painless retention are not urodynamically obstructed. All of those who were urodynamically obstructed also had evidence of instability. When compared to the maximal response to carbachol (10^{-5}M), nerve mediated responses reached a maximum of 10% in men with chronic retention and obstruction. Under the same conditions 3 specimens from asymptomatic subjects had a maximum nerve mediated response of about 75% of the response to 10^{-5}M carbachol. In chronic retention with obstruction the detrusor was unstable and had poor nerve mediated responses.

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37

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AN ASSESSMENT OF THE POORLY OR ACONTRACTILE BLADDER IN THE MALE IN THE ABSENCE OF NEUROPATHY

AIMS OF STUDY

It has been recognised that a small but significant percentage of males who continue to have symptoms of frequency, nocturia and urgency after prostatectomy prove to have poorly or acontractile bladders and poor flow rates on urodynamics. This fact stimulated the assessment, treatment and progress of patients with such bladders.

PATIENTS AND METHODS

68 patients aged 44-75 were originally studied on the basis of their urodynamic studies. 38 were discarded since their disturbance of bladder function was directly related to overt neuropathy. The remaining 30 patients had no evidence of neuropathy. Of these 18 had undergone at least one TUR. 14 had frequency urgency and nocturia, and 4 who had all had at least 2 TUR's were totally incontinent. The remaining 12 had been studied because of frequency, urgency, nocturia (plus perineal pain in 4 cases), were younger (<50 years), and/or had normal prostates to the feel.

RESULTS

Urodynamically 20 patients demonstrated no detrusor pressure during voiding at all and none reached a pressure of greater than 30cm of water. Similarly 27 patients had flow rates between 3 and 10cc/second and none were greater

than 15cc/second. However 18 patients emptied to completion by strain and only 4 patients had residual of greater than 100cc. The four patients who had erroneously had their persistent symptoms treated by repeat TUR were cured by insertion of an artificial sphincter. The post TUR group were treated with ubretid or carbachol without a single case being improved. The non-TUR group were treated either by bladder neck incision or beta blockers again without any improvement.

CONCLUSION

It is not clear why the male bladder may occasionally become acontractile either in the presence of obstruction or spontaneously without neuropathy. It is even less clear why most will hold at least 500cc and empty to completion or virtually so and yet have symptoms of severe urge syndrome. What is clear is that this is an untreatable condition, (except by accidentally - or deliberately) - making them incontinent and inserting an artificial sphincter.

38

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PRESSURE-FLOW STUDY COMBINED WITH STOP-FLOW TEST IN PROSTATISM

AIMS OF STUDY

Uroflowmetry is a useful screening procedure in prostatism, Jørgensen (1987), but a more detailed description of the voiding process necessitates pressure-flow studies. During pressure-flow studies both the "urethral resistance relation" (URR), Abrams (1979) and the "bladder output relation" (BOR), Griffiths (1977), may be delineated. However, the prognostic significance of these concepts has not been sufficiently clarified. Therefore a prospective study was undertaken, selecting the patients for prostatic surgery on an entirely non-urodynamic basis, while the results from an extensive urodynamic testing were blinded, Jørgensen (1987).

PATIENTS AND METHODS

Following exclusion of patients suffering from prostatic and bladder cancer, previous pelvic surgery, psychiatric, neurologic and metabolic diseases, the study group comprised 139 patients (median age 71 years, range 48-84 years), consecutively referred for prostatism. Nine patients were not considered as they for technical reasons had no preoperative pressure-flow study. The preoperative assessment included symptom score analysis, history of urinary retention and infection, residual urine, cystoscopy, serum creatinine and possibly intravenous urography. These data formed the background for the decision of surgery or not. The blinded urodynamic investigation consisted of uroflowmetry, medium-fill water cystometry and pressure-flow study combined with stop-flow test. Urodynamic infravesical obstruction (URR)

was decided from the nomogram of Abrams (1979). X-Y plot of the entire micturition was analysed in case of equivocal obstruction. Detrusor function (BOR) was examined in terms of the stop-flow test. Abnormal stop-tests were denoted patients with a theoretical maximum flow rate (Qm,est) less than 35 ml/sec (Qm,est = pdet,iso x Q /⊿p ml/sec, Griffiths (1977). All patients were re-evaluated 6 months postoperatively by means of symptom analysis, urodynamic testing as preoperatively and their subjective evaluation of the outcome of prostatic surgery, the latter being the key to the study.

RESULTS

URR : 87 patients were obstructed, 36 unobstructed, while 7 unambiguous patients were excluded. Preoperatively the two groups differed statistically significantly in urodynamic (uroflow and pressure-flow) variables, but not in symptom scores. Postoperatively no differences were found at all. However, the subjective success rate was significantly higher in the preoperatively obstructed group than in th unobstructed, namely 93% versus 78% ($p < 0.02$).

BOR : Stop-flow test was performed in 121 patients, but 23 had to be excluded because $\Delta p = 0$ (probably caused by reflex detrusor inhibition). 41 patients had normal detrusor function, while it was abnormal in 57. Pre- and postoperatively significant differences were found in Qmax and Qave, while generally symptom scores and pressure-flow variables were identical. Furthermore, the success rates in the two groups did not differ.

CONCLUSIONS

Preoperative classification of elderly males with prostatism in infravesically obstructed and unobstructed groups (pressure-flow study), proved to be of significant prognostic value, as to the subjective outcome of prostatic surgery.

Measurement of the detrusor function (stop-flow test) had no prognostic significance.

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39

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LOW DOSE INDORAMIN, AN ALPHA-ADRENORECEPTOR ANTAGONIST, IN THE MANAGEMENT OF BENIGN PROSTATIC HYPERTROPHY.

AIMS OF STUDY

Surgery is the treatment of choice for benign prostatic hypertrophy (B.P.H.) but for patients unwilling or unable to undergo surgery or who are awaiting surgery there is a need for a medical treatment to alleviate symptoms. It appears that stimulation of alpha-adrenoceptors contributes to the obstruction of B.P.H. and previous studies have shown alpha blockade to be effective in the treatment of B.P.H.(Caine[1978],Abrams[1982],Kirby[1987]). Indoramin is a competitive post-synaptic alpha-adrenoceptor antagonist with no ß-blocking, adrenergic neurone blocking or anti-cholinergic activities (Alps[1972a],Alps[1972b]).Recently, a pilot study using indoramin,(50-100mg. daily), produced significant relief of symptoms and improved peak flow rates (Iacovou[1987]). We therefore decided to investigate whether indoramin was effective in a lower dose range.

PATIENTS AND METHODS

A total of 139 patients with outflow obstruction due to B.P.H. and objective evidence of diminished urine flow were entered into a parallel group,placebo controlled study. One hundred and one patients have completed to date.Patients received either indoramin 20mg b.d., 20mg nocte or placebo in a double blind manner.Strict exclusion criteria were applied to ensure only patients with definite B.P.H. were entered into the study.Assessments were made of flow rates and voided volume. In addition subjective assessment was made of symptoms using the Boyarsky scale (Boyarsky [1977]) and the patients completed diary cards to record frequency and nocturia.

RESULTS

Full results will be discussed. The flow rate results of 88 patients will be presented in this abstract.

Peak flow rates improved by $\geq$15% in 82.1% of patients taking indoramin 20mg. b.d.(23/28 patients), compared with 63.6% on indoramin 20mg. nocte (21/33 patients) and 44.0% taking placebo (12/27 patients), ($p = <0.05$).This corresponds to a mean flow rate of 8.2 ml/sec at week 0 increasing to 15.6 ml/sec at week 8.

Of the 139 patients entered, to date,there have been six withdrawals (4.3%) due to adverse events, three on placebo (urinary tract infection, joint pain, agitation/anxiety), two on 20mg. b.d. (weak limbs, depression) and one on 20mg. nocte (failure of erection and ejaculation).All adverse events were mild.One patient on placebo was withdrawn due to worsening of his symptoms and two patients taking 20mg. nocte were withdrawn at their own request for non-study related events. A further ten patients defaulted or were excluded from analysis due to protocol violation.

CONCLUSION

These results indicate that indoramin, at the lower dose range of 20-40mg. daily, is a useful adjunct in the management of benign prostatic hypertrophy.There is no indication of a first dose hypotensive effect and the drug was well tolerated by the majority of patients.

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The U.K. Indoramin Study Group is comprised of the following centres:- St. Marys Hospital, Portsmouth; Dudley Road Hospital; Birmingham, New Cross Hospital, Wolverhampton; Walsgrave Hospital, Coventry; Kent and Canterbury Hospital, Canterbury; Royal United Hospital, Bath; General Hospital, Leicester; St. Woolos Hospital, Newport; Morristown Hospital, Swansea; Institute of Urology, London; General Hospital, Southampton; Royal Infirmary, Cardiff; Queen Elizabeth Hospital, Birmingham.

40

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Indoramin in the treatment of prostatic bladder outflow obstruction.

INTRODUCTION

A non-surgical method of treatment for bladder outflow obstruction due to prostatic hypertrophy remains desirable. Phenoxybenzamine, an alpha adrenoreceptor blocker, has been used with success, but has a high incidence of side-effects and may cause gastric dysplasia. Indoramin, another alpha-blocker, has been used successfully to treat hypertension since 1975. We have recently conducted a placebo controlled, double blind study of Indoramin in patients with proven bladder outflow obstruction.

METHODS

40 patients with symptoms of bladder outflow obstruction (subsequently confirmed with urodynamic studies) were entered into the trial. All patients initially received two weeks treatment with placebo.

Patients were then assessed by history, F/V chart, urine flow rates, urethral pressure profilometry and filling and voiding cystometrography (Week 0). They were then randomised to receive either 20 mg Indoramin b.d. or placebo. After 4 weeks treatment patients were re-assessed as at Week 0.

RESULTS (Table 1)

34 patients completed the trial (18 Indoramin, 16 placebo). Statistically significant improvement was seen in hesitancy, nocturia, volume voided (F/V chart), spontaneous peak flow rate, CMG peak flow rate, residual urine and urethral resistance. Improvement (not statistically significant) was also seen in frequency, bladder volume at 1st unstable wave, and detrusor pressure at peak flow. Other parameters remained unchanged.

Adverse events were recorded in 7 patients receiving Indoramin and in 7 patients receiving placebo. In 1 case on Indoramin, and 4 on placebo, these had been severe enough to warrant cessation of treatment. These 5 cases have been excluded from analysis.

CONCLUSION

Both symptoms and objective urodynamic parameters were improved by treatment with Indoramin. These results suggest that Indoramin may be a useful agent in the treatment of bladder outflow obstruction.

TABLE 1. RESULTS (All data are means)

	INDORAMIN		PLACEBO		
	Week 0	Week 4	Week 0	Week 4	Significance
Weekly nocturia	12.87	10.46	14.92	16.10	*p <0.01
Vol voided (F/V chart)	149.8	172.7	155.6	158.6	*p <0.05
Spontaneous peak flow rate	7.13	8.94	5.80	5.60	*p <0.05
CMG peak flow rate	6.71	9.36	7.00	6.56	*p <0.01
Residual urine	103.5	49.1	97.0	97.0	p <0.05
Urethral resistance	1.81	0.58	2.19	2.08	p <0.05
Daily frequency	8.06	7.28	8.50	8.38	NS
Bladder volume at 1st unstable wave	200.7	212.1	149.4	163.2	NS
Detrusor pressure at peak flow	97.8	81.2	106.9	103.4	NS

* Analysed after adjustment for differences between treatment groups at Week 0 using an analysis of covariance.

41

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VOIDING PATTERNS AFTER RELIEF OF RETENTION WITH THE DANISH INTRAPROSTATIC SPIRAL (PROSTAKATH (R))

AIMS OF STUDY

Acute or chronic retention due to benign prostatic hypertrophy (BPH) is usually treated with an indwelling catheter either before surgery or permanently. The intraurethral spiral was first described by Fabian (1980). Recently a Danish gold plated spiral has been designed along with a detachable device for insertion under surface analgesia with Lidocain-jelly. Transabdominal ultrasonic scanning was used for measurement of prostatic urethral length and control of

spiral position. In the present study we assessed the voiding patterns and flow rates during the first 3 months after spiral insertion.

PATIENTS AND METHODS

Thirtyfive consecutive patients with acute or chronic retention due to BPH entered the study. The median age was 76 years (range 50-93 years). All patients had oral prophylactic antibiotics for 1 or 2 days after spiral insertion. The patients were controlled 1, 2, 4, 8 and 12 weeks after insertion of the spiral with symptom analysis, urine cultures and uroflowmetry. Residual urine volume determined by transabdominal ultrasonic scanning was performed after 2 weeks.

RESULTS

Voiding was established after spiral insertion in all 35 patients. During the 3 months follow-up 5 patients had the spiral removed due to either incontinence, retention or displacement. Six patients had the spiral position adjusted endoscopically. Among the 30 patients with the spiral in situ at the 3 months follow-up, only 1 patient had fluctuating obstructive voiding symptoms, 7 had irritative symptoms and 3 had local complaints which were ascribed to the spiral. Four patients died of concomitant disorders in the observation period - but with the spiral in situ. The highest maximum flow rate in the observation period was 14 ml/s (median) with a range of 3-35 ml/s. Ten patients had significant bacteriuria when entering the study, but at 3 months follow-up only 8 patients had significant bacteriuria. Residual urine volume at 2 weeks control was 18 ml (median) with a range of 0-390 ml.

CONCLUSION

Treatment of acute or chronic retention with the intraprostatic spiral led to satisfactory voiding in the far majority of the patients. Local complaints were few. The registered flow rates were compatible with flow rates in healthy men in the same group. Infectious comolications were few, and bladder emptying judged by the residual urine volumes was good.

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42

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THE VALUE OF FREE FLOW RATE AND PRESSURE/FLOW-STUDIES IN THE ROUTINE INVESTIGATION OF BPH PATIENTS.

AIMS

Although urodynamics can definitely clarify the bladder voiding function, can clearly distinguish between different types of bladder

outlet obstruction and alterations in detrusor contraction strength, a pressure/flow-study is not accepted as an indispensable investigation before surgery for benign prostatic hypertrophy (BPH). The potential value of information available from pressure/flow-studies with computer analysis was investigated in a group of patients diagnosed and treated according to current standard routine procedures with free flow rate as the only urodynamic parameter.

PATIENTS & METHODS

All 68 patients (mean age 68 yrs.) consecutively submitted within 3 months to a town hospital for surgical treatment of BPH were included in the study. The routine investigation included patient's history, blood and urine laboratory parameters, rectal examination, uro-sonography, voiding cysto-urethrogram, cystoscopy, and free flow rate with residual urine volume determination. 8 pts were inoperable and excluded, 13 could not be measured because of various (medical, technical, and organisational) reasons.

In addition to the routine procedures 47 pts underwent pre-operative pressure/flow-studies via a suprapubic catheter which was placed to facilitate irrigation at TUR. Post-operative assessment is based only on symptoms and flow rate with residual volume.

Retrospectively the pre-operative urodynamic recordings were digitized and the computer analysis of the pressure/flow data for objectifying obstruction followed the concepts of PURR & DURR (Schäfer 85). 8 studies could not be evaluated: 4 pts could not void and 4 recordings were technically doubtful. Judgement of bladder outlet and detrusor function was based on these data alone, without any information about the patient. The measurements were specifically analyzed for compressive obstruction. The results were classified into unobstructed, obstructed, severely obstructed, as well as normal detrusor function, poor detrusor power, reduced detrusor energy.

RESULTS

According to free flow rate evaluation with the nomogram all patients were pre-operatively obstructed: 36 pts had a (-2) standard deviation maximum flow, 3 pts a (-1) st.d. maximum flow rate.

According to the PURR the degree of compressive obstruction was classified by the minimum urethral opening pressure (pmuo) as: severely obstructed [SO] pmuo > 40 mb [20 pts], obstructed [OO] pmuo = 25 - 40 mb [9 pts], and unobstructed [UO] with pmuo < 25 mb [10 pts]. No patient had a dominant constrictive obstruction.

After surgery in the SO-group the mean residual urine volume was reduced from 158 ml to 29 ml and the maximum flow rate increased from 4.8 to 20.8 ml/s at voided volumes of approximately 300 ml; in the OO-group this was 50 to 53 ml and 10.3 to 12.5 ml/s; in the UO 156 to 142 ml and 10.7 to 12.9 ml/s.

CONCLUSIONS

The free flow rate as the only urodynamic parameter in common use and established in the clinical routine of this hospital supported the diagnoses of obstructive BPH in all patients. According to the PURR only half of the patients were severely obstructed, one quarter were mildly obstructed, but one quarter were totally unobstructed with poor detrusor contraction power.

After surgery only in all severely obstructed [SO] patients a significant objective improvement in the voiding balance could be demonstrated by maximum flow rate and residual urine volume. In all other aspects, e.g. amount of resected adenoma, accompanying diseases, objective and subjective symptoms, we could not identify a significant difference between the patients at the time of dismissal from the hospital. These patients are followed now and more will be studied with the same procedure.

Free flow rate recordings alone are of poor value in the diagnosis of obstructive BPH. This "double blind" study shows that with 25% even more patients than the previously reported 10% (Schäfer 87) are surgically treated for BPH although they are not morphologically (mechanically) obstructed. Therefore, the rationale of surgical treatment for BPH and the role of urodynamics must be reconsidered.

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43

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FUNCTIONAL TYPES OF PROSTATIC OBSTRUCTION

INTRODUCTION

BPH compromises the process of voiding through two major mechanisms; interfering with bladder neck opening particularly at the beginning of flow and reducing the ability of the prostatic urethra to to convey urine due to configurational derangements such as compression, narrowing and kinking. Recognition of the obstruction patterns could be achieved earlier (Schafer, 1985) but the degree by which each of these mechanisms contributes to obstruction could not be assessed before. Advanced computer analysis of the voiding system energy profile during voiding enabled us to define, on functional basis, three different types of prostatic obstruction.

MATERIAL AND METHODS

Synchronous video/pressure/flow urodynamic studies were performed on 56 men (aged 60.8±10.7 years) who proved to have BPH. The simultaneously recorded detrusor pressure and urinary flow rate were digitized and analyzed by a set of computer programs, acting in sequence, to several parameters. These

were continuously followed throughout voiding. They include the rates of change in pressure and flow rate, bladder power and work, cumulative bladder and voided volumes. Further analysis of the changes in energy forms (external work and internal energy changes) resulted in a family of specific computer-generated performance indicators (CPIs).

DIAGNOSTIC PRINCIPLES

The discharge efficiency (DE) is a CPI which compares the external bladder work with the total energy change induced during voiding. It ranges from 1.0 (a theoretical optimum with maximum efficiency) to 0.0 (pump failure in isometric contraction). This index reflects the ability of the detrusor contraction to open the bladder neck and maintain it so during flow. The overall voiding efficiency (OVE), which was introduced by Schafer (1985), measures the volume of urine voided per unit energy discharged as external work. In other words it reflects, in terms of energy, the "readiness" of the urethra to conduct urine.

RESULTS

Results were compared with normal ranges of these parameters in men (surveyed in a previous study, submitted). When either parameter was subnormal (below -1SD of normal) but not the other, the diagnosis was directly made. When both were subnormal, their standard variables were compared by a type specifying weighing index [TWI = SV_{DE} / SV_{DE} + SV_{OVE}]. Grouping of the patients was based on the compromise in DE and OVE compared with normal. Subgroups in group III (when both parameters were compromised) were based on the TWI being above 0.6 [more compromise in DE, IIIa], between 0.4-0.6 [almost equal degree of compromise, IIIb] or below 0.4 [more compromise in OVE, was not encountered in any patient]. In group IV, neither parameter was subnormal.

GROUP	NO.	%	DE	OVE	TWI
total	56	100.0%	S: 25.1±13.7	S: 17.5± 8.9	
I	12	21.4%	S: 17.6± 7.5	N: 24.8± 5.6	
II	10	17.9%	N: 39.6± 4.0	S: 12.0± 3.4	
IIIa	8	14.1%	S: 11.1± 6.9	S: 13.0± 4.7	0.69±0.05
IIIb	14	25.0%	S: 22.0± 7.3	S: 10.8± 4.7	0.50±0.06
IV	12	21.4%	N: 39.8± 7.0	N: 25.3±10.1	

(S: subnormal - N: within normal)

CONCLUSION

Computer analysis of the energy profile changes in the voiding system determines the mechanisms by which the enlarged prostate compromises voiding function. Three functional types of prostatic obstruction could be defined. Type I (restrictive obstruction) is mainly due to the interference with bladder neck opening mechanism. Type II (dissipative obstruction) is mainly due to poor urine conduction in the urethra. Type III is due to both mechanisms, mainly the first (IIIa) or almost equally (IIIb). We believe that this approach will result in a better planning for treatment and selection of the appropriate surgical approach in every patient on functional basis.

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44

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BLADDER OUTLET CONDUCTANCE: EVOLUTION, NORMAL AND OBSTRUCTIVE PATTERNS

AIMS OF THE STUDY

We developed a method of demonstrating the pressure-flow relation throughout voiding by means of a computer-generated curve, which displays the ratio of flow rate to simultaneous detrusor pressure. The pattern of the curve in normal voidings and in patients with BPH shows distinct differences. An index for the degree of obstruction (the conductance factor, CF) could be derived to present an average value for the pressure flow relation for the whole voiding.

MATERIAL AND METHODS

Recorded data of the simultaneously measured detrusor pressure and urinary flow rate, obtained by video/pressure/flow urodynamic studies of 23 individuals (8 males and 16 females) who had no voiding abnormalities at the time of the study, as well as those of 80 patients who had obstructive voidings (due to BPH in 61 patients and vesical neck obstruction in 19 patients) were subject to this computer analysis. Pressure flow data were transformed into a digital form, using a special digitizer. A computer program synchronized the data with correction for the delay in flow rate measurement. The same program further analyzed them into several parameters followed throughout voiding including the rates of change in pressure and flow rate, cumulative bladder volume and voided volume and the ratio of the flow rate and detrusor pressure (instantaneous conductance). The bladder outlet conductance curve is the ratio continuously followed throughout voiding. Meanwhile the values of instantaneous conductance were integrated over time and divided by flow time to give the average conductance. The conductance factor (CF = average conductance x 100) as well as the conductance pattern, revealed from the curve, were studied.

RESULTS

Results are presented in table 1 and figure 1. A significant difference was observed in the pattern of the conductance curve between normal and obstructive voidings. The normal curve is markedly higher than the obstructive. A steep or sharp rise, a peak and a rather gradual decay characterize the normal curve while the obstructive curve has a flat prolonged plateaue and may be interruptions. The conductance factor was subnormal in most obstructive cases.

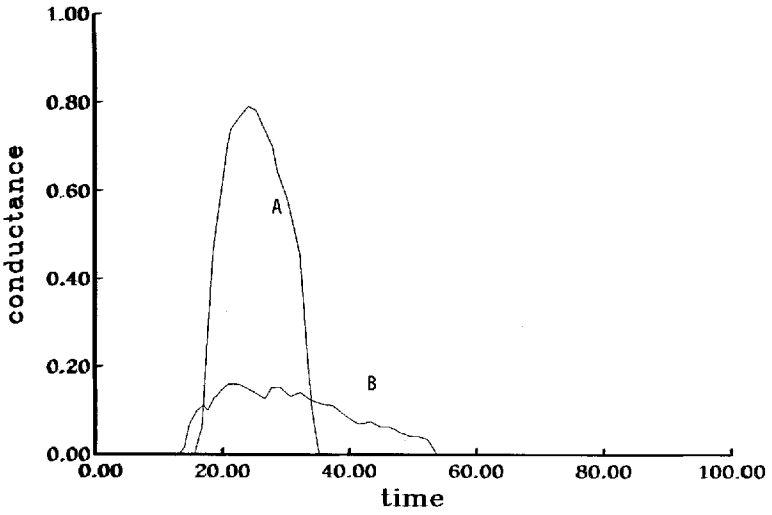

Fig. 1: Bladder outlet conductance curve in a normal (A) and an obstructive (B) voiding.

GROUP	No.	AGE	Qmax.	Pdet,max	CF
normal males	8	37.5±14.0	18.9±4.3	55.4±17.7	31.9±16.9
normal females	16	39.3±17.0	19.4±7.1	37.7±11.0	39.2±23.1
BPH	61	61.0±10.3	6.5±3.2	90.2±36.6	7.7± 6.2
BNO, males	11	50.7±12.9	9.4±5.5	122.4±54.6	8.1± 6.4
BNO, females	8	47.3± 5.1	5.9±2.6	57.3±14.9	8.6± 4.6

Table 1: results in normal and obstructive cases

CONCLUSION

Previous attempts for the analysis of pressure-flow relation (as pressure-flow plots) were associated with loss of the time factor and difficult interpretation of the curve. The conductance curve reflects the dynamic changes in voiding particularly the opening and closure events. The conductance factor is a simple parameter for the diagnosis of bladder outlet obstruction. It has the advantage of presenting an average value for the whole voiding and not at one point. We believe that The marked difference observed between normal and obstructive voidings both in curves and the values of the CF encourage the use of these parameters.

45

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THE LOW PRESSURE LOW FLOW SYNDROMES: A COMPUTER-BASED CLASSIFICATION ON FUNCTIONAL BASIS

INTRODUCTION

The low pressure low flow state is a frequent urodynamic finding in patients who usually present with obstructive voiding symptoms. In this work, we studied the urodynamic data of 29 patients who presented to us because of their voiding symptoms and were found on urodynamic study to have this condition. The goal of this work was to utilize an advanced diagnostic technique which is based on computer analysis of the changes in the energy profile of the voiding system during urine flow, in an attempt to reveal the etiological factors for voiding symptoms. A family of computer generated performance indicators (CPIs) that specifically describe different aspects of voiding function were employed. Four different disorders were found to be associated with the low pressure low flow state.

MATERIAL AND METHODS

Video/pressure/flow urodynamic studies were performed on 29 patients (12 men and 17 women) who presented with obstructive voiding symptoms. The simultaneously recorded detrusor pressure and urinary flow rate revealed low values for both parameters. Computer analysis of the urodynamic data was decided. The pressure-flow curves were transformed into digital data. A set of computer programs, acting in sequence, synchronized these data and analyzed them into several parameters. These include the rates of change of pressure and flow rate over time, external bladder power and cumulative instantaneous values of bladder volume, voided volume and external bladder work, as well as the ratio of the flow rate to detrusor pressure (bladder outlet conductance), continuously followed. Parameters which describe energy changes in the voiding system throughout voiding were finally incorporated into the CPIs.

RESULTS

The diagnosis of bladder outlet obstruction was based on the conductance factor (CF) which is derived from the integral expression of the instantaneous conductance divided by flow time. Bladder neck function was evaluated by the discharge efficiency (DE) which specifically describes the efficiency of the bladder as a pump by comparing the external work with the internal energy changes during voiding. It has a range from 1.0 (a theoretical optimal pumping efficiency) to 0.0 (pump failure in isometric contraction). Results were compared with normal ranges (obtained in another study, submitted). Four distinct groups of patients were found. Group A showed both obstruction and pumping compromise while group B showed obstruction only. Group C showed a compromise in bladder neck function without obstruction and finally group D showed neither disorder. Results are presented in table 1.

GROUP	No.	%	av.AGE	av.CF	av.DE	disorder
A males	7	58%	44.9	8.2	9.4	bladder neck obstruction
females	6	35%	50.0	7.7	12.8	
B males	2	17%	81.6	13.0	44.0	obstruction distal to bladder neck
females	3	18%	58.0	11.3	35.3	
C males	1	8%	47.0	16.0	25.0	detrusor-bladder neck dysfunction
females	3	18%	45.3	27.7	20.7	
D males	2	17%	62.0	25.0	40.0	primary detrusor insufficiency
females	5	29%	62.8	33.2	42.8	

Table 1: results (underlined values are below -1SD of normal for sex)

CONCLUSION

Four different disorders contribute to the pathogenesis of voiding symptoms in low pressure low flow states. The precise diagnosis, in every case, is possible when advanced computer analysis of voiding energy profile is performed. The main etiology in both sexes is bladder neck obstruction which is "masked" by the impaired detrusor contractility. Primary detrusor insufficiency as a "sole" etiology was somewhat more evident in women than in men. Detrusor-bladder neck dysfunction is characterized by inability of the weak detrusor contraction to maintain opening of the bladder neck during flow which, accordingly, tends to close. We believe that the precise determination of the underlying disorder is very important in planning for treatment in these cases.

46

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URETHRAL RESISTANCE AND URINARY BLADDER CONTRACTILITY BEFORE AND AFTER TRANSURETHRAL RESECTION AS DETERMINED BY THE COMPUTER PROGRAM CLIM.

AIMS OF STUDY

The aim of this study was two-fold : on the one hand to validate parameters characterizing urethral resistance and urinary bladder contractility by studying the changes in these parameters as a result of applying a well defined procedure, and on the other hand to investigate the possible role of these parameters in diagnosis and prediction of treatment results.

METHODS AND MATERIALS

23 patients in whom transurethral resection of the prostate was indicated on the basis of conventional diagnosis were evaluated before and after treatment in urodynamic sessions involving suprapubic puncture. Patients' bladders were filled three times in succession, and detrusor pressure and flow signals during voiding, as well as the isometric detrusor pressure rise just before flow started were stored in digital form using the computer program CLIM [1]. In subsequent analysis, the conventional parameters Q_{max} (maximum flow) and $p(Q_{max})$ (detrusor pressure at maximum flow) and the new parameters U/l

(maximum extrapolated rate of rise of phase plot of isometric pressure rise [2]), URA (intersection of quadratic urethral resistance relation with pressure axis of pressure-flow plot [3]), w_{max} (maximum of approximation of power generated by urinary bladder per surface area [4]) and ISL (sign of slope of approximated power as a function of bladder volume during emptying) were evaluated. Preoperatively patients were divided into obstructed and non-obstructed groups on the basis of randomized inspection of the form of pressure-flow plots. Postoperatively patients were divided into two groups, one with postoperative average residual urine larger than 50 ml, the other one averaging less than 50 ml of residual urine. Differences in parameter values were tested for significance at the 2% level using the Mann-Whitney U-test.

RESULTS

For all parameters there was a significant difference between the unobstructed and obstructed groups. On the basis of an average value for each patient the parameters U/l and URA performed best in discriminating both groups. Using a discrimination value of 54 W/m2 sensitivity and specificity of U/l were 100% and 95% respectively, whereas URA yielded 94% and 100% using a discrimination level of 29 cmH_2O. Postoperatively, obstructed patients showed a significant decrease in U/l, URA, w_{max}, $p(Q_{max})$ and residual volume, and a significant increase in Q_{max}. Nonobstructed patients showed postoperatively no significant decrease in residual volume, w_{max} or U/l. Preoperatively, patients in the group with significant postoperative residual urine had a significantly lower w_{max}, U/l, URA, and $p(Q_{max})$. For preoperative discrimination of such patients w_{max} performs best : at a discrimination level of 10.85 W/m2 a sensitivity of 100% and a specificity of 72% was obtained. Obstructed patients with and without "fading contraction" i.e. a decreasing approximated power parameter during bladder emptying only differed significantly in residual urine and U/l values. Postoperatively no "fading contraction" phenomena were observed, and no relation seemed to exist between a preoperative "fading contraction" and significant postoperative residual urine.

CONCLUSIONS

It is concluded that both U/l and URA are reliable parameters for detecting obstruction and that w_{max} characterizes urinary bladder contractility. If this contractility parameter is low preoperatively then there is an indicated risk of residual urine postoperatively. A preoperative fading contraction phenomenon is not maintained after operation and does not lead to significant postoperative residual urine. The MS-DOS compatible computer program CLIM forms an easy and userfriendly way to derive these parameters from on-line urodynamic measurements. On request the program can be demonstrated at the meeting.

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47

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ACCURACY OF UROFLOWMETRY IN THE DIFFERENTIAL DIAGNOSIS OF INFRAVESICAL OBSTRUCTION AND IMPAIRED DETRUSOR CONTRACTILITY.

AIMS OF STUDY

The accuracy of uroflowmetry in the detection of impaired micturition has been well established previously. MUDI (Dantec elektronik) variables yielded reproducebly sensitivities of 90 % - 100 % and specificities of 80 % - 95 %, utilizing implemented discrimination limits [Rollema et al., 1986; Mizunaga et al., 1986].

In this study we investigated whether uroflow variables alone can distinguish infravesical obstruction from impaired detrusor contractility, and thus might replace invasive urodynamics in differential diagnostics.

PATIENTS AND METHODS

From 46 patients, all candidates for a prostatectomy on clinical indication, 246 uroflow recordings were analyzed with the aid of MUDI software; 23 patients were also studied 3 months after prostatic surgery. The MUDI analysis was applied additionally to the CLIM analysis [Van Mastrigt and Rollema, 1988], which involved online storage and processing of simultaneously measured detrusor pressure and flow rate during voiding; in addition the isometric detrusor pressure rise just before flow started was stored. Each urodynamic session included at least 3 successive voidings per patient. All patients voided in standing position. Filling of the bladder with water and measurement of detrusor pressures were performed via a 9 Fr suprapubically inserted double lumen catheter (Braun, Melsungen).

Preoperatively patients were divided into obstructed (OBS) and non-obstructed (NOBS) on the basis of randomized inspection of pressure-flow plots.

The OBS patients (n=17) were divided in those with postoperative residual urine ($>$ 50 ml) and those without ($<$ 50 ml).

Among others the following MUDI variables were studied:

- Qmax: maximum flow rate,
- Tdesc: time from Qmax until 95 % of the volume has been voided,
- QM90: Mean flow rate during voiding time of 90 % of the volume,
- dl/dt40: estimated detrusor contraction velocity (calculated from flow rate and bladder volume) at 40 ml bladder contents,
- Classification factors of the above variables indicating the relative distance to the discrimination limits, corrected for the volume voided [Rollema et al., 1987].

The MUDI variables were compared to the following CLIM parameters:

- U/L: maximum extrapolated rate of rise of phase plot of isometric pressure rise,
- URA: intersection of quadratic urethral resistance relation with pressure axis of pressure-flow plot,
- Wmax: maximum of approximation of power generated by urinary bladder per surface area.

RESULTS

The described MUDI and CLIM parameters were significantly correlated (Spearman's rank correlation coefficients). Inspection of scatter diagrams showed that it is not possible to define unique relations between parameters from both groups.

For all MUDI variables statistically significant differences were found between the OBS and the NOBS group. Compared to the discrimination obtained by applying the CLIM parameters U/L and URA, it was not possible to discriminate between these groups on the basis of the uroflow variables alone, at comparable sensitivity (100 %) and specificity (95 %).

Also significant differences were found between pre- and postoperative values, except for Tdesc in the NOBS group. In the OBS group (n=17) the differences were more obvious than in the NOBS group (n=6).

In the OBS group (n=17) none of the MUDI variables showed preoperatively significant differences between those patients with residual urine postoperatively (n=7) and those without (n=10); therefore, no prognostic value can be ascribed to uroflow variables as to the prediction of postoperative residual urine.

CONCLUSION

The studied population comprized of patients planned for prostatectomy on clinical indication. MUDI variables derived from free flow have been proven to separate these patients from a healthy control group accurately. Additionally MUDI classification factors obviously show (postoperative) improvement or deterioration of individual patients. As such these variables can be efficiently utilized for routine clinical screening.

However, the present population consisted of patients with mixed pathological entities: infravesical obstruction and/or impaired detrusor contractility. Discrimination between these groups requires the additional information in the detrusor pressure signal. To this end CLIM software can be utilized, since it supplies sensitive and specific measures of these characteristics. Moreover Wmax has a prognostic value as to persisting post-operative residual urine.

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48

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IMPAIRED BLADDER CONTRACTILITY IN ASSOCIATION WITH DETRUSOR INSTABILITY: UNDERESTIMATED OCCURRENCE IN BENIGN PROSTATIC HYPERPLASIA

AIMS OF STUDY

The hyperactive bladder does not always completely empty as shown in 33% of institutionalized elderly people, Resnick (1987). The aim of this study is to evaluate a similar group in patients with benign prostatic hypertrophy.

PATIENTS AND METHODS

Forty-five patients with a mean age of 66.7 years in which TURP was planned because of symptoms had urodynamic evaluation. This evaluation consisted of uroflowmetry, residual urine determination, cystometrogram with medium fill. A rapid cystometrogram was done in 40 patients including micturition study with a stop-flow technique. Rapid cystometrogram was performed by injecting 100 cc of normal saline into the bladder within three seconds. The total volume used for injections was equal to bladder capacity determined previously by water-filling cystometrogram. It was shown previously, Susset (1982) that type A contraction on rapid cystometrogram is considered a sign of detrusor denervation, while a stronger and long-lasting contraction considered a sign of detrusor instability.

Detrusor instability is diagnosed urodynamically with the appearance of abnormal contractions either on medium filling time and/or on rapid injection cystometry. Impaired bladder contracility was diagnosed by the presence of significant residual urine, presence of type A contractions and unsustained bladder contraction with no or little detrusor reserve power.

RESULTS

Urodynamic evaluation showed that twenty-five out of 45 patients had detrusor instability. Seven of these patients showed impaired bladder contractility. The mean residual urine was 177 ml in this group. On micturition studies three of these patients showed low pressure, low uroflow pattern. Stop-flow technique revealed absence of detrusor reserve power in five patients, while two patients showed little detrusor reserve power.

CONCLUSION

The importance of recognizing detrusor instability in combination with poor contractility in patients with benign prostatic hyperplasia that one can anticipate incomplete bladder emptying even after TURP is performed. Indeed, detrusor instability is not associated exclusively with low residual urine values. The finding of a high incidence of type A contraction confirmed previous observations of altered bladder innervation, secondary to bladder outlet obstruction.

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49

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EVOKED POTENTIALS BY STIMULATION OF THE VESICO-URETHRAL -JUNCTION IN NORMAL PERSONS AND PATIENTS WITH DETRUSOR-DYSFUNCTION

AIMS OF STUDY

Whereas somatosensory evoked potentials (sSEP) are already routine in the electrodiagnostic evaluation of various neurological diseases, only a few studies on the use of viscero-sensory evoked potentials (VEP) in a compartively small number of individuals (Gerstenberg et al., 1981; Sarica and Karacan, 1986; Anten et al., 1987) are published so far. This report deals (a) with the reproducibility of VEP from the vesico-urethral junction (VUJ), (b) with its application and value for the electrodiagnostic evaluation of detrusor function and (c) with some considerations on the pathways conducting afferent stimuli from the VUJ.

PATIENTS AND METHODS

In 21 normal volunteers and 21 pat.s with either defined (13) or unclear detrusor function (8) VEP were recorded in addition to sSEP from the post. tibial nerve and the pudendal nerve. VEP were evaluated following stimulation at the VUJ using a bipolar ringelectrode mounted on a transurethral catheter. Recording was achieved by using a Medelec MS 6 with cup-electrodes attached over Cz/Pz, sSEP from the post. tibial nerve were recorded in the usual way, the stimulation of the pudendal nerve was carried out via stimulation of the dorsal nerve of the penis resp. clitoris.

RESULTS

In 17 of 21 normal persons a prominent negativity with a mean latency of 95 ms was recorded at the scalp and was reproducable. A high congruence was found between the presence of VEP and the persons` statements about subjective sensory perceptions during stimulation. However in 4 normal persons bacause of pain sensation stimulation could be carried out only with very low voltage therefore no clear response of VEP was demonstrable. In 21 pat.s the presence (11) or absence (10) of VEP demonstrated, if afferent stimuli from the VUJ are conducted to the cortex. In 3 pat.s with an acontractile detrusor and without the perception of urge and pain in the bladder, stimulation with relative-

ly high voltage was possible and resulted in very clear VEP, probably indicating a local damage of pain and urge conducting receptors. In 2 pat.s normal VEP together with normal sSEP from the pudendal nerve and the post. tib. nerve supported the psychogenic nature of the detrusor dysfunction. During stimulation of the VUJ normal individuals experience synchronous with the pulses a dull, pulsating sensation as well as a burning and painful sensation in the bladder sometimes combined with urge to void or painful urge. It is important to know that all patients with positive VEP also experience at the same time this dull, pulsating sensation whereas burning and pain sensation was not found to be essential for positive VEP.

CONCLUSION

1) The evaluation of VEP from the VUJ shows accurate and reproducable results. 2) Our findings let us conclude that the pulses, responsible for VEP from the bladder neck area are conducted in the posterior columns and not by the pain and urge conducting lateral columns; only positive VEP (which are always accompanied by the above mentioned dull pulsating sensation) together with the sensation of burning, pain or painful urge indicate completely intact afferent pathways from this area via the post. and lateral columns; negative VEP only indicate a lesion of the posterior columns, whereas afferent pathways via the lateral columns may still be possible; an exact judgement in regards to intact afferent pathways from the bladder neck area with the method given above is only possible with VEP in combination with the patients' subjective sensation during the investigation. 3) With this in mind VEP are useful in the electrodiagnostic evaluation of the detrusor in regards to its afferent innervation, moreoverVEP are helpful in the diagnosis of a local damage of the detrusor muscle and in regards to a psychogenic origin of the detrusor dysfunction.

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50

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CONTRADICTORY SENSORY FINDINGS AND ANOMALOUS BLADDER FUNCTION IN SPINAL CORD INJURY.

INTRODUCTION

Persistence of detrusor acontractility in patients with high spinal cord lesions, in whom there is normal somatic reflex activity, is an enigma. Light

(1987a) has shown, in such patients, abnormalities of the 'R' and 'S' waves of the lumbosacral evoked potentials (L.S.E.P), suggesting an occult dysfunction of sensory / motor integration at the sacral cord level. These abnormalities have also been shown in patients in whom transurethral sphincterotomy has failed due to poorly sustained detrusor contraction (Light 1987b). L.S.E.P.s are complex and difficult neurophysiological recordings which have only been reported, in relation to bladder function, from one centre.

METHOD

Forty male patients (ages 16 - 61, median 24) with chronic stable suprasacral cord lesions were studied (duration of injury, 6 - 444 months, median 38 months). There were 13 cervical and 27 thoracic injuries, all but 3 with complete motor and sensory loss below their lesions.

All patients underwent combined filling and voiding cystometry with radiological screening to assess vesicourethral function. Bladder function was categorised as a; hyperreflexic with efficient voiding (residual urine < 100 mls), b; hyperreflexic with poor emptying due to detrusor sphincter dyssynergia (D.S.D.), c; hyperreflexic with poor emptying due to poorly sustained detrusor contractions, and d; acontractile.

All patients underwent L.S.E.P. recording. The posterior tibial nerve was stimulated at the knee and monopolar evoked potential recordings made from the skin surface at T12, L2, L4, and S1 levels. Stimuli were delivered during the quiet phase of the E.C.G., and their strength monitored by recording of 'H' reflex and 'M' response of the ipsilateral Triceps Surae muscle. The Dantec Neuromatic 2000M 2 channel equipment was used, together with switching circuitry to enable any 2 of up to 8 channels to be viewed at a time. Twenty two normal subjects also underwent L.S.E.P. recording.

RESULTS

L.S.E.P.s recorded from normal subjects were similar to those reported by other workers. The results in the spinal cord injured patients are shown in the table.

	Reflex Efficient	Reflex D.S.D.	Reflex P.S.C.	Acontractile
All responses normal	7	6	6	4
'S' or 'R' wave missing		2	1	1
'S' or 'R' wave delayed	1		1	
One missing, one delayed		1	1	
No responses			1	2
Equivocal responses	3	2		1

All 11 patients with efficient reflex bladders had normal 'S' waves on L.S.E.P., though 4 had abnormalities of the 'R' wave. In no patient, in this group, were all L.S.E.P. responses missing. Poorly emptying hyperreflexic bladders were due to D.S.D. in 11 patients and poorly sustained contraction in 10. In neither group was any constant relationship seen with results of L.S.E.P.s.

Eight patients had acontractile bladders. Five of these, with suprasacral lesions and normal somatic reflex activity, had persistent acontractility more than a year post injury. Four of the five had normal L.S.E.P.s. but the fifth had abnormal 'R' waves. A further 3 patients had abnormal L.S.E.P.s which were to be expected on clinical grounds (ie; lesions below T10).

CONCLUSION

In patients with decreased contractility, previous evidence has implicated disordered afferent integration in the sacral cord. Only 5 / 15 such patients in this study give weight to that hypothesis. The other 10 had normal L.S.E.P. findings. Furthermore, the presence of L.S.E.P. abnormalities in patients with efficient hypereflexic bladders suggests that these studies, in present form, do not relate specifically enough to detrusor / sphincter function.

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51

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PUDENDAL MOTOR AND SOMATOSENSORY EVOKED POTENTIALS AND SACRAL REFLEX LATENCY TESTING.

AIMS OF STUDY

Central motor pathways to the pelvic floor have been poorly documented. The recent development of motor evoked potentials (MEPs) will fill this gap in our basic knowledge. The aim of our study was to determine the reference latencies of MEPs from the bulbocavernosus muscle (BC) and to assess the clinical usefulness of this new technique in a variety of neurological disorders.
Motor Evoked Potentials (MEPs) were then correlated to somatosensory evoked Potentials (SEPs) and Sacral Reflex Latency Testing (SRLT).

PATIENTS AND METHODS :

Twenty control male subjects and 10 neurological patients were examined.
MEPs were performed using a magneto-electrical stimulator (Cadwell MES-10). Transcranial brain stimulation was performed first at rest and then during slight, transient voluntary contraction of the examined muscle ("Facilitation" procedure). Sacral root stimulation was performed at rest. The responses were picked up in the bulbocavernosus muscle (BC).
SEPs were recorded over the lower thoracic spine (Th 12) and over the somatosensory cortex (2 cm behind the vertex) after electrical stimulation of the dorsal nerves of the penis.
SRLT was performed by electrically stimulating the dorsal nerves of penis and recording the response in BC.

RESULTS :

1. Normative data : see Table.
2. Patients : combined or isolated abnormalities of SEPs and MEPs were found in multiple sclerosis patients, lateral amyotrophic sclerosis patients, spinal trauma and other disorders of the central nervous system affecting secondarily the genitourinary tract. Delayed SRLT were observed in pelvic bone fractures and diabetes.

RESULTS : NORMATIVE DATA

	Mean latencies (msec)	SD
MEPs : 1. PERIPHERAL MOTOR CONDUCTION TIME	7,2	1,1
2. TOTAL MOTOR CONDUCTION TIME		
At rest	29,1	3
Contraction	21,6	2,4
3. CENTRAL MOTOR CONDUCTION TIME *		
At rest	22,4	1,9
Contraction	14,5	2,6
SEPS : 1. PERIPHERAL SENSORY CONDUCTION TIME	13,5	1,5
2. TOTAL SENSORY CONDUCTION TIME	40,4	1,9
3. CENTRAL SENSORY CONDUCTION TIME **	26,8	2,4
SRLT :	31,6	4,5

Comments :
* CENTRAL MOTOR CONDUCTION TIME (Cortex to Sacral roots) = Total Motor Conduction Time (Cortex -> BC muscle) - Peripheral Motor Conduction Time (Sacral Roots -> BC muscle)
** CENTRAL SENSORY CONDUCTION TIME (Spine to Cortex) = Total Sensory Conduction Time (Penis -> Cortex) - Peripheral Sensory Conduction Time (Penis -> Spine)

DISCUSSION

1. MEPs : Mean total motor conduction time at rest is 29 msec. Voluntary contraction of the target muscle during transcranial stimulation significantly shortens the latency of the response. The "facilitation" seems to act at the cortical and spinal levels: during voluntary muscle contraction fast propagating corticospinal motoneurons are recruited. Furthermore motoneurons in the anterior horn of the sacral cord being stimulated by the afferent "volley" from the contracted muscle are close to their firing level and therefore might discharge faster following cortical stimulation. We also investigated MEPs from the anal sphincter : reference latencies are in the same range as those from BC muscle. A study is currently undertaken to determine reference latencies from the periuretral striated musculature.
2. MEPs/SEPs : Total motor conduction time is shorter than total sensory conduction time : both peripheral and central motor conduction times are shorter than their sensory equivalent.
3. MEPs/SEPs/SRLT : Peripheral (motor + sensory) Conduction Times < SRLT latency. The difference (± 10 msec.) seems to correspond to the intraspinal transit time of the sacral reflex arc ? If this is true the reflex must be polysynaptic.

CONCLUSION

Combination of MEPs, SEPs and SRLT allows a comprehensive study of the sensory and motor somatic pathways from the lower genitourinary tract.

52

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PERINEAL MOTOR EVOKED RESPONSES

AIMS OF STUDY

Evoked perineal muscle responses on 'transcutaneous spinal stimulation' have been reported to demonstrate disturbances of innervation in patients with 'idiopathic' urinary and faecal incontinence (Snooks and Swash 1984, Kiff and Swash 1984). We report our results showing that surface recordings of perineal muscle responses (as opposed to needle recordings) might be unreliable indicators of sacral motor pathway function.

PATIENTS AND METHODS

Six male and two female subjects, continent and without sacral nervous system involvement (30 - 42 years old) were studied. EMG recordings were made simultaneously from the bulbocavernosus or the anal sphincter, and the gluteus medius muscle with concentric needle and surface disc electrodes. Several single impulses of up to 750 V, decaying with a time constant of 50 μs, were delivered through two pad electrodes. These were positioned on the scalp overlying the motor cortex, and over the lumbal spine. Subjects were asked to relax or slightly contract the perineal muscles; either manoeuvre was monitored on the oscilloscope.

RESULTS

Latencies of motor evoked responses are given in table 1. Simultaneous recordings from perineal muscles consistently showed longer latencies for responses obtained with needle as compared to surface electrodes (figure 1). The differences were more significant on stimulation over the back and ranged from 2.8 to 7.2 ms. For the gluteus medius muscle no such discrepancies were obtained (the latencies were 5.0 - 6.8 ms for surface and 5.8 - 6.2 ms for needle recordings, recorded in 3 subjects). Furthermore, the latencies of surface recorded perineal motor evoked responses on stimulation over the spine were very close to latencies of responses from the gluteus medius muscle in individual subjects.

CONCLUSION

Latencies obtained for surface recorded perineal motor evoked responses correspond closely to those reported by Snooks and Swash (1984) and Kiff and Swash (1984), they, however, do not correspond well with needle recordings from the same muscles, but more so with recordings from the gluteus medius muscle. We believe that surface recorded evoked perineal motor responses reflect also volume conducted activity from distant muscles and are therefore not selective enough to provide information about function of motor pathways to these comparatively very small muscles. Nevertheless the technique of motor evoked responses seems to have diagnostic potential and needs to be further explored; we suggest, however, the use of needle electrodes for selective recording.

Figure 1. Motor responses evoked by stimulation over the spine (L1 level) as recorded with needle (above) and surface electrodes below).

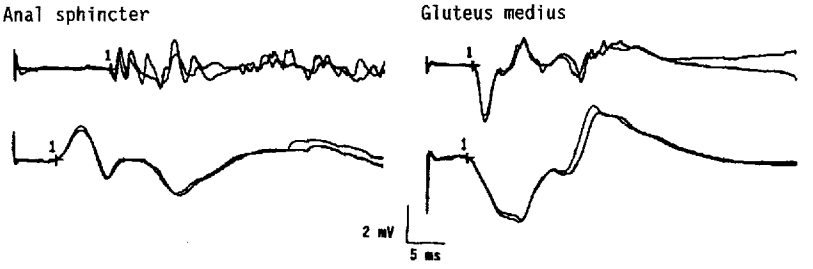

Table 1. Motor evoked responses in perineal muscles ($\bar{x} \pm SD$ and range of latencies in ms).

		Stimulation on the scalp		Stimulation over the spine (L1)
	Type of recording	Relaxation	Contraction	(Relaxation)
Bulbocavernosus muscle (n=6)	Surface	24.51.1 (23.0-25.5)	23.5±1.3 (22.0-25.0)	5.8±1.0 (4.5-6.8)
	Needle	27.6±1.8 (25.0-29.0)	26.6±2.0 (23.5-28.8)	10.6±1.5 (9.2-12.3)
Anal sphincter muscle (n=5)	Surface	-	26.0±1.4 (25.0-28.0)	5.4±0.8 (4.5-6.6)
	Needle	-	29.2±0.7 (28.3-30.0)	11.4±1.4 (9.9-13.0)

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53

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THE ROLE OF PREGNANCY AND CHILDBIRTH IN PARTIAL DENERVATION OF THE PELVIC FLOOR - AN UPDATE

AIMS OF STUDY

A study of 40 primigravid women has shown that pregnancy causes a change in urinary symptoms and that delivery causes partial denervation of the striated muscle of the pelvic floor (Allen, 1987). The number of women

participating in the study has since increased and this paper presents the current findings with particular regard to the effects of obstetric management.

PATIENTS AND METHODS

96 primigravid women were recruited from hospital ante-natal clinics. At 36 weeks gestation a questionaire is completed recording details of urinary control, exercise history, family history and general clinical examination. Pelvic floor function is assessed by measuring vaginal squeeze pressure using a perineometer and concentric needle electromyography as described in the original study. After delivery, a second questionaire is completed giving a detailed description of the labour and delivery. Before the patient leaves the hospital on the 2nd-6th post-partum day she is questioned on any changes in urinary control since delivery - vaginal squeeze pressure measurements are repeated and the conduction times of the pudendal nerve to the urethral sphincter, pelvic floor and anal sphincter are measured. Two months after delivery, the patient is questioned on changes in urinary control and pelvic floor function. Concentric needle E.M.G. and measurements of vaginal squeeze pressure and pudendal nerve conduction times are repeated.

RESULTS

Table 1 shows that post-natally, there is an increase in the duration of motor unit potentials compared to the ante-natal recordings. This indicates re-innervation of the pelvic floor following denervation. Only 4% of women ante-natally have mean durations in excess of 4.2 ms compared to 81% post-natally. Women who have had elective caesarean sections show no increase in motor unit potential duration post-natally. Age, height, weight, body mass index, shoe size, girth, length of 1st stage, baby head size, do not influence the degree of denervation, however, the length of the second stage, baby weight and social class (as shown in the table) do affect the outcome. Table 2 shows some comparisons in which there are no significant differences in post-natal motor unit potential duration.

Table 1

	Mean Duration (ms)	
	Mean (sd)	Significance
Ante-natal - all women	3.3 (0.6)	
Post-natal - all women	5.2 (1.5)	p<0.00001
Post-natal - short second stage	4.8 (1.3)	
Post-natal - long second stage	5.7 (1.6)	p=0.00386
Post-natal - light baby	4.8 (1.1)	
Post-natal - heavy baby	5.6 (1.7)	p=0.02285
Post-natal - social class 1 & 2	5.5 (1.4)	
Post-natal - social class 4 & 5	4.7 (1.8)	p=0.03291

Table 2

Normal vaginal delivery	vs Forceps delivery
Women with tears	vs Women with no tears
Women with an episiotomy	vs Women with no episiotomy
Women with tears and no episiotomy	vs Women with episiotomy and no tears
Women who have had syntocinon	vs Women with no syntocinon
Women with a spontaneous labour	vs Women with an induced labour
Women with marked or moderate striae	vs Women with few or no striae
Women with urinary problems in labour	vs Women with none
Women regularly practising PFE's	vs Women not practising PFE's

CONCLUSION

Women with stress incontinence of urine and genito-urinary prolapse have partially denervated pelvic floors (Smith, 1984). This paper demonstrates that childbirth also causes denervation although we do not yet know how many of these women will go on to develop symptoms in later life. Obstetric management appears to be only a minor influence on the degree of nerve damage observed post-natally.

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54

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SINGLE FIBRE EMG: A SENSITIVE TOOL FOR EVALUATION OF THE URETHRAL SPHINCTER

AIMS OF STUDY

Single fibre electromyography (SFEMG) is a sensitive tool for the evaluation of denervation/re-innervation muscle injury. Changes in fibre density in the anal sphincter have been shown to be associated with incompetence of that muscle and to occur following vaginal delivery (Snooks, 1984). SFEMG of the urethral sphincter has not been considered feasible because of its small size and concentric needle EMG has been employed instead. We have obtained single fibre signals from the urethral sphincter and report preliminary results.

PATIENTS AND METHODS

A Dantec 13K87 single fibre electrode was inserted one centimetre lateral to the external urethral meatus and passed cranially until the urethral sphincter was encountered. The sampling technique was as described by Henry (1985) for the anal sphincter, with the bladder filled to first desire to void to increase sphincter

activity. Recordings were obtained from five nulliparous controls, four multiparous continent patients and 13 parous stress incontinent patients. All patients were premenopausal and none had undergone bladder neck surgery. Each individual recording was classified according to the number of individual muscle cells firing. Results were analysed by the Mann Whitney U test approximation to the normal distribution with correction for ties.

The results of concentric needle EMG of the urethral sphincter obtained in the same patients by the technique of Fowler (1984) were compared using the two sample t-test.

RESULTS

There were significant differences in fibre density between nulliparous and parous continent ($z = 2.79$, $p = 0.005$) and between parous continent and incontinent patients ($z = 2.69$, $p = 0.006$). Motor unit potential durations (MUPD) in these patients were compared. There was a significant difference between the two continent groups ($t = 5.84$, $p < 0.001$), but not between the two parous groups ($t = 1.49$, $0.1 < p < 0.2$).

CONCLUSIONS

This pilot study confirms sphincter damage associated with delivery and subsequent incontinence and suggests that it is feasible to record satisfactory single fibre activity from the urethral sphincter. Furthermore this is a more sensitive tool than MUPD analysis for detecting differences between these clinical groups.

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55

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NEUROPHYSIOLOGICAL ASPECTS OF THE URETHRAL SYNDROME.

AIMS OF STUDY:

Many investigators have focused on the female urethral syndrome and its causes. The origin remains enigmatic, but the benign course of this condition, which appears to be very common, is well established. The most significant symptoms are frequency, dysuria and pelvic/urethral discomfort; these symptoms can be continuous or recurrent. Some of these women may occasionally have urinary tract infections (UTI), but generally urinary coltures are negative. Most women are between 25 and 45. In the past, we analyzed the urodynamic pictures of the urethral syndrome in 49 women (unpublished data). We found an abnormal voiding in 47% and a reduction in vesical capacity in 32%. We attributed these symptoms to spasticity of the perineal floor and to a disorder of bladder sensation. In 32% we found previous *hysterectomies and pelvic surgery*.
Two main causes have been proposed for this syndrome: psychogenic and infective. Stressful situations, anxiety and/or depression have been suggested on the basis of psychometric tests (Hafner, 1977; Rees, 1971). In 1980, the MMPI test was administered to 160 women with urethral syndrome. The majority scored higher on the hypochondriasis, hysteria and schizophrenia scale than controls (Carson, 1980). However, the fact that approximately 30% of these women had significant bacteriuria has drawn the attention towards a possible infective origin of the disease. Recurrent UTI could be the consequence of a lack in relaxation of the external sphincter during the voiding (Hendry, 1973; Tanagho, 1971). Stamm (1980) showed, in a group of 59 women with urethral syndrome, that 46% had bacteriuria but with fewer than 10^5 bacteria and 19% had chlamydial infections. One could also assume that the infection may be confined to the urethra (Charlton, 1973).
In order to find a new possible aetiological cause, we performed, in 36 women with urethral syndrome (mean age: 38 years ± 9.2), sacral evoked response (SER). This test measures the nervous conduction in the afferent and efferent branches of the pudendal nerve. An impaired conduction in the pudendal arc can be due to pudendal nerve disorders.

MATERIALS AND METHODS

We performed SER in 36 women with urethral syndrome and in 26 women as control group (mean age 37.7 years ± 15.8). An electric stimulus was applied (2/3 times the sensory threshold) on the right and on the left sides of the clitoris and EMG response was recorded at perianal level with surface electrodes. The active electrode was always put on the right side of the midline, in order to obtain a constant shape of the EMG response (Fanciullacci, 1987). We performed 4 determinations for each patient. Each determination consisted of 80-100 stimuli. The latency was measured at the beginning of the EMG response.

RESULTS

The two groups were homogenous in age ($T = -0.06$; $P = 0.95$). Normal women (99 determinations): mean latency: 33 msec (± 0.466 standard error of the mean). Women with urethral syndrome (132 determinations): mean latency: 37.23 msec (± 0.534 standard error of the mean). We found a normal distribution of the data in both groups. The analysis of variance was applied, which showed a highly significant difference between the two groups ($F = 32$; $P \leq 0.001$). Also comparing the right side responses of one group (32.94 msec) to the right side responses of the other (37.08 msec), and the same for the left side (33.06 and 37.38 msec respectively), we have the same significant difference ($P \leq 0.001$ at T-test). In order to confirm the reliability of the method, we compared, inside each group, the right-side to the left-side responses. Normal women: right side 32.94 msec; left side 33.06 msec. Women with urethral syndrome: right side 37.08 msec; left side 37.38 msec. T-test showed no statistical difference ($P = 0.89$ for the normal; $P = 0.78$ for urethral syndrome).

CONCLUSION

The great difference between the two groups suggests a disorder of pudendal innervation in women with urethral syndrome. From this point of view, the perineal pain can be due to an impairment of the pudendal nerve. This suggests a new possible cause giving rise to urethral syndrome, even if it is unclear how a sensory syndrome essentially affecting the bladder and the urethra can be connected to an impairment of the pudendal nerve.

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56

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BIOCHEMICAL AND METABOLIC CHARACTERISTICS OF THE RABBIT URINARY BLADDER.

AIMS OF STUDY

Proper function of the urinary bladder depends on the formation of high energy phosphate bonds by oxidative metabolism. This investigation was concerned with two aspects of bladder biochemistry: 1) the intracellular concentration of nucleotides in bladder base and body and 2) the ability of the bladder muscle to oxidize glucose and palmitate in vitro.

METHODS

White New Zealand rabbits were surgically anesthetized and the urinary bladder removed and dissected free of superficial fat and connective tissue. For nucleotide determination pieces of base and body were separated and frozen in liquid nitrogen for subsequent biochemical analysis. Nucleotides, as well as creatine (C) and creatine phosphate (CP) were determined by HPLC.

For studies of glucose and palmitate oxidation strips of bladder were collected in ice - cold saline for subsequent incubation in vitro. The tissue samples (about 100 mg each) were incubated in Tyrode - Hepes solution (pH 7.4) without glucose for 1 hour at 37^{o} C with oxygen as the gas phase. After the preliminary incubation the muscle strips were reincubated for 1 hour at 37^{o} in Tyrode's solution containing ^{14}C glucose or ^{14}C palmitate . The labeled CO_2 was absorbed by phenylethylamine placed in plastic wells. Radioactivity of the absorbed CO_2 was determined in a liquid scintillation counter.

RESULTS

The tissue concentrations of C, CP and nucleotides are presented in Table 1.

TABLE 1: nmols/mg protein (SEM)

Metabolite	Body	Base
C	26 (1.9)*	11 (1.9)
CP	68 (6.8)*	45 (5.8)
ATP	25 (1.0)	24 (0.9)
CTP	8.7 (0.56)	8.5 (0.49)
GTP	7.2 (0.60)*	4.5 (0.42)
UTP	3.0 (0.31)*	1.4 (0.20)

* Significantly higher than corresponding values for bladder base ($p < 0.05$).

There were distinct differences in metabolite concentrations between bladder base and body. Although the levels of ATP were the same in the two parts of the bladder, both creatine and creatine phosphate concentrations were much higher in the body than in the base. The extra supply of high energy phosphate bonds in the body of the bladder may be related to the higher energy needs of the bladder body compared to the bladder base.

The concentration of GTP as well as the level of the pyrimidine nucleotide, UTP, were significantly higher in the bladder body than in the base possibly reflecting a more active metabolism.

When, bladder strips were incubated in vitro in Tyrode's solution for 30 minutes at 37^0 there was a marked disappearance of PC, ATP, GTP and UTP. There was no further reduction in these concentrations over an additional 90 minutes. These results indicate that several metabolic reactions may become impaired during incubation of bladder muscle in vitro.

The investigation of bladder metabolism demonstrated that both glucose and palmitate were oxidized in vitro. The Kd and Vmax for glucose were 0.25 mM and 50 umols/g tissue/hr respectively, and for palmitate the Kd was 29 uM and Vmax 1.7 umols/g tissue/hr. At maximum concentration of each substrate the rate of CO_2 production was additive. Addition of non-radioactive glucose did not affect the oxidation of ^{14}C palmitate, nor did addition of cold palmitate influence the oxidation of radioactive glucose. Bethanechol stimulated the oxidation of glucose by two fold but did not have any stimulatory effect on palmitate metabolism

CONCLUSIONS

It is concluded that bladder muscle is very active metabolically and distinct biochemical differences exist between bladder base and body. Both carbohydrate and fatty acids are utilized for energy production. Although the maximum rate of fatty acid metabolism is lower than that of glucose, lipid metabolism should still be considered important due to the large amount of energy generated by this pathway. Although the contractile response of isolated strips of bladder muscle to both field stimulation and pharmacological agents is stable for several hours in isolated baths, the intracellular concentration of several important high-energy compounds decrease to reduced levels during prolonged periods of incubation.

57

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AGONIST INDUCED CONTRACTION AND ACCUMULATION OF INOSITOL PHOSPHATES IN GUINEA-PIG DETRUSOR SMOOTH MUSCLE

AIMS OF STUDY

Acetylcholine and ATP are established neurotransmitters in the guinea-pig detrusor (Burnstock et al, 1978). Stimulation of muscarinic or purine P_2 receptors produce a rise in the intracellular concentration of free calcium ions and thus activates the contractile apparatus. Studies in other tissues have shown that receptor stimulation can induce an influx of extracellular calcium ions or a release of ionised calcium from intracellular stores via the action of the intracellular 'second messenger' inositol trisphosphate (Abdel Latif, 1986). In this study, we have investigated whether carbachol and ATP can stimulate production of inositol phosphates in guinea-pig detrusor muscle and produce smooth muscle contraction.

METHODS

5 x 1 mm strips of detrusor were dissected from the dome of the urinary bladder. The strips were mounted between parallel platinum electrodes in a standard 20 ml organ bath and perfused by oxygenated Krebs solution at $37^{o}C$. Contractile responses to ATP and carbachol were measured isometrically both in the presence and absence of extracellular calcium. Agonist-induced accumulation of ^{3}H-inositol phosphates was measured in a suspension of detrusor smooth muscle segments prelabelled with ^{3}H myo-inositol.

RESULTS

Carbachol ($10^{-7}M$ to $10^{-3}M$) and ATP ($10^{-6}M$ to $10^{-3}M$) induced dose-dependent contraction to the strips. ATP-induced contractions were virtually abolished 10 minutes after removal of extracellular calcium whilst carbachol still produced a significant response at 40 minutes. At the doses used in the contractile studies muscarinic receptor but not purine receptor stimulation, induced a dose-dependent accumulation of inositol phosphates.

CONCLUSIONS

These studies suggest that carbachol stimulates the hydrolysis of inositol phospholipids in detrusor smooth muscle and can produce contraction in this tissue by releasing calcium from intracellular stores. In contrast, contraction induced by ATP receptor agonists appears to be more dependent on extracellular calcium; agonists at ATP receptors may, therefore, act by opening calcium channels in the cell membrane.

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58

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INFLUENCE OF HYPOXIA ON METABOLIC RATES AND CONTRACTION IN URINARY BLADDER FROM RATS WITH INFRAVESICAL OUTFLOW OBSTRUCTION

AIMS OF STUDY

Infravesical outflow obstruction in the rat induces a marked and rapid increase in bladder weight. This is associated with both hypertrophy and hyperplasia of the detrusor smooth muscle cells. The behaviour of such bladders (Andersson 1986) resembles in several aspects (residual urine, bladder instability) that observed in the human bladder subjected to outflow obstruction e.g. following prostatic enlargement. We have previously reported (Uvelius 1987) that smooth muscle from this animal model has a higher capacity than control detrusor to maintain active force at low oxygen tension (P_{O_2}). We have now determined the metabolic energy turnover in relation to contractile force in optimal and zero P_{O_2}.

METHODS

Hypertrophy of the detrusor in female rats was induced by a standardized partial urethral stenosis. Experiments were performed after 10 days. At this time, bladder weight had increased to about 240 mg from the normal weight of about 60 mg. Strips with longitudinally oriented smooth muscle bundles were dissected and mounted in a 1.3 ml chamber. The chamber was closed for 5-10 minutes during which oxygen consumption (J_{O_2}) was determined with a polarographic electrode. Lactate production (J_{LA}) was determined by assaying the chamber content for lactate. The experiments were performed in relaxing Ca^{2+}-free Krebs PSS and activating high-K^+ or carbachol (10^{-5}M) PSS at 37°C. Two O_2 levels were investigated, 60% O_2 (P_{O_2} 430mm Hg) and 0% O_2. Following the experiments the preparations were fixated for morphometric determination of smooth muscle content. Myosin light chain phosphorylation was determined by two-dimensional electrophoresis (Aksoy et al 1981) in separate experiments.

RESULTS

In relaxed control muscles, at optimal P_{O_2}, J_{O_2} and J_{LA}, related to smooth muscle volume, were 2.5 and 0.8 nmol min^{-1} mm^{-3}, respectively. This corresponds to an ATP hydrolysis rate (J_{ATP}, calculated as 6.42 J_{O_2} + 1.25 J_{LA}) of 17 ± 2 nmol min^{-1} mm^{-3}. In hypertrophic muscle J_{ATP} was similar (14 ± 1 nmol min^{-1} mm^{-3}) although the ratio J_{LA}/J_{O_2} (0.43) was slightly higher than for the controls (0.32). The active force following activation by high-K^+ or carbachol was significantly lower in the hypertrophic preparations when expressed per unit smooth muscle cross-sectional area. J_{O_2} and J_{LA} increased in both groups. The metabolic tension cost (increase in J_{ATP}/increase in force) was similar in the two groups for both models of activation. In hypoxia the active force of control preparations decreased to about 80% in carbachol contractions. Further, high-K^+ gave a characteristic biphasic response: the plateau of the contraction being markedly lower than the initial peak response. The relative myosin light chain phosphorylation fell from a peak value of about 31% to 16%, which is close to the basal level (13%). The rate of relaxation in Ca^{2+}-free medium was about 30% slower. In the hypertrophic

preparations the decrease in force was less pronounced and the high-K^+ induced contractions decayed less after the peak response. However, the myosin light chain phosphorylation showed similar variations as in the control group (peak: 44%, plateau 20%, basal 17%). The rate of relaxation was not affected by hypoxia. In both groups the basal J_{ATP} decreased in hypoxia although J_{LA} increased more than five-fold. J_{LA} was determined during two 5 minute periods following high-K^+ stimulation. In the controls J_{LA} increased during the first period and then decreased with force, but maintaining a level above the basal. In contrast, the increase in force and J_{LA} was more sustained in the hypertrophic muscle. The metabolic tension cost in hypoxia was similar in the two groups but significantly lower than at the optimum P_{O_2}.

CONCLUSIONS

1. Rat detrusor has as several other smooth muscles a high lactate production even at optimal P_{O_2}.

2. Hypertrophy is associated with an increase in the enzymal systems responsible for O_2 consumption and lactate production.

3. Similar tension cost suggests unaltered kinetics of cross-bridge turnover during contraction in hypertrophic detrusor.

4. Detrusor muscle has a high capacity to produce force at low P_{O_2}. This may be related to at activation of lactate production and a decreased energy demand during contraction.

5. Hypoxia provokes differences in contractile behaviour between normal and hypertrophic detrusor.

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59

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URODYNAMIC CHARACTERISTICS DURING ANIMAL HYPNOSIS IN THE RABBIT

AIMS OF STUDY

In animal experiments assessing the vesicourethral function, it is desirable to keep the micturition reflex in a physiologic state. Most anesthetic used to immobilize the animals tend to suppress the micturition reflex. An alternative means is decerebration. However, a decerebrated animal is not easily prepared. Instead of anesthesia or decerebration, we applied animal hypnosis[1] to rabbits for immobilization. The present study demonstrates the urodynamic characteristics during animal hypnosis. In addition, these urodynamic characteristics were compared with those under anesthesia.

MATERIALS AND METHODS

Twenty male rabbits weighting 2.5 to 3.0kg were used. Animal hypnosis was produced by placing the rabbit on its back and restraining it in a V-shape trough and maintaining it there until it relaxed. Under

hypnosis, cystometry was performed by the suprapubic route. The external sphincter EMG was recorded simultaneously with bladder pressure using a needle electrode. The urethral pressure profile was also measured during hypnosis. These measurements were repeated under anesthesia induced by intravenous pentobarbital injection(30mg/kg).

RESULTS

In the rabbit, hypnosis began within 1 min and lasted for 30 to 40 min. During hypnosis, insertion of catherter, pricking with a needle electrode and suprapubic puncture did not interrupt the immobility. Urodynamic study under animal hypnosis showed that as bladder volume increased, the sphincter EMG activity increased and that the EMG activity ceased with bladder contraction(Fig.1A). Bladder contraction coincided with the expulsion of saline from the urethral meatus. Maximal bladder pressure during micturition was 23.5±8.0mmHg. Maximal bladder capacity at which the micturition reflex occurred was 41.4±22.3ml. EMG amplitude was 110±49μV. Pentobarbital reduced the amplitude of sphincter EMG to the value of 11.0±8.1μV. Futhermore, saline infused into bladder leaked passively from the urethral meatus(Fig.1B). Thus, the micturition reflex did not occur under pentobarbital anesthesia. The urethral pressure profile could be measured during animal hypnosis(Fig.2A). The maximal closure pressures were 87.6±8.2mmHg under hypnosis and 58.3±2.36mmHg under anesthesia. Thus, pentobarbital significantly depressed the pressure profile (Fig.2B)

CONCLUSION

The present study demonstrated that under animal hypnosis in the rabbit, cystometrogram from the storage to the voiding phase, the external sphincter EMG and the urethral pressure profile were completely evaluated. In comparison with bladder and sphincter activity under pentobarbital, animal hypnosis was demonstrated to afford a more physiologic state. Therefore, this method seems to be useful for urodynamic studies in animal experiments.

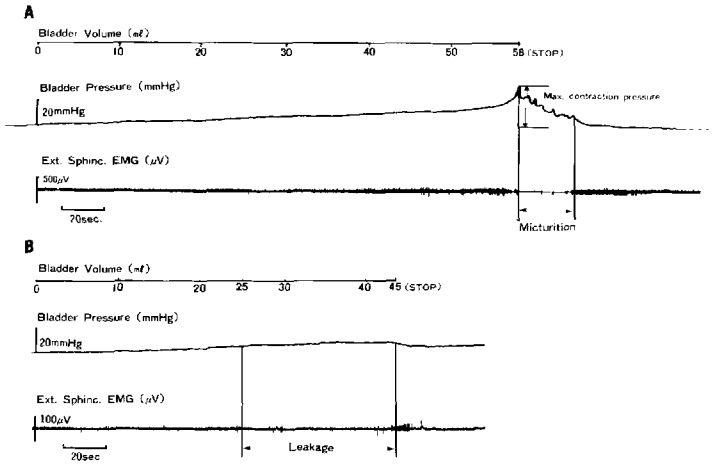

Figure 1

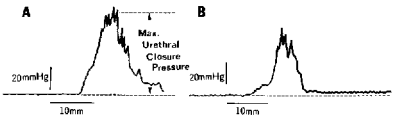

Figure 2

1) Carli,G., et al (1976).: Suppression of accompanying reactions to prolonged noxious stimulation during animal hypnosis in the rabbit. Exp. Neurol., 53: 1-11.

60

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THE BLADDER COOLING REFLEX: CHARACTERISATION OF AFFERENT MECHANISMS

AIMS OF STUDY

Subjects with sensory urge problems often experience aggravation of symptoms when cooled. Cooling also affects the motor behaviour of the bladder. Patients with neuropathic, hyperreflexive bladders typically present bladder contraction at instillation of small volumes of ice-water (Bors' ice-water test). Studies in progress at our clinic indicate that the urodynamic diagnosis may be refined by systematic use of bladder cooling. To better understand the neuronal mechanisms underlying the cooling effect we have recently initiated an experimental study in the cat. Findings so far demonstrate that bladder cooling elicites a reflex contraction of the detrusor and that other afferents than those associated with bladder tension receptors (Fall et al. 1987) are involved. The present study further delineates the afferent mechanisms of the bladder cooling reflex.

METHODS

Female cats, anaesthetized with α-chloralose (55 mg/kg), were used for the experiments. The urethra and the bladder neck were exposed extraperitoneally. Two catheters were inserted into the bladder through a slit in the urethra, about 5 mm from the bladder neck. One catheter was used for pressure recordings, the other for infusions of small volumes of saline at different temperatures. A third catheter in the urethra allowed urethral perfusion in the distal direction. Evoked efferent and afferent nerve activity was recorded simultaneously from pelvic nerve filaments. A small bladder branch was divided proximally to the vesical parasympathetical ganglia and split into several thin filaments for single- and multi-unit recordings. Proximal and distal filaments were mounted on separate electrodes in a paraffin oil bath. The nerve signals were amplified, rectified and integrated with a time constant of 1.1 s. They were displayed together with the bladder pressure recording on a chart recorder and stored with a DC tape recorder. In some cases the hypogastric, pelvic and pudendal nerves were exposed bilaterally and transected during the course of the experiments. Xylocaine (2%) and menthol (0.01%) solutions were instilled into the bladder in order to interfear with the bladder afference.

RESULTS

A bladder cooling reflex could be evoked by either bladder or urethral cooling. The bladder elicited component of the reflex was reversibly depressed by intravesical instillation of the local anaesthetic Xylocaine and eliminated by selective bladder denervation. The reflex remained unchanged after bilateral hypogastric nerve transections but was abolished by transections of the pelvic nerves. The cooling reflex evoked from the distal urethra survived all these manipulations. This component was abolished by pudendal nerve transections. The threshold temperature for the cooling reflex was about 30°C in our experimental situations. This high threshold temperature seems to preclude that nociceptors are involved. From a clinical point of view it is noteworthy that a sizeable cooling reflex was evoked by infusates at room temperature (20-22°C). The cooling reflex was greatly exaggerated by intravesical instillation of menthol, a drug that selectively enhances the sensitivity of cutaneous cold receptors (Hensel and Zotterman 1951).

CONCLUSIONS

The bladder cooling reflex is evoked by bladder and urethral receptors with afferent fibres in the pelvic and pudendal nerves. The responsible receptors have properties similar to cutaneous cold receptors. Bladder tension receptors or nociceptors are not directly involved. The specific receptor origin and high sensitivity of the cooling reflex suggest that temperature stimulation might be of value in urodynamic assessments.

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61

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EXPERIMENTAL MODELS OF REFLEX CONTRACTILE ACTIVITY IN RABBITS.

AIMS OF STUDY

Uninhibited bladder contractions are closely associated with several forms of bladder dysfunction including outlet obstruction and neurogenic bladder. In addition, they can also occur in the absence of any known dysfunction. In order to develop effective therapies for this form of reflex contractile activity, it is important to create experimental models which demonstrate uninhibited bladder contractions. In this study we created two types of experimental models which displayed a high degree of reflex contractile activity in rabbits. One of them was produced by a distal urethral occulusive ligation. In the other model a somatovesical reflex was induced by perineal touching or pinching. We investigated the characteristics of these two types of bladder excitatory reflex activities.

MATERIALS AND METHODS

Male New Zealand White rabbits were anesthetized with ketamine/xylazine. Intravesical and intra-abdominal pressures were monitored simultaneously using transducer-tipped catheters. In the first series of experiments we investigated the possibility that a typical somatovesical reflex could be produced in rabbits. Ten to twenty seconds of touching or pinching of a localized area of the perineal skin was used. For the second experiment the distal portion of the urethra was ligated tightly with 4-0 silk , creating urethral occulusion (of the anesthetized rabbit). In some animals the penis was injected with 2% lidocaine (s.c.) near the ligation for local anesthesia. In the third group of animals the prostatic portion of urethra was ligated with 4-0 silk. Intravesical pressure was monitored without saline into the bladder to avoid the influence of bladder contractions secondary to bladder filling.

Some experiments were performed in acute spinal rabbits. Spinalization was performed by cutting the spinal cord at the level of the intervertebral space C6-C7 under pentobarbital anesthesia. After 2 hours reflex bladder contractions were initiated by perineal pinching or distal urethral ligation as described above. The effect of the following drugs (iv) on reflex contractile activity was determined: hexamethonium (20 mg/kg), atropine (1 mg/kg), phentolamine (1 mg/kg), and propranolol (1 mg/kg).

RESULTS

Pinching of the perineal skin elicited rapid phasic contractions having an amplitude of approximately 10 to 20 cm H_2O. Hexamethonium (iv), suppressed the amplitude of the induced spontaneous bladder contractions by over 90%, thus, indicating that these contractions were mediated through a neurogenic reflex. Atropine (i.v.) diminished these contractions by approximately 60%, indicating that this reflex contraction was mediated primarily through muscarinic stimulation. These contractions could also be observed in all rabbits with spinal cord transection, thus, confirming that this reflex was organized at the spinal level. There was no relationship between intra-abdominal and intravesical pressure. Neither model produced a significant increase in abdominal activity as reflected by intra-abdominal pressure activity.

Spontaneous rhythmic contractions (10 to 20 cm H_2O in amplitude, 2 to 4 contractions per minute) began between 10 to 30 min. after distal urethral ligation, and continued throughout the study (at least 3 hours). Similar to that described above, hexamethonium (i.v.) virtually abolished the contractile activity while atropine suppressed the contractile activity by approximately 60%. Neither phentolamine nor propranolol had any effects on spontaneous contractions. Unlike the contractions induced by perineal pinching, the rhythmic contractions initiated by urethral ligation were eliminated by spinal section, indicating that supraspinal areas were probably involved in this reflex. Local aneasthsia of the penis around the ligation did not inhibit the spontaneous contractions. This indicated that spontaneous contractions were not produced by penile pain or sensation but by urethral occulusion. Intra-abdominal ligation of the proximal urethra caused no spontaneous contractions.

CONCLUSIONS

1) Pinching of the perineal skin induced phasic bladder contractions which may be organized through a neurogenic reflex at the spinal level.

2) Distal urethral ligation caused rhythmic bladder contractions which may be probably due to a supraspinal reflex.

3) In both types of contractile reflexes, hexamethonium (i.v.) abolished the activity by over 90%. Atropine (i.v.) diminished contractions by approximately 60%, thereby, suggesting the possibility of a noncholinergic component to these contractions.

4) We were able to produce uninhibited bladder contractions, physiologically, using both experimental models (probably via a neurogenic reflex). Therefore, these models would be useful in developing more effective therapies for hyperreflexic bladders ; such therapies might include i.v. drug administration, intravesical instillation or neural blocks.

62

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THE ROLE OF THE MICTURITION REFLEX ON UNSTABLE BLADDER CONTRACTIONS IN THE MINIPIG

AIMS OF STUDY

A Anaesthesia or section of selected spinal roots has been used to treat bladder instability. Whilst it undoubtedly reduces or abolishes unstable contractions in some patients, in others there is no symptomatic or objective improvement. Thus the importance of an intact micturition reflex in maintaining instability remains unclear. Two animal models of the unstable bladder have been developed in our laboratory; in one of these the instability is associated with bladder outflow obstruction, whilst the other, produced by transecting the bladder, may more closely represent the idiopathic unstable bladder. We have therefore investigated the effect of spinal nerve root section on the two types of unstable bladder.

METHODS

Experiments were performed on 7 minipigs all of whom had proven bladder instability. (4 due to outflow obstruction, 3 after transection). A wide lumbosacral laminectomy was performed and the nerve roots to the bladder were identified by the effects of their electrical stimulation on intravesical pressure. The persistence of abnormal contractions under light general anaesthesia was confirmed. Filling cystometrograms were then performed after serial section of the relevant nerve roots. The frequency and amplitude of the contractions was recorded.

RESULTS

As the bladder content rose from 25 to 100% of its capacity the amplitude of the unstable contractions rose by 298% in the obstructed animals but by only 108% in the transected animals ($p < 0.01$). Following section of all the nerve roots that influenced bladder function, unstable contractions persisted in both groups. However the rise of amplitude with increasing bladder content fell to 55% in the transected group (NS), and 69% in the obstructed group ($p < 0.01$). This change was largely explained by denervation causing a significant increase in the amplitude of the contractions at low bladder content.

CONCLUSIONS

We conclude that an intact micturition reflex does have a role in suppressing unstable bladder contractions. The fact that after denervation the size of the contractions still increases with increasing bladder content suggests that the amplitude of a detrusor contraction depends upon the degree to which it is stretched. Further in vitro experiments are being performed to clarify this relationship.

63

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DISAPPEARANCE OF BLADDER INSTABILITY IN RATS AFTER REMOVAL OF INFRAVESICAL OUTFLOW OBSTRUCTION

AIMS OF STUDY

Unstable bladder contractions are common in patients with bladder outflow obstruction, e.g., due to prostatic enlargement. After prostatectomy, the bladder instability persists in approximately 25 % of the patients (Abrams, 1978). Partial bladder outflow obstruction in the rat leads to bladder hypertrophy, bladder instability (Malmgren et al 1987a), and to altered micturition patterns. The obstructed rat bladder is characterized by a rightward shift of the frequency-response relation obtained by electrical field stimulation in vitro, and by a diminished contractile response to exogenously applied substance P compared to controls. The response to carbachol is unaltered.The present investigation was performed in order to follow the bladder function cystometrically after relief of the outflow obstruction and to examine the contractile responses in such bladders in vitro.

METHODS

A partial obstruction of the urethra in female rats (weight 200 g) was obtained by a silk ligature. After six weeks cystometrical investigations of the bladder and recordings of micturition volumes and intervals were performed. In some obstructed rats the urethral ligature was removed. The rats were then divided into two groups and cystometrical investigations were performed 1, 3, 5 and 2, 4, 6 days, respectively, after removal of the ligature. On day 14 the rats were killed, the bladder removed and bladder strips were dissected out. The strips were mounted in isolated organ baths and isometric tension was recorded on exposure to carbachol (cumulative addition), substance P (non-cumulative addition) and during electrical field stimulation in the presence and absence of scopolamine.

RESULTS

Fourteen days after removal of the ligature, the bladder weight had decreased to half the weight of obstructed bladders.

Cystometrical recordings revealed bladder instability in all obstructed rats (mean amplitude of spontaneous contractions > 15 cm H_2O). After removal of the ligature the instability decreased and after 7 days it had disappeared completely. At this time the micturition pattern had returned to normal and the micturition pressure had decreased to half of that obtained in the presence of the ligature. However, in vitro experiments showed that the maximal response to electrical stimulation (E_{max}) was significantly larger in previously obstructed bladders than in controls, whereas the slopes of the frequency-response curves were similar. However, in the presence of scopolamine, the E_{max} was significantly lower in previously obstructed bladder strips than in controls. Moreover, the contraction-response relation to carbachol showed a significant leftward shift in strips from previously obstructed bladders compared to controls, the EC_{50}-value being more than ten times lower in previously obstructed bladders than in controls. The maximal responses were similar. The responses to substance P were similar in control and previously obstructed bladder muscle.

CONCLUSION

Removal of the urethral ligature in obstructed rats led to the development of

supersensitivity to carbachol and to electrical field stimulation in the urinary bladder. The mechanisms behind this supersensitivity cannot be readily explained from the present data. However, during cystometrical investigations in obstructed rats muscarinic receptor blockade by atropine led to a decreased micturition pressure, whereas no effects could be seen on the bladder instability (Malmgren 1987b). Thus, the fact that the instability disappeared after removal of the urethral ligature despite the developed supersensitivity to carbachol, clearly supports the view that the instability is not mediated by cholinergic neurons. The instability may rather be due to an increased myogenic activity of the smooth muscle cells.

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64

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HYPOGASTRIC NERVE-EVOKED CONSTRICTIONS OF THE MALE FELINE RHABDOSPHINCTER AFTER CHRONIC CAUDA EQUINA LESION.

AIMS OF STUDY

The phenomenon of "isolated distal sphincter obstruction" is commonly seen on videourodynamic testing in patients with vesicourethral lower motor neuron lesions (conus, cauda equina or sacral roots). Suggested mechanisms include adrenergic smooth muscle supersensitivity (Sunder et al, 1978; Koyanagi, 1978) sympathetic dysynnergia (Awad and Downie, 1978) and fibrosis of the rhabdosphincter (Bauer, 1977). However, autonomic re-innervation of the somatically-denervated feline rhabdosphincter has been demonstrated ultrastructurally (Elbadawi and Atta, 1986) making this another possible mechanism. We investigated this possibility in a feline model of vesicourethral lower motor neuron lesion.

METHODS

Mature male cats were subjected to bilateral whole root sacral rhizotomy from S_{1-3} or S_{2-3}. Twelve weeks later, under chloralose anaesthesia, the preprostatic urethra was cannulated 1 cm above the prostate and perfused antegradely. The hypogastric nerves (HGN) were stimulated at 0.5-50 Hz and urethral pressure responses recorded.

RESULTS

Normalised frequency-response curves and mean maximum responses (absolute pressure) in chronically-treated (n=11) and neurally-intact cats (n=12) were not significantly different. After prazosin (0.2 mg/kg i.v.) however, there was a sigificantly greater residual pressure response seen at frequencies above 5 Hz ($p<0.005$) in the chronically-treated cats. Furthermore, dose-response curves of urethral pressure responses evoked by HGN stimulation after prazosin showed that in

chronically-treated cats (n=9) this response was truly prazosin-resistant amounting to 14.7 ± 2.9% of control at 10 Hz and 28.2 ± 4.9% of control at 20 Hz. Atropine (0.5mg/kg i.v) caused a significant reduction in this prazosin-resistant component only at 20 Hz (to 21.9 ± 4.7% of control, $p<0.005$). In the cats with S_{2-3} lesions (n=4) the prazosin/atropine-resistant component of the response was significantly lower at both 10 (6.8 ± 2.7% of control, $p<0.025$) and 20 (8.8 ± 3% of control) Hz. In addition, the only chronically-treated cat who did not show a prazosin/atropine-resistant component was in this group and this cat was also the only animal to show any recovery of the micturition reflex. After both types of chronic lesion yohimbine (0.2 mg/kg i.v.) did not reduce the prazosin/atropine-resistant component further. Gallamine (2mg/kg i.v.) or the more selective skeletal muscle blocker atrocurium (0.25 mg/kg i.v.) usually abolished this component as did hexamethonium (5-10mg i.a.). Acute treatment with 6-hydroxydopamine (20 mg/kg i.a.) significantly reduced the α-adrenergic component but did not affect the prazosin/atropine-resistant component of the response. Some of the frequency-response characteristics of the prazosin/atropine-resistant component (rapid "on" and "off" response, frequency-dependent twitch response) were similar to those observed after pudendal nerve stimulation using the same preparation in neurally-intact cats. Finally, pressure profilometry carried out during HGN stimulation at 10 or 20 Hz showed that the prazosin/atropine-resistant component of the response was maximal in that region of the feline urethra where the bulk of the rhabdosphincter is located.

CONCLUSIONS

We conclude that sympathetic activation of the rhabdosphincter can occur after chronic sacral rhizotomy and does so via cholinergic postganglionic neurons acting at nicotinic receptors. This effect requires a complete or near-complete lesion of the appropriate sacral roots. This may explain the failure of α-adrenolytic therapy in some cases of isolated distal sphincter obstruction seen after vesicourethral lower motor neuron lesions.

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65

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THE EFFECT OF TRANSPLANTATION OF ADRENAL GLAND TO THE SACRAL SPINAL CORD ON THE BLADDER AND URETHRAL FUNCTION IN THE SPINAL CAT

AIMS OF STUDY

In our previous study, the pontine micturition center (PMC), from where electrical stimulation evoked micturition, is located to the nucleus locus coeruleus alpha (LCa) in the cat (Sugaya et al.). Some of neurons in the LCa is known to contain

noradrenaline as a transmitter, and project to the sacral intermediate gray. On the other hand, neurophysiological results suggest that neuronal substrates for detrusor-sphincter coordinated micturition may not exist entirely within the spinal cord (Galeano et al.). Therefore, it is thought that neurons in the LCa inhibit the sacral somatic neurons innervating the external urethral sphincter muscle via inhibitory neurons or directly during bladder contraction by noradrenaline as a transmitter. In this study, the effect of transplantation of adrenal medulla that contain catecholamine secretory cells to the sacral spinal cord on the bladder and urethral function was investigated in the spinal cat at lower thoracic level.

MATERIALS AND METHODS

This study was based on data obtained from eight female cats weighing 1.7-2.9kg. Under nembutal anesthesia, laminectomy was performed to expose the T13 and S1-3 cord segments. After incision of the dura, T13 cord segment was completely tied with 0 silk. In 5 of these eight spinal cats, right adrenal gland was removed retroperitoneally to make blocks (1-1.5 mm^3) of adrenal medulla. Three blocks were autografted into the gray matter of the S1-2 cord segments through the dura and dorsal funiculus, and 3-5 blocks were placed between the dura and the surface of the sacral spinal cord. The other 3 cats had sham operations on the sacral spinal cord and acted as controls. In unanesthetized condition, residural volume in the bladder before cystometry, cystometrogram and the electromyogram (EMG) of the external urethral sphincter muscle were evaluated every weeks after operation. After eight weeks, animals were sacrificed and the sacral cord segments were examined histologically.

RESULTS

After one week operation, cystometrograms and the EMGs of transplanted and control cats showed weak bladder contractions and weak activities of the sphincter muscles, and detrusor-sphincter dyssynergia. In transplanted cats, cystometrograms and the EMGs showed detrusor-sphincter coordinated micturitions after two weeks (4 cats) or three weeks (1 cat). This synergic pattern continued untill sacrifice at eight weeks. In the controls, synergic pattern was recorded firstly after three weeks (1 cat) or four weeks (2 cats). However, even after four weeks, detrusor-sphincter coordinated activity was unstable, and the duration of it was short and frequently absent. The residural volumes were 12.9±12.8 *ml* and 19.8±21.4 ml in six week transplanted and control cats, respectively. The peak bladder pressures were 38.8±10.2 cmH2O and 42.0±5.9 cmH2O in six week transplanted and control cats, respectively. There were no significant differences in residural volumes and peak bladder pressures between transplanted and control cats. Histologically, transplanted tissues existed in and on the S1-2 cord segments.

CONCLUSION

Neuronal mechanisms for detrusor-sphincter coordinated micturition were thought to exist in the pons and the sacral spinal cord. In the pons, neurons in the PMC inhibitorilly project to the pontine urine-storage center which correspond to the lateral tegmental field (Nishizawa et al.). In the sacral spinal cord, projecting fibers from the PMC inhibit somatic neurons in the Onuf's nucleus that is nucleus of origin of the pudendal nerve. However, neurons in the PMC contain at least two transmitters; acetylcholine and noradrenaline (Sakai). Our results suggest that

noradrenaline containing neurons in the PMC act as one of the inhibitory components of the external urethral sphincter activity during micturition at the sacral spinal cord. Moreover, transplantation of adrenal medulla to the sacral spinal cord is thought to have a possibility of treatment for detrusor-sphincter dyssynergia.

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66

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EFFECT OF CEREBELLECTOMY ON REFLEX MICTURITION IN THE DECEREBRATE DOG

AIMS OF STUDY

The presence of cerebellar influences on micturition is widely recognized, however, the precise mode of action remains controversial. In the previous experimental studies by ablation and electrical stimulation (Chambers, 1949; Bradley and Teague, 1969; Martner, 1975), three types of cerebellar influences has been reported to be: suppression, enhancement, and either suppression or enhancement depending on the prevailing bladder tone. To clarify the role of the cerebellum on bladder and urethral sphincter functions, it was considered of interest to investigate the entire reflex micturition cycle of the decerebrate dog with cystometric and urethral sphincter EMG studies both before and after cerebellectomy.

MATERIALS AND METHODS

Eleven supracollicular decerebrate dogs were used. The bladder pressure was measured with the one channel of the suprapubic double lumen catheter connected to a Statham P 50 transducer. The urethral sphincter EMG was measured with two wire electrodes inserted into the urethral wall. The dog was placed in the standing position by fixing the vertebrae of the thoracic segments and pelvis in a stereotaxic instrument. The bony tentorium was removed for future cerebellectomy by the use of suction.

After the anesthetic effect wore off in the decerebrate state, a series of experiments was performed. As a control study, the cystometry and urethral sphincter EMG were recorded during the reflex micturition in response to bladder filling. After cerebellectomy cystometry and urethral sphincter EMG was repeated during reflex micturition induced by bladder filling. The following urodynamic parameters were evaluated: threshold volume, threshold pressure, contraction pressure, voided volume, voiding time, residual volume and after voiding contraction bladder pressure.

RESULTS

In the control conditions and after cerebellectomy, reflex micturition with bladder contraction and spasmodic contractions of the urethral sphincter occurred when a critical degree of filling was reached. Cerebellectomy however did result in a significant decrease in threshold volume and threshold pressure in the collecting phase, and contraction pressure and voided volume in the emptying phase. In 10 out of 11 dogs, after voiding bladder contraction with pressures of $48.6+16.8cmH_2O$(mean+S.D.)occurred in the control condition and was decreased significantly to pressures of $13.4+20.8cmH_2O$ after cerebellectomy(p 0.01).

CONCLUSION

The present results show that the cerebellum plays an inhibitory role in the collecting phase and a facilitatory role in the emptying phase during the reflex micturiton cycle of the decerebrate dog. It is interesting that cerebellar influences on the lower urinary tract function seems to be different between the collecting and emptying phases. Further study waits concerning the neurotransmission mechanism of these effects.

The clinical study by Leach et.(1982) reported that urodynamic manifestation in patients with cerebellar ataxia showed hyperreflexia and/or acontractile bladder and coordinated and/or dyssynergic urethral sphicter. They pointed that the variability of the urodynamic finding in patients of cerebellar ataxia may be partly explained by multifocal involvement of the nervous system. Our results in the decerbrate dog suggest that a focal cerebellar disease produces hyperreflexic bladder and a coordinated urethral sphincter.

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67

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ARE THERE LIMITATIONS TO PELVIC FLOOR REHABILITATION IN FEMALE STRESS URINARY INCONTINENCE ?

AIMS OF STUDY

Pelvic floor rehabilitation is to date a well recognized way of treatment for female stress urinary incontinence. We had already presented our good results Sandri (1986). Now as we got larger experience in this field, we want to find if there are some limitations to this treatment. Therefore we evaluated our results in order to better select patients before enrolling them in a time and cost consuming treatment.

PATIENTS AND METHODS

59 female patients (mean age 52yrs) complaining of stress urinary incontinence, after complete clinical, radiological and urodynamic investigations were submitted to pelvic floor rehabilitation. They were instructed to contract frequently perineal muscles, avoiding simultaneous contractions of other synergic or dyssynergic muscles. They were also asked to try to stop urinary stream during each micturition. At follow up (min 4 max 26 mean 11 months)results were judged both subjectively by the patient and objectively with a pad test. 61% referred improvement while 39% remained unchanged. Perineometer showed improvement of vaginal contraction with a highly significant difference (p=0.002 using Student test for paired samples).

RESULTS

Age did not limit our results. No difference was found between patients less than 60 yrs old and older ones (p=0.78 using X^2). Body weight did not influence our results too. We found no difference between patients weighting less and more than 70 Kgs (p=0.18 using Fisher test). Even increase or decrease of more than 2 kgs of body weight during follow up showed no statistical difference (p=0.58 using X^2). Duration of incontinence did not influence our results (p=0.34 using X^2) although other Authors have found rehabilitation less effective with long duration of symptoms Henalla (1986). We could not demonstrate difference among patients with different colpocystourethrographic patterns. Demonstration of severe weakness of perineal floor before treatment shown as a faible vaginal contraction ($\leq$10 cmH20) at perineometer or reduced urethral closure pressure ($\leq$30 cmH20) at urethral pressure profile did not worsen our results significantly (p=0.13 and p=0.34 using Fisher test respectively). Previous surgical treatment for urinary stress incontinence reduced but not significantly our results (p=0.29 using Fisher test). Even detrusor instability, found in 12 patients associated to a defective urethral closure, wasn't a worsening factor (p=0.50 using X^2). Severity of urine loss, as found at the initial pad test, did not influence our results (p=0.60 using X^2).

Those patients who were unable to stop micturition before starting the treatment obtained similar results (p=0.63 using Fisher test). Finally simultaneous treatment with topic estrogen did not significantly improve our results in postmenopausal patients (p=0.46 using Fisher test).

CONCLUSIONS

We were unable to find any limiting factor that could influence significantly the results of pelvic floor rehabilitation . Therefore we actually submit all females complaining of stress urinary incontinence to this treatment. We are now trying to perform more specific training of the perineal muscles using biofeedback technics in order to further improve our results.

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68

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WHO BENEFITS FROM PHYSIOTHERAPY?

AIMS OF STUDY

Pelvic floor exercises are widely advocated in the management of genuine stress incontinence (GSI). Physiotherapy aims to increase the tone and power of the peri-urethral striated muscle, thereby improving its occlusive action, and enhancing urethral support. The success of physiotherapy is variable but those patients most likely to benefit from this treatment have yet to be identified. We have performed a prospective study of the effect of physiotherapy on women with urodynamically proven GSI, and have identified the good prognostic features.

PATIENTS AND METHODS

Women complaining of incontinence underwent assessment including a symptom questionnaire, visual analogue scoring of lower urinary tract symptoms, videocysto-urethrography (VCU), one hour pad test and urethral pressure profilometry. 45 consecutive women diagnosed by VCU as having GSI were treated with physiotherapy for 3 months. This was performed by one doctor and a dedicated continence advisor. Patients were given a detailed description of their condition and the anatomy of the pelvic floor; they were examined vaginally and were taught pelvic floor

exercises. Their competence at performing these exercises was confirmed. Patients were reviewed weekly and after the course of therapy were re-investigated as described above. We divided our patients into two groups: those cured (VCU) and those with persistent GSI in order to define differences between them on the basis of their pre-treatment work up.

RESULTS

12 of the 45 women were cured and 33 had persistent GSI. We assessed a large number of symptomatic and urodynamic parameters and identified 5 where there was a significant difference between the two groups: menopausal age, duration of symptoms, visual analogue score of the symptom of stress incontinence (VAS stress), stress functional urethral length (sFUL) and stress maximum urethral pressure (sMUP). The data was statistically analysed (Table 1).

Those likely to succeed with physiotherapy are pre-menopausal with a shorter duration of symptoms, lower score on the VAS stress, and better urethral function during stress. Unfortunately the overlap between those cured and those with persistent GSI is too great for any one of these parameters to be used alone

Table 1

		No.	Median	10th %ile	90th %ile	M-W
Menopausal age (years)	C	12	0	0	4	0.026
	GSI	33	2	0	11	
Duration of symptoms (years)	C	10*	1.5	0.1	6.8	0.04
	GSI	32*	4	1	20	
s FUL (mm)	C	10*	11	5	22.6	0.043
	GSI	32*	4	0	18	
s MUP (cm H_2O)	C	10*	36	9.4	80	0.001
	GSI	31*	0	0	42.8	

		No.	Mean	SD	SEM	t test
VAS stress (/100)	C	12	61.7	25.3	7.29	0.005
	GSI	31	84.7	17	3.05	

C=cured by physiotherapy GSI=persistent GSI M-W=Mann Whitney *=missing data

prospectively to predict outcome. However taking the 10th and 90th centiles or the mean +/- one SD for those cured three parameters may be used in conjunction (VAS stress, s FUL and s MUP). Thus, we can select those with the following parameters: VAS stress < 87; s FUL > 5 mm; s MUP > 9.4 cm H_2O. Table 2 shows the number of patients in our two groups who have none, some or all of these pre-treatment characteristics.

Table 2

Patients who have none, some or all of the following three characteristics: VAS stress < 87;, s FUL 8 5 mm; s MUP > 9.4 cm H_2O).

	0/3	1/3	2/3	3/3	
C	0	0	4	6	n=10
GSI	8	11	7	4	n=30

(only patients with complete data were entered)

C = cured GSI=persistent GSI

If 2 out of the 3 criteria were met we could identify all those patients who would be cured by physiotherapy and only include 11/40 patients who would fail physiotherapy. 19/40 patients would not receive unnecessary and time-consuming treatment.

We also noted that none of those patients with severe stress incontinence (leak with first cough at VCU) or marked descent of the bladder base were cured by physiotherapy. If they are excluded from treatment then we will correctly identify 10/40 patients who will be cured by physiotherapy; perform physiotherapy on 9/40 women unnecessarily; and avoid physiotherapy in 21/40 women.

CONCLUSION

Physiotherapy is a simple, safe form of treatment for GSI but has a low cure rate (12/45). In order to avoid unnecessary treatment we have developed a simple technique to identify those patients most likely to succeed and exclude those likely to fail.

69

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KNOWLEDGE ABOUT AND ABILITY TO CORRECT PELVIC FLOOR MUSCLE EXERCISES IN WOMEN WITH URINARY STRESS INCONTINENCE

AIMS OF STUDY

During the last decade there has been more open discussion and information about the problems of urinary stress incontinence in women. World wide, newspapers and women's magazines have published articles about the item, concentrating on exercise programs to increase pelvic floor muscle strength as a simple treatment for stress incontinence.

The aim of this study was to evaluate the knowledge about pelvic floor muscle exercises in women suffering from stress incontinence, and also to compare this knowledge with clinical examination of the women's ability to correct pelvic floor muscle contractions.

PATIENTS AND METHODS

60 women, mean age 46.3 years (24-64 years) with genuine stress incontinence proven clinically and urodynamically took part in the study. 18 of the women had reached postmenopausal age and 56 had gone through childbirth.

After clinical and urodynamical examination the women responded to a questionnaire concerning their knowledge about and previous trials in pelvic floor exercises. They were subsequently taught about pelvic floor anatomy on an individual basis and carefully instructed how to contract their muscles correctly. Palpation-observation and fiber-tip transducer connected to a balloon catheter were used to examine their ability to contract their muscles correctly. Subsequently they were questioned whether their previous trials had been executed correctly.

RESULTS

10 out of 60 women stated that they never had received any information about pelvic floor exercises as treatment of urinary leakage. 46 had received some information about exercises and only 4 claimed to be well informed about such exercises. Only 9 were informed about the topic in special birth preparation courses while 23 had received the information from the hospital physiotherapist after delivery. None recalled to have received any information at the 6 weeks consultation after delivery, and only 3 women had received any information from their own physician. 17 women had received most of their information from newspapers and magazines.

21 women (33.3%) had never performed any pelvic floor exercises before, 9 had exercised after all their deliveries and 9 only after their last delivery. 15 women were exercising their pelvic floor muscles irregularly presently, and only 2 performed regular exercises presently.

41 women (68.3%) had a positive palpation test indicating correct pelvic floor muscle contraction performance, but 19 (31.7%) did not manage to use their muscles correctly. 27 out of 39 women (69.2%) who had exercised their pelvic floor muscles voluntarily at home previously stated that they must have done it incorrectly. The most common misunderstanding was to exercise their gluteal muscles instead of in the inner pelvic floor muscles.

16 out of 27 who had not practised correct exercises previously succeeded after the first palpation test.

CONCLUSIONS

Correct pelvic floor muscle contractions are difficult to perform. Palpation seems to be of utmost importance in evaluation of correct contractions. In clinical trials investigating the effect of pelvic floor exercises for urinary stress incontinence the investigater must control for correct performance.

70

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'TREATMENT OF FEMALE GENUINE STRESS URINARY INCONTINENCE WITH PELVIC FLOOR RE-EDUCATION IN TWO DIFFERENT HOSPITALS'

AIM OF THE STUDY

This study was designed to compare the results of pelvic floor exercises in the treatment of genuine stress incontinence in a District General Hospital and a Central Teaching Hospital fifty miles apart.

PATIENTS AND METHODS

Two different groups of patients who were diagnosed urodynamically to have genuine stress urinary incontinence were treated with pelvic floor education in two different hospitals. Thirty-two patients (aged 27-77) were treated at a District General Hospital and twenty-six patients (aged 26-74) were treated at a Central Teaching Hospital. The two groups of patients were comparable regarding their age, weight, parity and the severity of their incontinence ($p>0.05$). The same investigator had carried out patient assessments in both studies. This included perineal pad weight testing for quantitative assessment of urine loss before and three months from commencing treatment. This test was a slight modification from the originally described test by Sutherst et al. (1981) and proved to be highly reproducible. The two groups of patients were treated by two different physiotherapists at the two hospitals. Long-term follow-up was carried out by questionnaire analysis between nine to twelve months from commencing the treatment.

RESULTS

In all fifty-eight patients with genuine stress incontinence in the two hospitals were treated with pelvic floor re-education by a simple exercise regimen. The overall successful outcome from both studies was 67% after three months. A similar percentage of patients in the two studies responded to treatment and became either completely dry or significantly improved (68.8% at Lincoln Hospital and 65.4% at Leicester Hospital). This was clearly demonstrated according to mean pad weight changes before and after treatment. Fifty-seven per cent of patients at the first study and 50% of patients at the second study were still improved and did not wish any further treatment at the second follow-up 'nine to twelve months from commencing treatment'.

CONCLUSION

It appears from these two described studies in the two different hospitals that pelvic floor exercises is an effective method for the treatment of urinary stress incontinence. These results can be reproduced in most centres providing there is enough supervision on the behalf of the physiotherapist treating the patients. The severity of urinary incontinence did not affect the treatment outcome and the enthusiasm of a particular therapist does not seem to be a major deciding factor.

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71

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A COMPARISON OF URETHRAL ELECTRICAL CONDUCTANCE AND PERINEOMETRY DURING A COURSE OF PELVIC FLOOR EXERCISES FOR GENUINE STRESS INCONTINENCE.

AIMS OF STUDY

Conservative management of patients suffering from genuine stress incontinence has centred around the use of exercises specifically aimed at developing the pelvic floor musculature. Shepherd et al (1983) used a perineometer to monitor their patients' progress during a course of such exercises. They found that the perineometer increased the success rate when compared with a group of controls performing the same exercises. The measurement of urethral electrical conductance can be used to detect (Plevnik et al 1985) or quantify (Mayne and Hilton 1988) the presence of urine within the urethra, and therefore, has the potential to monitor the effect of treatment. This study was undertaken to compare the effects of monitoring patients during a course of pelvic floor exercises with either perineometry or urethral electrical conductance.

METHOD

Patients with genuine stress incontinence were recruited, and randomly allocated into the two study groups. The pre-treatment assessment included: subtracted dual channel cystometry, urethral pressure measurement at rest and on stress, a urethral electrical conductance profile and a short exercise perineal pad test. The patients were instructed in how to exercise their pelvic floor muscles, and seen weekly for one month to check that they were performing the exercises correctly. Further follow up was monthly for three months. At each visit the patients' progress was assessed either with the perineometer or by means of a urethral competence electrical conductance test (Plevnik et al 1985), and the result conveyed visually. On completion of the course of exercises the urodynamic assessment outlined above was repeated.

RESULTS

34 patients were recruited to the study. Of the 27 who completed the course of treatment 13 were monitored using perineometry (mean age 45 years) and 14 using urethral electrical conductance (mean rate 56 years). The patients were divided into 4 groups on the basis of the perineal pad tests. Results were not significantly different $X^2 = 0{\cdot}05$.

	Cured	Improved	No Change	Worse
Perineometer	2	5	5	1
Urethral electrical conductance	2	5	6	1

CONCLUSION

Monitoring the progress of patients undergoing physiotherapy for genuine stress incontinence is currently unsatisfactory. Attempts to measure the strength of voluntary pelvic floor contractions with the perineometer are unreliable, since almost any increase in intra-abdominal pressure tends to register on the device,

and thus give the impression of improvement, yet is counter-productive as far as continence is concerned. In this study we have used urethral electrical conductance to monitor the effect of treatment; it has been demonstrated to be as effective as perineometry despite the significant difference in age between the two groups.

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72

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CONES VERSUS PHYSIOTHERAPY AS CONSERVATIVE MANAGEMENT OF GENUINE STRESS INCONTINENCE

BACKGROUND

We have previously reported the use of cones to train the pelvic floor muscles in conservative management of genuine stress incontinence with 70% cure or improvement (Peattie, 1988). This new modality of therapy is now compared with standard physiotherapy exercises for the pelvic floor. The aim of this study was to compare patients randomly allocated to each method of training to see which method was more efficacious.

PATIENTS AND METHODS

Thirty seven premenopausal women with cystometrically proven genuine stress incontinence awaiting corrective surgery were recruited and randomly allocated to pelvic floor exercises or the use of cones. Urine loss was assessed subjectively and by means of an extended pad test, pre- and post-treatment. The cone programme was as previously described with assessment of passive and active cone weights (Peattie, 1988). The time to instruct was 20 minutes on the first visit. Follow up was conducted by telephone on a weekly basis and reassessment took 5 minutes at the completion of the programme. At the first visit to physiotherapy, a session of one hour was allowed to instruct patients on the anatomical relationship and means of exercising the pelvic floor muscles. A second visit a week later lasting 30 minutes reinforces this teaching, the final visit being three weeks later for 15 minutes to encourage continuation with

exercises. Urine loss is reassessed after the final visit. Between visits, the patients are instructed to practise the exercises 50 times a day.

RESULTS

Two of 19 (11%) in the cones group defaulted, one with lumbar disc problems. Four of 18 (22%) patients did not complete pelvic floor exercises - three defaulted and one patient became pregnant. A further seven patients (2 cones and 5 pelvic floor exercises) are still undergoing treatment. Patients treated with cones demonstrated an improvement in both active and passive cones in line with our previous study.

Only 3 out of 15 (20%) patients allocated to treatment with cones did not report subjective improvement as compared to 4 out of 9 (44%) patients allocated to receive pelvic floor exercises. Unfortunately with the small numbers who have completed treatment, this difference did not achieve statistical significance. Both groups benefitted from therapy in that there was a statistical reduction in the mean urine loss as assessed by the pad weighing test on completion of therapy. There is however no statistical difference between the two groups.

Patients who failed to achieve a satisfactory result with therapy in each group were referred for surgery and this resulted in 5 of 15 (33%) in the cone group being referred for surgery and 4 out of 9 (44%) from the pelvic floor exercises group. Compliance was 100% in the cones group and 67% (6 out of 9) in the pelvic floor exercise group.

CONCLUSION

1. The 80% subjective and 60% objective improvement in the cone group confirms our previous findings.
2. Fewer patients treated with cone therapy needed bladder neck surgery following the course of treatment.
3. The time required for teaching pelvic floor exercises is more than three times that required for teaching cones.

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73

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A PROSPECTIVE TRIAL COMPARING INTERFERENTIAL THEAPY AND TREATMENT USING CONES IN PATIENTS WITH SYMPTOMS OF STRESS INCONTINENCE.

AIMS OF STUDY

There are a number of techniques available to 're-educate' and strengthen the pelvic floor muscles, the standard method of therapy in our unit being interferential therapy. Plevnik (1985) first showed that normal women could be trained to retain cones of increasing weight in the vagina, thus initiating a powerful feedback of the feeling of 'losing the cone', thus making the pelvic floor contract around it. Since the promising results of early trials (Stanton et al. 1986) this method of treatment is now an acceptable form of therapy in many centres.

The aim of the study was to compare the effectiveness of treatment with the cones and pelvic floor exercises with the use of interferential therapy and pelvic floor exercises in patients referred to the department of physiotherapy with symptoms of stress incontinence. The efficiency and cost-effectiveness of each method was also compared.

PATIENTS AND METHODS

69 patients with symptoms of stress incontinence referred from gynaecological and urological clinics to the department of physiotherapy were entered into the trial and were randomly allocated to either interferential therapy (36 patients), or to treatment with cones (33 patients). Subsequently, 15 patients failed to complete the trial (9 cones, 6 interferential). The two treatment groups were well matched for age, weight and previous surgical repairs.

Patients entered into the trial were asked to keep a continence chart for a week prior to treatment, which was continued during treatment. All patients were shown how to perform pelvic floor exercises. Further assessment before and after treatment was by (a) the patient's subjective response, (b) continence/frequency charts, (c) digital assessment of pelvic floor contractions, (d) perineometer measurements, (e) the weight of the cone that could be retained passively and actively, and (f) a standard 1 hour pad test.

Patients treated with the cones attended the physiotherapy department once a week for four weeks. The patients were asked to train their pelvic floor muscles by retaining the passive cone weight that they had coped with on first testing. The patients were then asked to try and retain this cone twice a day for up to 15 minutes. When they could do this on 2 consecutive occasions they graduated to the next cone.

Patients in the interferential group attended the physiotherapy department three times a week for four weeks. An interferential current of between 0-100 Hz was given, the intensity of which was the maximum that the patient could comfortably tolerate. Treatment was given for 15 minutes.

RESULTS

There was a good subjective response to treatment in both groups. In the cones group, 19 patients (78.2%) were improved, 4 (16.7%) reported no change and 1 (4.17%) reported a deterioration. This correlates quite well with the continence chart results, which show an improvement in 20 patients (83.4%), no change in 3 (12.5%), and a deterioration in 1 (4.1%). In the interferential group, 27 patients (90%) were improved, 3 (10%) reported no change in their symptoms, and there were no patients that deteriorated. In this group the correlation with the continence charting is poor with 18 (60%) of patients showing an improvement, 10 patients (33.3%) with no change in their symptoms, and 2 patients (6.7%) worse.

Objective measurement of incontinence was by pad testing. Before treatment the average loss of urine during the pad test in the cones treatment group was 27.7gm compared with 32.2gm in the interferential group. This difference was bourne out by the patient's subjective assessment of their symptoms prior to treatment, when 76% of interferential patients considered themselves to have severe/moderate symptoms, compared to 56% of the cones group. However, the interferential group showed a more marked improvement with treatment, 23 patient (76.7%) improving, 2 patients (6.7%) remaining unchanged, and 5 (16.7%) showing a deterioration.

Digital assessment of the pelvic floor yields similar results for each group, and assessment with the perineometer demonstrated a small difference in favour of the cones treatment group.

On assessment with the cones, there was no significant difference between the two groups on passive testing. However, there was a more marked improvement in the cones group on active testing (Cones: improved, 19 [79.2%], no change, 3 [12.5%], worse, 2 [8.3%]; Interferential: improved, 17 [56.7%], no change, 12 [40%], worse, 1 [3.3%]).

There was a marked difference in the treatment times between the two groups. The average treatment time for the cones group was 36.7 hours (range 20-60), and the average time for the interferential group was 184.9 hours (range 177-215).

CONCLUSIONS

Both methods of treating patients with the symptoms of stress incontinence are effective, although the results with interferential therapy are slightly better than those of the cones. This study has also shown a poor correlation of many objective and subjective tests with the degree of incontinence. Whilst the cones can give an objective assessment of pelvic floor strength, there is a less accurate assessment of the degree of incontinence, and thus improved pelvic floor contractions do not necessarliy correlate with an improvement in symptoms. Interferential therapy, on the other hand has a more general effect on the pelvic musculature.

This study has further shown that treatment with the cones is an effective, and cost effective method of treatment, with a marked reduction in phsiotherapy time and time spent by the patient in hospital. A case could be made for using cones as a primary method of treatment, reserving interferential therapy for those patients who did not benefit from treatment.

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74

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INTERFERENTIAL THERAPY IN THE TREATMENT OF GENUINE STRESS INCONTINENCE

AIMS OF STUDY

Electrical stimulation in the management of G.S.I. has been described by Plevnik (1986) using low frequency, battery operated stimulators, via vaginal electrodes.

This study examines a non-invasive technique using Interferential Therapy with variable frequencies, and compares its efficacy with pelvic floor exercises.

BACKGROUND Interferential Therapy (IT) is based on the beat frequency phenomenom whereby two medium frequency alternating currents e.g. 4000 Hz and 4020 Hz are superimposed to give a low frequency effect in the tissues, equal to the difference between the two medium frequency currents i.e. 20 Hz in this example. This method overcomes the high skin resistance encountered by low frequency currents, according to the formula:

$$x = \frac{1}{2\pi fc}$$

x = capacitive resistance (reactance)
f = frequency
c = constant = polarization capacitance of the tissue

The resulting amplitude modulated signal is delivered to the neuromuscular structures of the pelvic floor by 2 or 4 electrodes (Laycock, 1988). The periurethral levator ani muscles, composed of a heterogenous population of fast and slow twitch muscle fibres, assist in the maintenance of continence; the slow twitch fibres have a postural role and the fast twitch fibres are thought to be recruited during physical stress e.g. coughing. (Gosling, 1981). The firing rate of slow twitch fibres is 10 - 20 c.p.s. and fast twitch fibres is 30 - 60 c.p.s. (Eccles, 1958); effective electrical stimulation should mimic these frequencies. The Endomed 433 (Enraf Nonius) I.T. machine used in this study delivers a varying frequency sweep, enabling all frequencies in the desired range to be covered: 10 - 50 Hz is recommended for G.S.I.

PATIENTS AND METHODS

36 female patients, mean age 44 (range 30 - 74) with urodynamically proven G.S.I. were randomly allocated to two groups. Group 1 (n = 20) received Interferential Therapy only. Group 2 (n = 16) received pelvic floor exercises only. Group 1 patients received an average of 11 (range 7 - 13) ½ hour sessions of IT, 2 or 3 times per week, for 4 - 6 weeks. Group 2 patients received a 6 - 8 week course of pelvic floor exercises, attending 1/week, and following a home exercise programme. All patients were assessed before and after treatment subjectively and with the Pad Test, and after 3 months by postal questionnaire.

RESULTS

Of the 36 patients who entered the study 29 were available for analysis. Results of the pad test in Group 1 (n = 18) showed a mean difference in urine loss of 30.55g (range 3.0 - 78.0) and in Group 2 (n = 11) a mean difference in urine loss of 36.33g (range 7.7 - 72.4); using the patients as their own controls, there was a significant reduction in urine loss - Group 1 p = 0.01, Group 2 p = 0.01 (Wilcoxon). Subjectively, 50% of patients in Group 1 were much improved, with a further 39% showing some improvement. In Group 2, 55% showed much improvement, with a further 18% showing some improvement. At 3 months, all patients had maintained their level of improvement.

CONCLUSION

Interferential Therapy, on its own, is an effective treatment for G.S.I. In our unit, it is a useful adjunct to pelvic floor exercises and is the treatment of choice for patients unable to co-operate in a course of pelvic floor exercises e.g. the elderly. The study continues.

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75

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The Scandinavian Multicenter Study Group

URGE INCONTINENCE TREATED WITH MAXIMAL ELECTRIC STIMULATION

AIM OF STUDY: Recently a maximal electric stimulator for treatment of urge incontinence has been developed in Norway, the Medicon MS-103. In order to evaluate this device a multicenter trial was started in 1987, nine clinics in Denmark, Finland, Norway and Sweden participate.
PATIENTS AND METHODS: Fourty-six patients have completed the study, 35 of these suffered from urge incontinence due to detrusor instability, and 11 had detrusor hyperreflexia.
Group I: Detrusor hyperreflexia consists of 3 males and 8 females, all with known neurological diseases. Mean age 41 years (25-71).
Group II: Detrusor instability, consist of 8 males and 27 females, mean age 58 years (22-78). The device is equipped with two electrodes, one for anal and one for vaginal application, and both can be used simultaneous. Monofasic, intermittant, square pulses of 1 msec duration is applied with a frequency sweeping between 5 and 10 Hz in 4 sec. with a pause of 1.5 sec. The current intensity can be gradually increased to the pain treshold, and kept there for 20 minutes. Maximal intensity is 100 mA on each channel. All patients were given 12 treatments of 20 minutes stimulation. The effect was estimated by micturition charts and cystometry before treatment, directly before and 6 weeks after the last treatment. The patients subjective response was recorded as cured: meaning no more use for pads, less frequency and larger capacity, improved: meaning only occationally use for pads and finally unchanged.
RESULTS
Group I. (Table I). Five were improved during and after treatment but only 3 remained so after 6 weeks.
Group II. (Table II). After 6 weeks 6 out of 35 were cured. ($p < 0.001$). Twenty-one were initially improved, but after 6 weeks this number was reduced to 13.

Table I

RESULTS

Group I

Subjective evaluation:	Pre	Post	6 weeks
Improved		5	3
Unchanged		6	8
Frequency: Day	8.4	7.8	7.2
Night	2	1.8	1.6
Mean volume (ml)	142	138	117
Cystometric capacity: (ml)	136	180	208
p^{ves} at urgency ($cm H_2O$)	87	61 ($p = 0.05$)	75

Table II

Group II	Pre	Post	6 weeks
Subjective evaluation:			
Cured		3 (p< 0.001)	6 (p< 0.001)
Improved		21	13
Unchanged		11	16
Frequency: Day	8.9	8.0 (p= 0.11)	7.9 (p= 0.023)
Night	1.7	1.2 (p= 0.018)	1.2 (p= 0.004)
Mean volume: (ml)	168	196 (p= 0.002)	195 (p= 0.003)
Cystometric capacity (ml)	278	329 (p= 0.003)	323 (p= 0.019)
p^{ves} at urgency (cm H_2O)	57	61	55

CONCLUSION

The overall results in this group of patients are encouraging. Particularily in detrusor instability did more than half of the patients experiences significant improvement. It is possible that prolonged treatment in the patients with detrusor hyperreflexia could improve the results because 5/11 had initial effect.

76

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A SILASTIC VAGINAL DEVICE FOR THE TREATMENT OF STRESS URINARY INCONTINENCE

AIMS OF STUDY

Stress incontinence still remains to be a problem in a large number of female individuals spanning various age groups. Surgical treatment is extremely satisfactory, although there are a number of female patients, in whom, surgery is, either contraindicated, deferred, or has failed. Non surgical management is not always very satisfactory, and a number of these patients have to wear absorbent pads for protection. A new silastic vaginal device has been described, which restores continence by elevating and supporting bladder base and bladder neck. The results are comparable to surgical cure of stress incontinence.

PATIENTS AND METHODS

Total number of 44 patients were fitted with the device, of whom, 18 patients had one or more previous surgery, 15 patients were unsuitable for surgery and in 10 patients surgery had to be deferred. Diagnosis of stress incontinence was made on urodynamic assesment, cystoscopy and cystourethrogram. The device was inserted in the vagina, in similar manner to a ring pessary, so that, the anterior projections of the device elevate the paraurethral and bladder neck region by at-

least 2 centimeters or more, creating a 'hammock' at the region of bladder neck. Postinsertion straining and voiding cystourethrograms were performed, as well as uroflowmetry, to assess continence and any voiding difficulties. Device was left in situ for atleast 3 months.

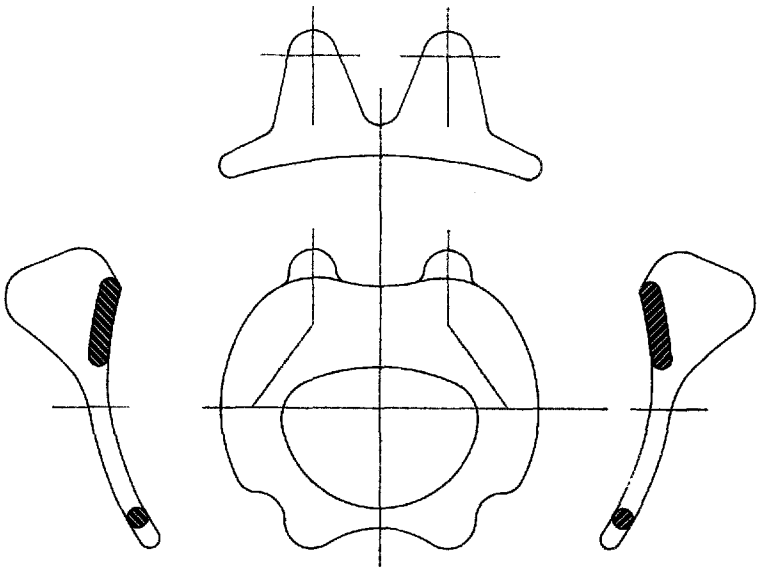
RESULTS

Continence was objectly documented in 38 patients (85%). Of the 18 patients with previous surgery, 15 (83%) were continent, with 12 patients of this group having had more than one surgery. Of the 16 patients unsuitable for surgery, 14 (87%) were much improved. Overall continence was high in all groups, and expulsion rate was low, 5/44 (11%). In 4 patients (8.5%), device was unacceptable.

CONCLUSIONS

This incontinence device appears to be a valuable adjunct to nonsurgical management of stress incontinence, especially in patients with failed incontinent surgery, or who is unsuitable for surgery. Expulsion rate is low, and patients compliance is moderately high. There appears to be no morbidity or mortality.

SCHEMATIC DIAGRAM OF THE SILASTIC VAGINAL DEVICE



77

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LONGTERM EXPERIENCE WITH INTERMITTENT SELFCATHETERISATION.

Aims of study

Intermittent selfcatheterisation is a well-accepted method of treating patients with a neuropathic and a non-neuropathic bladder dysfunction : in this study we reviewed the results in a group of patients with longterm follow-up.

Patients and methods

Over 450 patients learned intermittent selfcatheterisation (IC) between 1974 and 1987. The method was chosen mainly because bladder drill and pharmacotherapy proved unsuccessfull or contraindicated at that time. Most of the patients succeeded in becoming catheterfree afterwards. In this study we review the files of 75 patients who had to continue IC with a mean follow-up of 5 years 8 months (between 1 and 12 years). There are 33 male and 42 female mean age 28 years old (between 1,5 years old and 76 years old).

69 had a neuropathic bladder (spinal cord injury or meningomyelocoele). Six patients had a non-neuropathic dysfunction. Their urodynamic patterns are presented.

Urological control has been done every 3 to 6 months. Radiographic and urodynamic studies every year or every two years.

Results

- Upper tract evolution

51 patients had normal intravenous urography (IVU) at start. 3 of them developed a minor upper tract dilatation due to low detrusor compliance.

19 patients started with bilateral hydronephrosis. 14 regained a normal IVU, the 5 others a minor dilatation.

Renal function remained normal in all patients except in 3 patients with marked pyelonephritis at start who showed a slow but continuous renal deterioration.

- Vesico-ureteral reflux was present in 21 patients at start. In 8 patients reflux disappeared. 13 patients were operated on with success. Two patients developed reflux during IC but it disappeared spontaneously with conservative treatment.
- Urinary tract infection (UTI)

52 patients had chronic UTI at start.

31 patients remained infected chronically - in 22 because of a well defined underlying cause (prostatitis, pyelonephritis).

In 31 patients urine became sterile (50 % without chronic antibacterial medication).

13 patients had recurrent infection 1 or 2 times a year.

- Continence

47 patients were continent - 25 with pharmacotherapy

22 patients did wet once a day (18 with pharmacotherapy).

In 6 patients the continence period was less than 4 hours.

81 % of the patients showed an improvement in continence compared to their pre IC period.

- Urological complications

23 complications were seen in 15 patients. Urethral trauma in 13, epididymitis in 6, bladder calculi in 3, acute pyelonephritis in 1.

Conclusion

The longterm results with intermittent selfcatheterisation in these patients are, in our opinion, acceptable. Renal function, vesico-ureteral reflux and urinary continence are mainly improved or unchanged.

Infection continues to be present in more than 40 % of the patients with seldom clinical signs.

The rare evolution to hydronephrosis and the appearance of reflux which were seldom seen nevertheless make close follow-up mandatory. Local complications especially in man may be seen in a growing number with increasing application time (up to 20 % in this series).

The fact that a lot of our patients who started on intermittent catheterisation could achieve a state of balanced bladder afterwards is important.

Regular urodynamic evaluation of patients on IC may demonstrate if bladder reeducation may be tried out somewhere during follow-up. In our hands this reeducation was not seldom successfull.

78

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RISK FACTORS FOR INCONTINENCE IN THE NURSING HOME: A MULTIVARIATE APPROACH.

AIMS OF STUDY

Incontinence in the nursing home is prevalent and frustrating, and largely dealt with by diapers and catheters. This approach is not only expensive, but is also associated with significant morbidity, including UTIs and pressure sores, and decreased patient and staff morale. The little data available suggest that incontinence is associated with dementia and various other disabilities. But since such disabilities commonly occur with dementia, it is unclear whether it is dementia alone, the other disabilities, or other unrecognized factors that are the major problem. The issue is important. Although dementia may be irreversible, other factors may contribute just as strongly, and may be more amenable to intervention. Previous studies examined simple correlations and thus may have missed such factors. Therefore, we conducted a

prospective study and analyzed the data with multivariate techniques. Such an approach identifies traits which are independently associated with incontinence after controlling for other factors. Results are expressed as odds ratios (OR). If the OR is 0.5, it implies that individuals with this factor are half as likely to be incontinent; if 2.0, they are twice as likely.

METHODS

All subjects were residents of a 725-bed nursing home for at least 6 months. Incontinent individuals (n=272) were defined as those who leaked at least thrice weekly, while continent individuals (n=339) were completely dry; both criteria were ascertained by interview with the patient's nurse. Detailed chart reviews were performed for all incontinent patients and for a random sample of continent individuals. Functional status was determined by a standardized rating scale. With the exception of fecal incontinence (which we were not able to ask about), we included information on all variables previously shown to be correlated with incontinence, as well as data on a host of other medical, medication, demographic, and functional parameters. Factors traditionally associated with incontinence, as well as additional factors found by univariate analysis, were then eligible for multivariate analysis, using backwards stepwise logistic regression.

RESULTS

Of 30 variables evaluated, 10 emerged as statistically significant. Coefficients with a negative value are protective, as shown by the OR.

Variable	Coeff.	O.R.	95% C.I.	p
Immobility	1.37	3.93	1.86-8.30	.0003
Parkinson's disease	0.95	2.58	1.03-6.47	.04
Dressing dependence	0.93	2.53	1.41-4.52	.002
Dementia	0.67	1.95	1.38-2.76	.0002
Stroke	0.64	1.90	1.07-3.39	.03
Diabetes	0.55	1.73	1.00-2.99	.05
Antidepressant drugs	-1.12	0.33	0.16-0.68	.003
Ca^{+2} channel blocker	-0.89	0.41	0.20-0.85	.02
Antipsychotic drugs	-0.73	0.48	0.25-0.93	.03
Diuretics	-0.50	0.61	0.40-0.91	.02

CONCLUSIONS

Thus, multiple factors are independently associated with incontinence in this setting; functional characteristics are at least as strongly associated with incontinence as medical diagnoses; age, sex, parity, UTI's, and prostatic and pelvic operations--among other factors--are not independently associated with incontinence; and drugs may be protective if used appropriately. These data also

suggest that restoring continence in this setting may require more than a single intervention such as an operation, medication, or bladder training. On the other hand, while dementia is irreversible, many of the other identified factors are amenable to intervention and small improvements in many domains may be sufficient to restore continence. We conclude that incontinence in the nursing home, even in demented individuals, may not be as hopeless as widely believed. These data should suggest new therapeutic strategies. They should also be considered when planning research in this setting, since incontinent nursing home patients, even demented ones, are not all the same.

79

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BLADDER TRAINING IN WOMEN WITH URINARY INCONTINENCE

Aims of Study

The effectiveness of bladder training in the management of urinary incontinence has been reported from 44% to 100% (Hadley, 1986). Discrepancies may result from differences in the study populations, management strategies and/or outcome assessment. In addition, bladder training has been primarily used in the management of detrusor instability without incorporating patients with pure sphincteric incompetence (Frewen, 1978). This study reports on an ongoing 5 year controlled clinical trial to determine the effect of bladder training on community-dwelling urinary incontinent women with detrusor instability, urethral incompetence or both.

Patients and Methods

The study sample consisted of 109 women, 55 years or older, who live in the community and suffer involuntary urine loss at least once a week. The protocol incorporates comprehensive clinical evaluation, urodynamic and functional testing as well as environmental and psychosocial assessments. Subjects were stratified according to urodynamic criteria into those with incompetent urethral closure mechanism and those with detrusor instability with or without concomitant urethral incompetence. Subjects were randomized into those receiving treatment immediately and those without treatment (control group). Control subjects were treated after the observational (control) period. Treatment consisted of a 6-week outpatient bladder training protocol of scheduled voidings without concomitant drug intervention. Outcome was assessed by determining 1) number of incontinent episodes,

diurnal and nocturnal micturition frequency as reported on standardized weekly urinary diary (Wyman, 1988) and 2) objective quantitation of fluid loss as determined by standardized method of retrograde filling, controlled exertions and perineal pad weighing (Fantl, 1987). To date 109 subjects have been followed 6 weeks, and 73 have completed their 6-month follow-up.

Results

The mean age of the sample was 68 ± 9. Comparison between treated and control groups are shown in Table I. When results are compared between urodynamic diagnostic groups, no difference in the change at 6 weeks (p=0.1 to p=0.8) nor at 6 months (p=0.2 to p=0.9) could be observed. Comparison of short and long term effect also show no statistical differences (p=0.1 to p=0.4).

Table I: Effect of Bladder Training in Women with Urinary Incontinence: Comparison Between Treated and Control Groups

Study Group	UI Episodes #/week		Fluid Loss Quant. gms		Diurnal Mic. Frequency #/week		Nocturnal Mic. Frequency #/week	
	pre	post	pre	post	pre	post	pre	post
Treated (N=56)	22±20	9±11	38±63	18±37	64±29	52±14	9±7	5±5
Control (N=53)	21±19	17±17	38±80	46±87	56±20	55±22	9±6	8±6
	p=0.001		p=0.004		p=0.003		p=0.01	

Conclusion

Outpatient bladder training is effective in managing urinary incontinence in older community-dwelling women. Its effectiveness seems independent of whether the patients have either urethral incompetence, detrusor instability or both, and are maintained over time. The mechanism of action remains unclear but it seems to involve changes in behavior.

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80

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AN URODYNAMIC AND BEHAVIORAL ANALYSIS OF INCONTINENCE IN NURSING HOME PATIENTS

AIMS OF STUDY

Behavioral therapy treatment of urinary incontinence was conducted with 101 elderly nursing home patients. The purpose of this study is to relate the behavioral and urological characteristics of these subjects to their treatment response. The specific identification of prognostic indices that can be used to assess rehabilitation potential of patients are described.

PATIENT AND METHODS

The subjects were 101 eighty two year old patients of whom 37% showed detrusor instability; 13% post-voiding residuals above 100 ml; 12% stress incontinence; 10% mixed problems; and 28% normal CMG's. Incontinence frequencies were measured in these patients during 77 hourly checks between 7:00 AM and 7:00 PM. The patient was next prompted to ask for toileting assistance and reinforced for continent voids for an average of 142 hourly checks. Multiple regression analyses were used with seven urologic and behavioral variables to predict incontinence frequency before and during treatment and appropriate toileting during treatment.

RESULTS

Four variables were identified that, in different combinations,were most predictive of the outcome measures. The variables were the patient's maximum voided volume collected during twelve hours of data collection; the patient's maximum CMG capacity minus their post-voiding residual; a measure of the patient's self-help functioning; and a measure of the patient's responsiveness to questions. The variables most predictive of a patient's continence during treatment were the patient's self-help skills and a measure of their bladder capacity. Patients with higher self-help skills and capacities were more likely to become continent. (Multiple R = .52, Adjusted R^2 = .28 $p < .000$). Appropriate toileting was predicted by the patient's self-help skills, bladder capacity, and question responsiveness. Higher scores on the latter variables were predictive of higher appropriate toileting rates. (Multiple R = .61, Adjusted R^2 = .35 $p < .000$).

CONCLUSIONS

The data supports the view that patient incontinence is due to an interaction between urological and behavioral deficits. The fewer deficits a patient demonstrates, the more efficiently incontinence can be reversed. Four diagnostic measures useful in assessing a patient's incontinence potential were quantified. How these diagnostic measures can be utilized to suggest treatment procedures for patients are discussed.

81

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A CLINICAL TRIAL OF A BEHAVIORAL THERAPY TO REDUCE URINARY INCONTINENCE IN NURSING HOMES

AIMS OF STUDY

This is the first study to rigorously clinically evaluate a behavioral bladder training therapy in a randomized experimental design. The study aims were (1) to measure the clinical effectiveness of a bladder training therapy, (2) to estimate the psychosocial, health, and resource costs of urinary incontinence among the elderly, (3) to identify factors that influence the therapy's effectiveness, and (4) to compare the costs and effectiveness of the therapy with management not based on bladder training. Our hypothesis was that incontinent elderly should be able to respond to a bladder training program that involved prompted voiding and social reinforcement of appropriate toileting behaviors.

PATIENTS AND METHODS

Over a 3-year period (1984-87), 133 incontinent women in 7 nursing homes were randomly assigned to a 13-week bladder training program based on psychological principles of behavioral change, or to a control group, that received usual treatment. A 22-week follow-up period examined the durability of the treatment effects. The subjects' mean age was 85. They had an average residual urine of 100cc and an average bladder capacity of 285cc. Close to 40 percent had a normal cystometrogram; very few were assigned to the overflow capacity. They averaged 2 wet episodes per day during the 3-week baseline period. They needed assistance with many of their activities of daily living, and their Mini-Mental Status Exam scores suggested that the group was very cognitively impaired.

RESULTS

The therapy became effective after 6 weeks of training. By the final month of training, the treatment women's wet episodes had been reduced by 0.6 episode per day, or a 26 percent reduction over baseline. The reduction in wet episodes of the treatment women was statistically significant, both with respect to their baseline levels of incontinence and in comparison to the performance of the control women. The wet episodes of the control group remained about the same throughout the training and follow-up periods; their improvement of only 0.1-0.2 episode per day was not statistically significant. The treatment women improved over time partly because they learned to request help, a response prompted and reinforced by the program. Even after the training program was terminated, self-initiated requests to toilet by the treatment women remained higher than for the control group and higher than in their own baseline period. Examination of the distribution of improvement revealed that during the last month of training, 74 percent of the trainees improved to various degrees: about 39 percent improved more than 50 percent over their baseline levels, while 35 percent improved less than 50 percent. The more severely incontinent improved most. Multivariate regression analysis

using changes in incontinence status as a dependent variable and such variables as ADL score, MMSE score, urological classification and bladder capacity, age, baseline wet episodes, and treatment versus control group revealed that residents in the treatment group reduced their wet episodes by .45 episode per day after 6 weeks, a statistically significant reduction ($p<.05$) that validated the conclusions drawn from group averages. Trainees with a high frequency of incontinence during baseline, those relatively more cognitive residents, and residents with a normal bladder capacity responded better to this training program, information that should be helpful in future implementation of behavioral bladder training therapies.

CONCLUSIONS

This study confirmed that the bladder training therapy used was effective in reducing incontinence episodes among the women in the treatment group. The results were encouraging because the target behavior (i.e., continence) was maintained during a 6-month follow-up period even though the social reinforcement was terminated, in part because trainees had learned to make self-initiated requests to toilet. One finding of the study is that in the short run, the labor costs of bladder training may be higher than the savings in laundry costs to the nursing homes. A program focused on more severely incontinent and more cognitively alert residents would reduce the time required to realize monetary payoff. A major requirement for the success of this kind of program is motivating nursing home staff (particularly nursing aides) to generate the higher work output necessary to produce more continence.

82

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EFFECTIVENESS OF BIOFEEDBACK THERAPY FOR STRESS INCONTINENT FEMALES

AIMS OF STUDY

Urinary incontinence caused by either relaxed pelvic musculature or detrusor instability is a frequently reported health problem among elderly females. A study done by the University of Michigan found the most common symptom reported by elderly women was mixed incontinence 55.3%, of these 26.7% reported symptoms of stress incontinence (Diokono, 1986). Many studies have described the efficacy of surgical and drug treatments for this condition but few have been conducted to test the effectiveness of behavioral treatments (Bissada, 1978). This paper presents the outcomes of a randomized controlled clinical trial testing the effectiveness of a biofeedback therapy for women with stress of mixed incontinence.

METHODS

Study participants were recruited from a U.S.A. city by means of newspaper advertisements, physician referral and a poster campaign between

March 1, 1985 and January 1, 1988. Three hundred and forty subjects were recruited and screened with a telephone interview and physical examination and yielded as a sample of 120 women who met study criteria. All subjects were randomly assigned to either a Kegel exercise treatment (Group 1), Biofeedback and Kegel exercise (Group 2) or a control (Group 3). The dependent variables were measured through self reports of urine loss, grams of urine lost during a sequence of provocative stress maneuvers, pelvic muscle activity and maximal urethral pressure obtained during a comprehensive urodynamic evaluation. A measure of pelvic muscle activity was recorded in microvolts using a computerized electromyograph machine with a vaginal probe (perineometer).

RESULTS

Subjects were predominantly white, middle class, and married with a mean age of 62 years. The average subject had a 14 year urine loss history with 17 losses per week. All subjects were mentally competent (Mini-Mental Status score $x=29.10$, S.D.=1.1), and nondepressed (Center for Epidemiological Studies Depression scale $x=7.55$, S.D.= 5.74). Randomization techniques were employed to prevent systematic contamination of treatment effects with other extraneous variables. An analysis of the primary dependent variables in this Clinical Trial showed no significant difference between treatment groups prior to the interventions. Correlated t-tests were used to compare pre and post treatment means of individual groups. Pelvic muscle activity recorded as both a quick and sustained contraction score (4.63, $p<.05$ 2.93 $p<.01$) was found to be statistically changed in the biofeedback treatment group. Symptoms of urine loss were significantly decreased in both treatment groups (group 1=10.27, $p<.01$; group 2=5.61, $p<.01$). Although Group 2 evidenced a greater percentage of change, 75%, as compared to the 50% reduction in symptoms in the Kegel exercise therapy, Group 1. Grams of urine lost during a quantitation pad test (Fantl, 1987) also revealed statistical difference from pre to post treatment which appears to be similar across treatment groups. The measures of maximal urethral pressure obtained using a six channel DISA recorder were not significantly changed in either treatment group.

CONCLUSIONS

The results of this single blinded controlled trial appear to demonstrate the effectiveness of an adjunctive behavioral therapy for treatment of stress incontinence. Further exploration of the predictors of outcome measures should add valuable insight into treatment for women with stress incontinence. Our findings to date have demonstrated that conservative treatment measures for women with stress incontinence are effective and a viable alternative to surgical intervention. It is easily accomplished within a primary health care setting and rewarding to the client who can monitor her progress and take an active part in her health care.

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83

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BIOFEEDBACK THERAPY OF URINARY INCONTINENCE IN ELDERLY MEN

Aims of Study

The most serious social and economic impact of urinary incontinence in the aged occurs in the institutionalized patient. The most difficult patient for evaluation and treatment of urinary incontinence is also the chronic care inpatient. The objective of this study was to evaluate the efficacy of biofeedback therapy as an intervention for treatment of urinary incontinence in elderly chronic care inpatient males over 65 years of age.

Methods

The initial contact with participants was made by nursing personnel on chronic care wards. Patients having clinical urinary incontinence were screened for autonomic drug therapy, medical illnesses, and competency to participate in the study. Baseline quantitative urinary incontinence measurements were made using telemetric monitoring of frequency and a pad weight exchange technique for volume determination. Patients were randomly assigned to a control group and an experimental group. The experimental group received immediate treatment consisting of five weeks of biofeedback therapy for bladder control. The control group received no incontinence therapy during the five week interval. The biofeedback therapy sessions were administered twice weekly for one hour. Biofeedback was provided to the patient as pitch variable audio feedback and color line graphic video feedback

using external anal sphincter electromyographic activity as the signal source. The EMG signal was derived from perianal patch electrodes, monitored using an EMG oscilloscope, and displayed using a dedicated biofeedback unit. At the conclusion of the five week period, each group had urinary incontinence measurements.

Results

The frequency and volume measurements of incontinence were done over 24 hours per day and are reported as total 5 day measurements. The mean incontinence frequency in the immediate treatment group (n=20) was 26.5 episodes per 5 days at baseline and 10.0 episodes per 5 days after therapy. The mean incontinence frequency in the control group (n=28) was 25.4 episodes per 5 days at baseline and 25.8 episodes per 5 days after the non-treated interval. Comparison of the number of episodes at baseline showed no difference between the groups. After the five week interval, the number of incontinence episodes was significantly lower in the treatment group ($p=<.01$). The mean volume of involuntary urine loss in the immediate treatment group was 2623 cc per five days at baseline and 1043 cc per 5 days after treatment. The mean volume in the control group was 2817 cc per 5 days at baseline and 2988cc per 5 days after the non-treated interval. Comparison of incontinence volume at baseline showed no difference between groups. After the five week interval, the volume of involuntary urine loss was significantly lower in the treatment group ($p=<.01$).

Conclusions

The results of this study show that biofeedback therapy administered as described to elderly chronic care inpatient males was associated with a significant reduction in the frequency of incontinent episodes and the volume of involuntary urine loss.

84

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LONG-TERM FOLLOW-UP OF HABIT RE-TRAINING IN THE ELDERLY

AIMS OF STUDY

Patients with urge syndrome have been shown to have an initial cure/improvement rate of 85%, Holmes (1983), when habit re-training is used. Although some return of symptoms occurred in 43% of patients in one study, there is little information about long-term benefits of habit re-training in the elderly. The aim of this study was to determine whether elderly patients treated with habit re-training for urge syndrome had return of symptoms after 2 - 3 years.

METHODS

Eighty seven patients were admitted to the hospital for treatment of urinary incontinence during 1984 and 1985. Attempts were made by telephone or letter to contact these patients during August to December, 1986, and to ask a series of specific questions about their symptoms. Seventy five patients (14 by letter) were traced. Ninety six per cent had been assessed urodynamically before admission and all had a normal abbreviated mental test score, Qureshi (1974). Sixty of the traced patients had an urodynamic diagnosis of unstable bladder. Ten of these patients also had some mild stress incontinence and one male had some obstruction. Forty six were female (mean age 81 years, range 58 - 91) and 14 were male (mean age 79.8, range 68 - 89). Following admission to hospital, the patients were treated with habit re-training, Lancet (1986). Pelvic floor exercises and anticholinergic drugs were added if appropriate. Following discharge from hospital, an outpatient clinic appointment at one month was offered.

RESULTS

Of the 60 patients with unstable bladder admitted to hospital for treatment, 40 (67%) improved, 11 (18%) were unchanged, and 9 (15%) were catheterized. Thirty (50%) attended for their outpatient appointment; 13 had deteriorated, 9 maintained their improvement, 5 were better than in hospital and 3 had been catheterized. At the time of follow-up in 1987, 18 (45%) of the 40 patients who had improved in hospital were less good (including 2 who had been catheterized), 17 (42%) maintained their improvement, and 5 (13%) had died in the interim with no further information available. Four of the 9 who had been catheterized in hospital had died with their catheter in situ, 3 had had their catheter removed and were being treated with pads, and 2 had their catheter still in situ, but were bothered by leakage. Eight of the 11 patients whose symptoms were unchanged by their period in hospital continued to suffer the same symptoms, a further 2 were less good and one had died.

CONCLUSION

Habit re-training was effective treatment of urge incontinence in the elderly in the short-term, as it is in younger age groups, Jarvis (1980). It is a relatively effective, cheap, non-invasive form of treatment with few side-effects. However,

there was a substantial relapse rate immediately after leaving hospital, suggesting that understanding or motivation were poor. The further relapse over the next few years might be prevented by closer follow-up and reinforcement, perhaps by community continence nurses. Forty two per cent maintained their intial improvement, and a further analysis is taking place to determine whether this group could be identified from the outset.

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85

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BEHAVIOURAL CONTINENCE TRAINING IN MENTAL HANDICAP: A 10 YEAR FOLLOW UP STUDY.

AIMS OF STUDY.

Intensive behaviour modification continence training programmes were developed for people with severe or profound mental handicaps in the 1970's. These programmes were important in changing attitudes towards what was formerly regarded as an intractible problem, but there has been no formal long-term follow up study of the effects of such training. The purpose of this study was to determine firstly, whether the acquisition of urinary continence had been maintained over a long period secondly whether independence at toilet had been maintained and thirdly, whether these expensive programmes had been cost effective.

PATIENTS AND METHODS.

Ten years ago, 15 children with a mean age of 12 years and a mean developmental level of about 18 months, on one ward in a large mental handicap hospital, were incontinent. All of the children were ambulant and only one child had acquired a few single words of speech. Three different behavioural methods of training (2 intensive individual and 1 less intensive group training) were used with five children for each method. Training utilised systematic use of reinforcement, increased fluid intake, pants alarms and bowl alarms to detect incontinent and continent urination, and a five minutes dry pants check procedure. Training was aimed at both teaching the skills of passing urine on the toilet and the ability to go to toilet of own accord. Details of the original study are outlined by Smith (1979). Ten year follow up data were collected for 9 hours a day over a seven day period, using methods of direct observation and recording.

RESULTS.

Of the 15 children, 14 were contacted and one had died. Nine children were still in hospital and 5 had been discharged to the community. The results are given below separately for the three methods of training. The child who had died was in the third method. One child in the first method is excluded from part of the follow up data due to suspicion of unreliable recording at home.

Continence: with regard to the first intensive individual training method, for 4 children there were a total of 67 wetting accidents per week before training and 1 accident (99% improvement) after 12 weeks' training. At 10 year follow up there were 8 accidents (88% improvement). With the 5 children from the second intensive individual training method, there were 117 accidents per week before training, 23 accidents after 12 weeks (80% improvement) and at 10 year follow up there were 30 accidents (74% improvement). The 4 children who received less intensive group training had 86 accidents per week before training and 52 accidents after 12 weeks (39% improvement), with 41 accidents at 10 year follow up (52% improvement).

Independence: with regard to independence at toilet, before training, all children were totally dependent on carers for being taken to the toilet. After training for the 2 intensive individual methods respectively, 5 out of 5 and 4 out of 5 children were completely independent at toilet. For the third group training method, none of the 5 children reached independence. At 10 year follow up, only 1 child in the first method alone was still completely independent at toilet. However, prior to training, physical prompting to toilet was required for all children on 100% of occasions. At 10 year follow up physical prompts were required on 24%, 38% and 91% of toileting respectively for the first, second and third methods. Verbally prompted, gesturally prompted or self initiated toiletings occurred on 76%, 62% and 9% of occasions respectively. Study of the time taken by carers for toileting needs indicated that each wetting accident entailed an average of 15 minutes carer time and each physically prompted toileting entailed an average of 10 minutes carer time.

CONCLUSIONS.

When considering the long-term effects of behavioural continence training programmes, Smith and Smith (1987) found few studies reporting hard data beyond about 18 months follow up. The present study, although small, affords an intriguing contrast between the effects of the intensive and less intensive methods. The intensive methods have good initial results for continence and appear to hold reasonably well. The less intensive group method did not have such good initial results but this group appears to have shown some slight improvement over the intervening years. Independence at toilet in the complete sense is not maintained well. However, the level of prompting to toilet required for the intensive methods is substantially reduced. These training methods were expensive; the first (intensive) required 2330 staff hours, the second 2079 staff hours and the third (group training) 1260 hours. Given the time taken per toileting and per accident the first method repaid its investment of staff time in 41 weeks and the second in 47 weeks. For these two methods over 10 years, there was a total saving of 52,260 staff hours over and above the group training method.

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86

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ISOMETRIC DETRUSOR TESTS - A PREDICTOR OF POST-OPERATIVE VOIDING DIFFICULTIES

AIMS OF STUDY

Postoperative voiding dysfunction is seen in approximately 20% of women undergoing surgery for genuine stress incontinence Patients unable to generate higher detrusor pressures to overcome outflow obstruction may be at increased risk of developing postoperative voiding difficulties. Maximum detrusor pressure and peak flow rate have been used with some success to predict delay in voiding after surgery. The aim of this study is to determine whether the isometric detrusor test can predict postoperative voiding difficulties in women undergoing surgery for stress incontinence.

PATIENTS AND METHODS

One hundred women with urodynamically proven genuine stress incontinence and about to undergo bladder neck surgery were studied preoperatively. Fifty were asked to perform an additional test as part of their pre-operative urodynamic evaluation. During peak urine flow measurement and usually after the patient had voided at least 150ml, the patient was asked to stop her flow abruptly using contraction of the pelvic floor. Both the change in detrusor pressure (P_{stop}) and absolute isometric detrusor pressure (P_{iso}) were recorded. Postoperatively a suprapubic catheter was used to drain the bladder with a standard catheter clamping routine ([1]). Patients who still require catheterisation after the seventh postoperative day were defined as having voiding difficulties. All terminology conforms to ICS standards. Chi square with Yates correction was used for data analysis.

RESULTS

Of the 100 patients, 22 were excluded from the study for the following reasons: inability to void during testing (9), inability to arrest urine flow (3), procedures performed in addition to bladder neck surgery (8) and intra-operative cystostomy requiring prolonged drainage (2). Twelve (26%) of the 46 patients undergoing isometric detrusor tests and 18 (23%) of the 78 patients overall, developed postoperative voiding difficulties. The isometric detrusor test was not predictive of postoperative voiding difficulties using either P_{iso} or P_{stop}. Maximum voiding pressure (MVP) and peak flow rate (PFR) were predictive using levels of 20cm/H_2O and 25ml/sec. Patients who developed delayed voiding after surgery did not differ from the remainder in age, type of operation, history of previous surgery or history of voiding difficulties.

CONCLUSION

The isometric detrusor test has been reported as an indicator of successful surgical outcome. In our study, the isometric test was not helpful in predicting delayed voiding.

Using the predictive levels chosen here, the maximum voiding pressure and peak urine flow rate were predictive of voiding difficulty.

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87

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The Stamey Operation for correction of genuine stress incontinence in the elderly.

AIMS OF STUDY

Stamey et al (1975) advocated an endoscopic bladder neck suspension for all patients with genuine stress incontinence and reported 93% cure. Mundy (1983) compared the Stamey procedure with a colposuspension for the treatment for genuine stress incontinence and found an objective cure rate of 40% for the Stamey procedure and 73% for the colposuspension. This prospective study assesses the morbidity and results of the Stamey procedure for elderly women with urodynamically proven genuine stress incontinence.

PATIENTS AND METHODS

From January 1985, 44 patients aged 65 - 94 years had 46 Stamey operations. All were assessed pre- and post-operatively with a urodynamic questionnaire, clinical exmaination, twin channel subtracted cystometry or videocystourethrography, a Urilos pad test, and lateral chain cystography. Six patients had concurrent ideopathic detrusor instability. The Stamey operation was performed as described and modified by Mundy (1983). Patients were followed up two to three months post-operatively.

RESULTS

Fourteen patients continued to complain of stress incontinence and urodynamic studies showed this was demonstrable in 26 patients. Symptoms, signs and urodynamic features are shown in the table.

Symptoms and signs	Pre-op.	Post-op.
Stress incontinence	44	14
Urge incontinecne	33	24
Frequency	23	13
Cystourethrocoele	23	7
GSI at CMG	44	26
DI at CMG	6	13
PFR less than 15ml/sec	6	14
Voiding difficulty	10	6

The average operating time was 33 minutes and seven patients had a blood loss in excess of 100 ml (range 100 - 600 ml). Thirty five patients had their catheters removed by the eighth post-operative day and the mean hospital stay was 11 days. The complications included sutures cutting through at operation (5), wound infection (1), haematoma (3), voiding difficulty (1), deep vein thrombosis and congestive cardiac failure (1) and at follow-up, suture in the bladder (1). Analysis of their pre-operative characteristics, failed to show any predictive factors for the success of the Stamey operation.

CONCLUSIONS

Although this operation offers low morbidity and a relatively pain free post-operative course it has only a 41% objective cure of genuine stress incontinence. For patients cured by this procedure, it is satisfactory, but its lack of predictability for the majority of elderly patients forced us to discontinue this study.

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88

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USE OF A SPRING SCALE IN THE STAMEY'S BLADDER NECK SUSPENSION: ANALYSIS OF CLINICAL PARAMETERS.

AIMS OF STUDY

Despite Stmey's endoscopic bladder neck suspension (Stamey, 1973) has been universally accepted as effective for patients with stress incontinence, no article has quantified tension on the nylon loops until recently. We have compared the clinical parameters between patients with undetermined tension and patients with quantified tension on the nylon threads.

MATERIALS AND METHODS

14 patients were operated on by the Stamey's procedure with undemined tension (control group). Later thread tension was quantified in 57 patients with a spring scale (Kondo, 1987): 12 patients with tension of 1000 gm on each nylon loop (i.e. total tension of 2000 gm), 5 patients 800 gm, 9 patients 700 gm, 11 patients 600 gm, and 20 patients 400 gm. Age and period of follow up ranged from 33 to 73 years old (m=52) and 11 to 61 months (m=20), respectively. The follow-

ing parameters were investigated: the pad test (urine loss), the posterior urethrovesical angle, a maximum urinary flowrate, and a period of suprapubic catheter drainage.

RESULTS

Pad-tests ranged from 5.0 to 245.0 gm pre-operatively. After surgery significant urine loss (4.8 to 70.0 gm/hr) was confirmed in 7 patients with failure. The posterior urethrovesical angle and the maximum urinary flowrate (recorded within 2 weeks after surgery) decreased in all the groups with no significant difference. In comparison with the control, however, the period of suprapubic catheter drainage reduced significantly (p less than 0.01) in all the groups with tension quantified except the 800 gm group (figure). Operative success was 86 % in the control and 91 % in the patients with quantified tension. Of the 7 patients with failure, tearing of the endopelvic fascia was either suspected or confirmed in 6 and insufficient suspension of the bladder neck in 1.

CONCLUSION

Present study indicated for the first time that optimal tension on a nylon loop was 400 to 600 gm. The posterior urethrovesical angle after surgery did not correlate with tension given. This would be probably explained by the fact that each patient had variable severity of the urethrovesical descent. Post-operative maximum flowrate did not show significant difference between the control group and groups with tension determined. The patients with tension of 400 to 600 gm, however, have shown more improved flowrate a few months later. The figure illustrates that the period of cystostomy in the patients with 400 to 600 gm remarkably have reduced compared to the control, which will facilitate early recovery of bladder function and prevent tearing of the endopelvic fascia. In conclusion, use of a spring scale is of clinical use for obtaining surgical success and the present method is easy to teach a beginner how tightly to tie the nylon threads.

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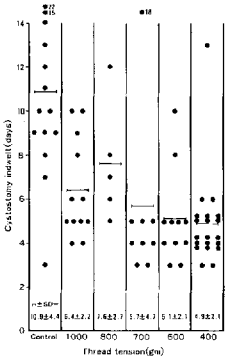

Figure. Period of a cystostomy indwelt versus thread tension found in 71 patients.

89

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TRANSVAGINAL IMPLANTATION OF THE ARTIFICIAL URINARY SPHINCTER IN TYPE III STRESS URINARY INCONTINENCE

AIMS OF STUDY

The use of the artificial urinary sphincter (AUS) is an accepted form of management of urinary incontinence in patients where the underlying cause is urethral sphincteric incompetence. There have been relatively few females implanted since the cuff placement must be made at the level of the bladder neck and the urethro-vaginal septum is not a true surgical plane. It was felt that a vaginal approach to cuff placement could facilitate placement of sphincteric cuff while protecting the urinary organs. Concerns regarding any increased risk of cuff infection or erosion could then also be addressed.

PATIENTS AND METHODS

34 women aged 24-65 years with urodynamically demonstrated type III stress urinary incontinence underwent implantation of the AUS using the American Medical Systems device (AMS #800™) via a combined vaginal and minimal retropubic approach between July, 1984 and June, 1987. All patients had undergone at least two previous surgical procedures. Primary deactivation of the AUS was performed in all 34 patients. Operative technique will be described.

RESULTS

19/34 patients have the device in place at least three years by January, 1988.

Continent: initial 31 patients
long-term 34 patients

Surgical revision: 3 patients (2 for cuff sizing;1 for connector leak)

Infection: 0; Erosion: 0

Detrusor Instability: 0; Dyspareunia: 0

Self-Catheterizing: 4

CONCLUSION

The AUS is intended to permit intermittent urethral compression thus allowing voiding to occur without obstruction. However, the complication rate in women has been high leading to very few females undergoing implantation, primarily due to technical difficulties encountered during the crucial creation of a space for the cuff between the posterior urethra/bladder neck and the vagina. Perforations have led to infections and erosions of the cuff. Successful transvaginal cuff placement may be attributed to patient selection, judicious use of antibiotics in the pre-operative period, urodynamic determination of

the lowest cuff pressure needed, and primary deactivation allowing for primary healing at the cuff site before intermittent compression begins. The deliberate opening of the vagina facilitates placement of the cuff serving to protect the bladder and urethra without increasing the risks of cuff infection or erosion.

90

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TRANSVAGINAL PLACEMENT OF THE AMS 800 ARTIFICIAL URINARY SPHINCTER FOR THE TREATMENT OF URINARY INCONTINENCE

AIMS OF STUDY

This abstract discusses the rationale, describes the technique, and reviews the results of transvaginal insertion of the artificial urinary sphincter. Rationale for a vaginal rather than lower abdominal incision is, the former allows easier access to the urethra and bladder neck in the patient who has had multiple operations for urinary incontinence.

PATIENTS AND METHODS

All patients had genuine stress urinary incontinence associated with a well supported urethra and bladder neck. The technique utilizes an apically based semicircular, anterior vaginal incision through which the cuff is placed around the overlying urethra and bladder neck. Through a small transverse suprapubic incision the pump is passed into the labia and the reservoir is inserted into the prevesical space. With finger-tip guidance, the curved tubing-passer is transferred from the suprapubic incision, through the abdominal wall fascia, and into the vaginal incision. The tubing is attached to the passer and withdrawn to the suprapubic wound. The vaginal flap is then trimmed and advanced over the cuff. A Martius flap is interposed in selected patients. Except for a small suprapubic incision in which the reservoir and pump are placed, the procedure is completed entirely through the vaginal incision. The cuff is not activated until six weeks after the operation.

RESULTS

Transvaginal placement of the artificial sphincter has been completed on ten patients. Follow-up time is from 4-16 months. Nine of ten (9/10) patients are continent of urine (i.e., wear 0-1 pad per day). One patient experienced early complications including an infection in the suprapubic wound managed by removal of the pump and reservoir only. These components were replaced eight weeks later. The patient is now continent six months after her second operation. A second

patient developed a purulent infection six months post-operatively. This infection occurred ten days after a dilatation and curettage procedure that was complicated by bowel perforation.

CONCLUSION

Our experience indicates that the artificial urinary sphincter can be successfully placed by way of a vaginal incision.

91

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URODYNAMIC FEATURES AND CLINICAL APPLICATION OF A NEW CONTINENT URINARY SPHINCTER USED IN TOTAL LOWER URINARY TRACT SUBSTITUTION

AIMS OF STUDY

Total substitution of the lower urinary tract is now a reality. The bladder can be replaced by a capacious intestinal segment and emptied by intermittent catheterization. Sphincter substitution however remains imperfect. Most intestinal sphincter designs which employ imbrication, intussusception, or a nipple technique to achieve continence are basically unphysiologic; as the reservoir volumes enlarge and pressures increase, the anti-leakage mechanism weakens rather than strengthens and ultimately is subject to break down and leakage. As an alternative, we have tried to develop a more physiological continent intestinal urinary sphincter which is urodynamically sensitive and responsive to pressure and volume changes, and thus does not easily leak. We describe the design, urodynamic features and initial clinical experience with this sphincter in patients requiring continent diversion for total urinary tract substitution.

PATIENTS AND METHODS

The sphincter was developed in an animal model (Koff, 1987) and adapted for clinical use. The distal ileum, cecum and ascending colon are used for the reconstruction. The sphincter mechanism is formed from two short (7-10 cm.) ileal segments, one passing through the other. Both segments are connected to the intestinal reservoir formed from the detubularized colonic segments. The inner imbricated ileal segment provides fixed, passive resistance to urinary leakage as well as catheterizable access to the reservoir. The outer ileal segment transmits urinary volume and elevations in pressure to the inner segment to dynamically alter its resistance and to maintain urinary continence.

RESULTS

Ten patients ranging in age from 15 to 62 years underwent continent diversion for total lower urinary tract substitution in this fashion. Follow-up ranges from 6 - 28 months. Nine are continent on intermittent catheterization. One required early postoperative stomal revision, one developed a bowel obstruction and one died of malignancy. All patients have had urodynamic study of the intestinal sphincter. Sphincter pressure profile studies showed that as reservoir volume

and pressure increase, the sphincter actually tightens to increase its resistance to urinary leakage, which also occurs in response to increased intra-abdominal pressure.

CONCLUSIONS

This study shows that a continent, catheterizable physiologically responsive urinary sphincter can be created from a short segment of ileum. The sphincter, which is based on a new conceptual design, has been shown to function well experimentally and now appears to be easy to construct and effective in maintaining continence in patients who require continent urinary diversion. Because it is dynamic and urodynamically sensitive to pressure changes within both the urinary reservoir and abdomen, it appears to have application in a variety to clinical incontinence settings.

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92

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TRANS-TRIGONAL PHENOL - The end of an era?

AIMS OF THE STUDY

Since the description of transtrigonal phenol injections of the pelvic plexus nerves for the treatment of bladder instability in 1982, varied success rates have been reported (1)(2). However we felt for some time that our results did not match the reported rates and therefore decided to review all our patients who underwent this procedure at this Institution.

PATIENTS AND METHODS

A total of 54 patients had transtrigonal phenol injections of the pelvic plexus nerves, of which 51 were female and 3 male. The 3 male patients have been excluded from the results analysis. The age range of the included patients was 21 to 80 with a mean age of 49.9. All patients had urodynamically proven detrusor instability, reduced compliance or hypersensitivity. Patients were divided into three groups:

1.- Post Pelvic Surgery or Trauma(49%),
2.- Neuropathic(27%),
3.- Idiopathic(24%).

The injection technique was as originally described by Ewing et al. (1) using a 6% Aqueous Solution of Phenol was injected via a 20FG 35cm long metal needle passed through the working channel of a cystoscope bilaterally half way between the ureteric orifice and the internal urethral meatus. The amount of phenol used varied between 2ml and 10ml on each side. The number of injections per patient ranged between 1 and 5 with a mean of 1.69. The results of 86 transtrigonal phenol injections in 51 patients were included in this study.

RESULTS

TOTAL NUMBER OF INJECTIONS = 86

	fail	Improved at 1/12	2/12	3/12	6/12	12/12	24/12	lost
Post Surg. n = 39	49%	49%	31%	23%	18%	2.5%	2.5%	2.5%
Neuropathic n = 25	28%	64%	56%	48%	24%	8%	0%	8%
Idiopathic n = 22	59%	32%	32%	23%	9%	0%	0%	9%
Total n=86	45%	49%	38%	30%	17%	3.5%	1.2%	5.8%

Success rates were poor in both the Post Surgical and the Idiopathic groups. Patients in the Neuropathic group were more likely to experience an improvement in their symptoms which was sustained for longer periods and this applied to patients at all ages in this group, the youngest patient treated was aged 21 (2).
We found no serious complications following phenol injection of the pelvic plexus.

CONCLUSION

Our series shows very high failure and recurrence rates in patients with Post Surgical and Idiopathic bladder instability. In Neuropathic patients the success rates are better but the duration of the effect tended to be short lived. Only 8% of this group had clinically significant improvent for one year and the longest effect in one patient was of 14 months.

We conclude therefore that although the procedure is safe:

1. The temporary nature of the effect does not justify the anaesthetic risk.

2. Patients with severe symptoms who are significantly improved only derive temporary benefit.

3. Augmentation enterocystoplasty has proven to be a more effective and reliable answer for this type of patients when conservative meassures have failed.

We propose that this method of treatment should be reserved for those patients with neuropathic bladder dysfunction with hyperreflexia who are prepared to accept the benefit of a short period of relief from their symptoms.

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