Committee 11 B

Surgical Treatment of Urinary Incontinence in Men

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INTRODUCTION AND SUMMARY

Surgery for male incontinence is an important aspect of treatment with the changing demographics of society and the global increase in surgery for prostate cancer.

Basic evaluation of the patient is similar to other areas of incontinence and includes primarily a clinical approach with history, voiding record, and physical examination. Since most of the surgeries apply to patients with incontinence after other operation or trauma, radiographic imaging of the lower urinary tract, cystoscopy, and urodynamic studies may provide invaluable information for the treating clinician.

Although prostatectomy for benign disease has become less frequent in many countries, the complication of incontinence is a rare but unfortunate occurrence that merits treatment. After a period of conservative therapy has been tried, surgical treatment, with implantation of the artificial urinary sphincter, has cured 75-80% of sufferers. Injection therapy with agents such as collagen has helped 40-50% of men.

Radical prostatectomy for prostate cancer, on the other hand, is performed far more frequently now than 10 years ago. Approximately 5-25% of patients will experience incontinence and of those a good number will require surgical treatment. The artificial sphincter has provided a satisfactory cure in most cases with a positive impact on quality of life. Other therapies such as collagen injections and sling procedures are being evaluated.

Incontinence following radiation therapy, cryosurgery, other pelvic operations and trauma is a particularly challenging problem because of tissue damage outside the lower urinary tract. The artificial sphincter implant is the most widely used surgical procedure but complications may be more likely than in other areas and other surgical approaches may be necessary. Unresolved problems from the pediatric age group and patients with refractory incontinence from overactive bladders may demand a variety of complex reconstructive surgical procedures. Other unique problems encountered are fistulae between the urethra and skin and the prostate and rectum. Surgical reconstructions in experienced hands are usually successful.

With extensive worldwide use of the artificial sphincter in the surgical management of male incontinence, its complications and their management are well known. Durability of the device is an important aspect that impacts on outcome and cost of treatment.

New surgical therapies such as slings are emerging. Although the literature is replete with well done cohort studies, there is a need for prospective randomized clinical trials.

• Materials and methods

The committee was charged with the responsibility of assessing and reviewing the outcomes of surgical therapy that have been published since the first consultation [1] for non-neurogenic male incontinence. Articles from peer-reviewed journals, abstracts from scientific meetings, and literature searches by hand and electronically formed the basis of this review. The outcomes were analyzed, discussed among the members of the committee and included in the chapter.

In order to rationally discuss surgical therapy the incontinence problems were classified according to their etiology, i.e. either primarily sphincter or bladder related, and are listed in Table 1. Treatment of fistulae is covered separately.

Specific recommendations are made on the basis of published results and determined by the levels of evidence. Consensus of the committee determined the recommendations, which are found at the end of the chapter. New surgical modalities and recommendations for future research are also included.

Table 1 : Classification of surgically correctable problems

Sphincter related

Postoperative
- Post-prostatectomy for prostate cancer
- Post-prostatectomy for benign disease
- TURP and radiation for prostate cancer
- Post-cystectomy and neobladder for bladder cancer

Post-traumatic
- After prostato-membanous urethral reconstruction
- Pelvic floor trauma

Unresolved pediatric urologic incontinence
- Exstrophy and epispadias

Bladder related

Refractory urge incontinence due to detrusor overactivity
Small fibrotic bladder

Fistulae

Prostato-rectal
Urethrocutaneous

I. EVALUATION PRIOR TO SURGICAL THERAPY

Before surgical treatment of the incontinent male is undertaken, the following evaluations should be done. Basic evaluation includes history [2], physical examination (including neuro-urological examination: perineal sensation, anal tone, voluntary contraction and relaxation of the anal sphincter, bulbocavernosus reflex [3]) urinalysis, urine culture, and a frequency-volume chart [4] (indicating daytime and nighttime frequency of micturition, incontinence episodes, functional bladder capacity, 24-hour urinary output, etc.). No clear guidelines can be found in the literature indicating the minimum number of days necessary to furnish reliable data. According to Wyman et al. [5] the 7-day diary can be considered as the gold standard for voiding diaries. The pad test quantifies the severity of incontinence. The 24-hour home test is the pad test of choice for quantification and diagnosis of urinary incontinence because it is the most reproducible [6]. The 1-hour pad test is widely used, mainly because it is more easily done, and better standardized. Post-void residual urine is a good estimation of voiding efficiency [7] [8]. Blood testing (BUN, creatinine, glucose) is recommended only if compromised renal function is suspected or if polyuria (in the absence of diuretics) is documented by the frequency-volume chart [9]. These basic investigations should be done in every incontinent male where surgical therapy, especially when eventual implantation of an artificial urinary sphincter is planned.

Further evaluation should be adapted to the particular patient. Cystourethroscopy is useful to verify integrity of the urethral wall (anterior aspect of the distal sphincteric mechanism in post-TURP incontinence [10], erosion by the cuff of the artificial sphincter, voluntary contraction of the pelvic floor, etc.) and the status of the bladder (trabeculation, stone, diverticula, etc).

Imaging techniques includes a plain abdominal X-ray in cases of incontinence following artificial sphincter implantation when, during the original procedure, the hydraulic system has been filled with contrast medium. Figure 1 illustrates the case of a young spina bifida patient in whom an artificial sphincter has been implanted with the cuff around the bladder neck. After more than 10 years, he became suddenly incontinent. Recent KUB compared to previous one clearly demonstrated fluid loss from the system. Cystography may demonstrate open bladder neck when bladder denervation is suspected [11] (e.g.: following abdominoperineal resection of the rectum). Cystourethrography is used to demonstrate fistula, stricture or urethral diverticulum following healing of the urethral wall erosion provoked by the cuff of the artificial urinary sphincter (Fig. 2). Ultrasound is widely used not only to evaluate the upper urinary tract, but also to evaluate post-void residual urine. The sensitivity of 66,7% and specificity of 96,5% when post-void residual is 100 ml or more is certainly adequate for routine clinical use [12]. It seems also to be cost-effective when compared to catheterization [13]. Other modalities (transurethral ultrasound [14], magnetic resonance imaging of the external sphincter, etc.) are still under development.

In the opinion of the Committee no incontinent male patient should be considered for surgical treatment without a thorough urodynamic evaluation to characterize the underlying pathophysiology. In patients with incontinence secondary to radical prostatectomy who developed bladder neck stenosis, the urethral catheter can create obstruction giving false values for Valsalva leak point pressure. Sphincter weakness can be documented by determining the Valsalva [15] or cough [16] abdominal leak point pressure. A recent study suggested that Valsalva leak point pressure is significantly lower than cough leak point pressure [17]. Its reproducibility has been studied almost exclusively in women. Catheter size seems to have a significant influence, but the correlation is extremely high between the test-retest leak point pressures when the same size of catheter is used [18] [19]. In males, abdominal leak point pressure should be evaluated via a rectal catheter because a urethral catheter is much more likely to invalidate Valsalva leak point pressure measurements than it does in female [20].

It becomes more and more evident that bladder volume influences Valsalva leak point pressure, i.e. it decreases with bladder filling [21] [22] [23]. This observation, however, is not unanimous [24]. Unfortunately, no standardi-

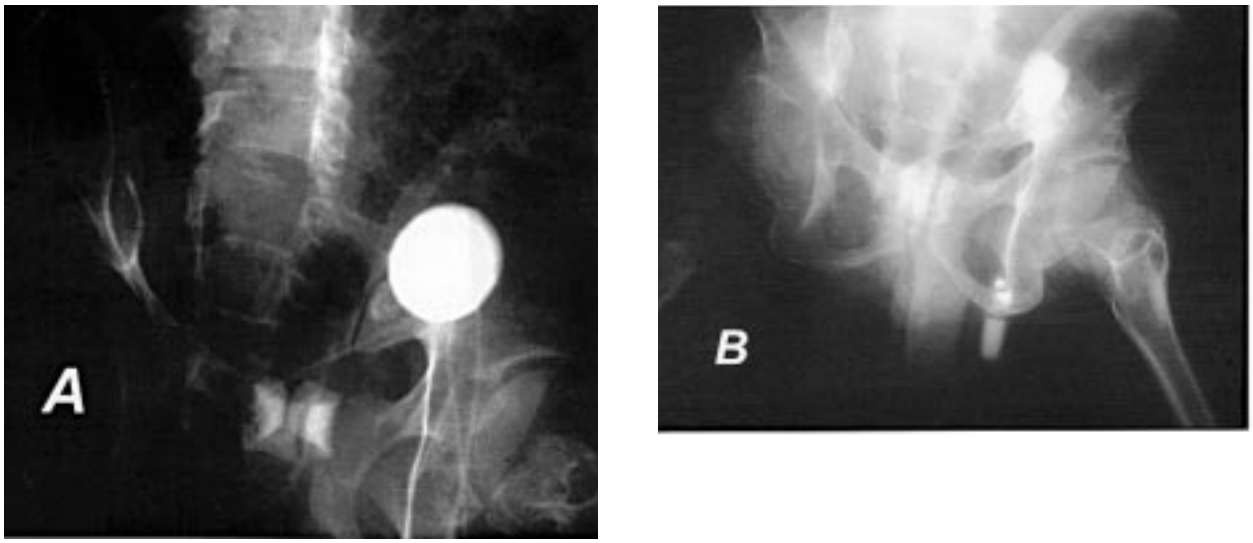

Figure 1 : Young spina bifida patient who had a bladder neck artificial sphincter implanted. After more than 10 years, he became incontinent. Early abdominal plain film, A, shows a full reservoir. After leakage started abdominal plain film, B, demonstrates loss of fluid from the reservoir.

zation of the technique and agreement upon it exists at the present time which somewhat limits its usefulness [25]. Measurement of leak point volume provides information on the functional capacity of the bladder [26]. Retrograde leak point pressure has been used to study incontinence following the placement of an artificial sphincter [27,28]. It correlates with the lowest abdominal leak point pressure [29]. The intraoperative use of this technique has been proposed as it allows early recognition of intraoperative urethral injury and mechanical malfunction [30]. Electrophysiological studies, mainly sphincter electromyography, may be useful to document denervation of the pelvic floor when nerve injury or neurological pathology is suspected [31].

Detrusor function is best evaluated by multichannel urodynamics, which is considered to be the gold standard today. Its main purpose is to detect detrusor overactivity and/or decreased bladder compliance. It can be coupled with fluoroscopic imaging (video-urodynamics). It has also been proposed by some that fluoroscopy be replaced with transrectal ultrasound [32,33]. It has even been suggested that ultrasound measurement of bladder wall thickness is a better predictor of bladder outlet obstruction such as an anastomotic stricture, than uroflowmetry [34]. Furthermore, non-invasive pressure-flow-like urodynamic evaluation based on Doppler ultrasound seems to have some definite potential for diagnosing bladder outlet obstruction [35].

However invasive, pressure-flow studies are still the gold standard in the incontinent male to rule out bladder outlet obstruction accompanied by detrusor overactivity [36], which in turn can cause incontinence.

The proposed evaluation of the incontinent male is summarized in Table 2.

Table 2 : Evaluation prior to surgical therapy

- **History**
- **Physical examination**
- **Urinalysis**
- **Urine culture**
- **Post-void residual (by ultrasound)**
- **Voiding diary (2-7 days)**
  - polyuria without diuretics: BUN, Creatinine, Glucose
- **Pad-test**
- **Cystourethroscopy**
- **Urodynamics :**
  - Valsalva leak-point pressure
  - Retrograde leak-point pressure
  - Multichannel urodynamics

II. INCONTINENCE AFTER RADICAL PROSTATECTOMY FOR PROSTATE CANCER

1. Incidence and risk factors

Urinary incontinence occurring after radical prostatectomy is a significant problem. The reported incidence of post-radical prostatectomy incontinence varies widely [37, 38, 39, 40]. The main factors determining these reported percentages seem to be the definition of incontinence, the methodology used to determine the continence status of the patient, the duration of follow-up and the initial characteristics of the patient population. Whether or not a physiotherapist treated the patients after the operation may also have had an impact on these rates. Most authors reporting their continence rates do not give details on this subject although it seems likely that many men will have followed some program of pelvic floor exercises with or without the physician knowing about it. Incidence rates determined by telephone or face-to-face interview by the physician who treated the patient or his associates are presently considered to be invalid. Self-administered questionnaires or interviews by an independent party are more reliable; additionally, pad-testing can quantify urine loss more objectively. These tests will have to be done on the total population of treated patients to avoid selection bias.

The duration of follow-up is an important factor. Immediately after removal of the stenting urethral catheter more than 40-50% of the patients have serious difficulties with urinary control [38, 39]. However, the percentage of incontinent patients decreases dramatically in the first one to one and a half years of follow-up [41].

Nerve sparing radical prostatectomy associated with a meticulous dissection of the apex of the prostate could theoretically lead to a lower incontinence rate. However, Steiner et al describing the Johns Hopkins experience in 593 patients have not found statistically significant differences in continence rates among patients with or without preservation of the neurovascular bundles [37]. Wei et al. recently reported improved continence rates in patients whose nerves were spared bilaterally whereas bladder neck preservation was not beneficial [42]. Advancing age was also a negative factor in that study. Other investigators have reported that patients who were more than 70 years old at the time of radical prostatectomy had a smaller chance of regaining continence [38, 41]. Hautmann et al found that older patients regained continence less rapidly but eventually achieved continence rates comparable to the younger patients [39].

The major cause of post-radical prostatectomy incontinence is impaired function of the external urethral sphincter, although detrusor overactivity and/or decreased compliance seem to be an additional problem [43, 44, 45]. Conflicting data have been presented with regard to the percentage of patients with pure sphincteric weakness and detrusor overactivity, with or without decreased compliance, or a combination of these features [43, 44, 45]. The percentage of patients with post-radical prostatectomy incontinence, with sphincteric weakness as the only cause has varied between 8 and 57% [43, 44, 45]. The percentage of those with sphincteric weakness, in combination with other causes has varied between 39 and 52% [43, 44, 45]. All in all, sphincteric weakness is either the only cause or a major contributing cause in more than 80-85% of the patients.

The incidence of incontinence after radical prostatectomy as reported in papers published in 1997 and 1998 was reviewed for the First ICI. Most of these papers were from the USA. The percentage of incontinent patients, that is those wearing pads, varied between 9 and 48 %. In the National Medicare experience in the USA [40] it was found that 31% of patients "wear pads, diapers or a penile clamp" after a radical prostatectomy. European series have reported percentages of patients using incontinence pads after more than one year of follow-up in 18.8% [39] and 14.1% [38] of the men. In a recent paper from the USA, an incidence of 8% was reported [41]. Wei et al. found that "any leakage of urine" was reported by patients who underwent non-nerve sparing or nerve sparing radical prostatectomy in 35.4% and 25.8% respectively, after 24 months of follow-up [42].

2. Timing of surgical intervention

There are no clear data on timing of a surgical intervention for the treatment of post-radical prostatectomy incontinence. It seems that the largest percentage of patients who were incontinent after removal of the catheter regains continence during the first six months of follow-up [38, 39, 41]. Therefore, a certain period of watchful waiting supplemented with conservative measures, particularly pelvic floor physiotherapy, seems to be a reasonable option. This conservative management may be tried for periods of up to 6-12 months depending on whether there is any progress noted by the patient.

3. Surgical treatment options

a) Artificial sphincter

In the series of Leach et al [43], 54 out of 102 of patients incontinent after radical retropubic prostatectomy (53%) were eventually treated by implantation of

the artificial urinary sphincter. In the Rotterdam series, 52% of the patients having to wear pads eventually underwent implantation of an artificial urinary sphincter [38]. Based on these figures one can tentatively postulate that about half of the patients with post-radical prostatectomy incontinence severe enough to necessitate the use of protective pads may be implanted with an artificial sphincter.

An overview of the results of the artificial urinary sphincter was reported previously: after an average of 3 years of follow-up, 75 to 87% are dry or require only one pad a day at most [1].

More recently some additional reports have been published and added (Table 3). Mottet et al. reported on 96 men treated with an AUS for post-radical prostatectomy incontinence in the period between 1995 and 1997 [50]. After a minimum follow-up of 1 year, 80% of the men were either dry or used 1 protective pad at most. The revision rate was 16.5%. Klijn et al. reported on 27 men treated with an AUS because of incontinence after radical prostatectomy [51]. The 5-year "primary adequate function rate" (P-AF) and the "additional procedure assisted adequate function rate" (APA-AF) based on Kaplan-Meier analysis, were 49% and 71% respectively. Although satisfactory continence in combination with a functioning AUS (without having had to exchange the complete AUS) was achieved in more than 70% at the 5-year follow-up mark, only about half of these patients did not need any operative revisions. If those patients who needed a complete exchange of the AUS were taken into account the satisfactory continence rate was more than 80%. Madjar et al. reviewed their experience with 131 AUS implants for post-radical prostatectomy incontinence [52]. Unfortunately, only 54% of the men were available for evaluation. The remaining men had an average follow-up of 7.7 years. Of these, 27% wear no pads and 32% one pad at most for a total of 59% being satisfactorily continent.

Table 3 : Results of the artificial urinary sphincter in post-radical prostatectomy incontinence

Author	No. pts.	years follow-up	0-1 pads/ day
Montague [46]	66	3.2	75%
Perez and Webster [47]	49	3.7	85%
Martins and Boyd [48]	28	2	85%
Fleshner and Herschorn [49]	30	3	87%
Mottet et al. [50]	96	1	86%
Madjar et al. [52]	71/131 followed	7.7	59%

A comparative study of the artificial urinary sphincter and collagen injections in men suffering from post-radical prostatectomy incontinence was reported by Kuznetsov et al. [53]. These authors conducted a retrospective comparative non-randomized study in in 85 men. Of these, 44 were treated with collagen and 41 with the AUS. The response rate to the quality of life and incontinence questionnaires was 93% in the collagen and 88% in the AUS group. 22% of the men in the AUS group were collagen failures. After an average follow-up of 19 months, 19% of the collagen patients versus 75% of the AUS patients used one pad or less. Quality of life based on the Incontinence Impact Questionnaire was better in the AUS patients.

Some patients who receive an AUS after a radical prostatectomy develop local recurrence and are candidates for external beam radiotherapy. Christie et al have demonstrated that irradiation of the device in a water bath with a dose of 400 Gy did not create any damage or malfunction [54]. A patient with an implanted AUS received a dose of 45 Gy without deleterious effects to the AUS.

b) Injectables

Periurethral injections using different substances either retrogradely or antegradely have achieved a variable improvement rate of 10-70% (first ICI) often with repeated injection sessions. Table 4 contains summarized results from different series of post-prostatectomy incontinence.

Recently, Klutke et al. followed 20 men who were antegradely injected with collagen for a mean of 28 months. Only 10% of the men were dry and an additional 35% were improved [69]. Bevan-Thomas reported on their experience with transurethral collagen injection and found that in a favorable group of post-radical prostatectomy incontinence patients who had normal bladder compliance and who had not needed dilatations or incisions of the neo-bladder neck, a continence rate of 21% could be achieved. An additional 28% were improved. These men had needed a mean of 3.8 injections with a mean total volume of 29 mL [70]. Kutznetsov et al. [53] reported a social continence rate of 19% (use of one pad or less per day) in patients treated with transurethral collagen injections. Only 2% were completely dry.

Summary

Based on these results it can be concluded that the AUS still is the preferred treatment option in properly selected men who are incontinent after radical prostatectomy.

III. INCONTINENCE AFTER PROSTATECTOMY FOR BENIGN DISEASE

1. Incidence and risk factors

The prevalence of urinary incontinence after prostatectomy for benign disease has been reviewed and described in the AHCPR Benign Prostatic Hyperplasia Clinical Practice Guidelines [71]. The following percentages for stress incontinence and total incontinence, respectively, were reported:

Open surgery (retropubic or transvesical prostatectomy): 1.9% and 0.5%.

TUIP (transurethral incision of the prostate): 1.8% and 0.1%.

TURP (transurethral resection of the prostate): 2.2% and 1.0%.

These figures were based on studies reported before 1990. Several other series were published after 1990. These series were reviewed for the 1st International Consultation on Incontinence [1]. A clear description of the method of follow-up and assessment of the continence status was indicated in only about one third of these studies. The incidence of incontinence after open surgery, TURP and TUIP was low but probably not as low as in the AHPCR review: The reported percentages ranged between 0 and 8.4%. Since the method of assessment of the continence status and the definition of incontinence is rarely stated it is actually not possible to make a distinction between simple stress incontinence and total incontinence. There is no clear indication that the incidence is affected by patient age or (resected) prostatic volume [1]. One comparative study of TURP and TUVP seems to indicate that the incontinence rate is somewhat higher after TUVP [72].

In summary, the prevalence of urinary incontinence after open surgery, transurethral resection of the prostate and transurethral incision of the prostate is low, but probably not as low as reported in the AHPCR review, which reported rates below 2%. The quality of reporting does not provide a distinction between total and lesser degrees of incontinence.

2. Timing of surgical intervention

There are no clear data on timing of a surgical intervention for the treatment of incontinence. Therefore, guidelines as to timing of the surgery cannot be formulated. A certain period of watchful waiting supplemented with conservative measures, particularly pelvic floor physiotherapy, seems to be a reasonable option. Thus, conservative management may be tried for periods of up to 6-12 months depending on whether there is any progress noted by the patient.

3. Surgical treatment options

a) Artificial sphincter

The literature on this subject was reviewed for the occasion of the 1st International Consultation on Incontinence [1]. Candidates for treatment with the artificial urinary sphincter (AUS) are patients with incontinence due to intrinsic sphincteric deficiency that have normal bladder compliance [73]. Detrusor overactivity is not an absolute contraindication but the response to medical treatment should be assessed before implantation of an AUS. The AUS has been placed around the bulbar urethra via a perineal route, around the bladder neck [74] and around the membranous urethra at the apex of the prostate via a retropubic route [75]. The above mentioned review of the results obtained with the AUS indicated that more than 70% of the men treated with the AUS for this indication are dry or almost dry after a follow-up of more than 2-3 years [1]. Unfortunately, most series on the AUS lump together post-prostatectomy incontinence after treatment for benign and malignant disease [1]. Placement of the AUS cuff around the bladder neck results in a slightly better continence rate than placement around the bulbar urethra [74].

Other surgical alternatives are mainly of historical interest, although bulbar urethral compression seems to be regaining some interest because of the availability of synthetic slings [76].

In summary, the AUS is a successful surgical treatment option for post-prostatectomy incontinence. The available literature seems to indicate that more than 70% of the men treated with the artificial urinary sphincter will be dry or almost dry. The artificial urinary sphincter is the treatment of choice in patients with incontinence after prostatectomy for benign disease, if the incontinence is due to intrinsic sphincteric deficiency and if the compliance of the bladder is normal.

b) Injectable agents

What has been said for the artificial sphincter is true for collagen injection as well: again most series lump together post-prostatectomy incontinence after treatment for benign and malignant disease (Table 4). A recent report on the use of transurethral collagen injections in men with intrinsic sphincter deficiency indicated that out of a total of 322 men only 14 were treated for incontinence after surgery for BPH [70]. There are no reports about the use of other types of injectables in this particular group of patients. The follow-up of patients treated with collagen ranged between 6 and 15 months. Based on the available data, the treatment fails in more than 50% of the patients and seems to lead to significant but short-term improvement in about 40% of the men or less.

In summary, bulking therapy fails in more than 50% of

Table 4 A : Results of transurethral collagen injection therapy for postprostatectomy incontinence

Investigators	No. Patients	Mean Follow-up (mo)	Mean No. Injections	Mean Volume (cc)	% Cured	% Improved	% Failed
Shortliffe et al 55	14	19-23	1.6	28.4	21	36	43
Herschorn et al 56	10	6	4.7	51.8	20	50	30
Bevan-Thomas et al 57	257	28	4.4	36.6	20	39	41
Smith et al 58	54	29	4	20	-	38	62
Cespedes et al 59	110	7	4.2	28.4	53	9	38
Aboseif et al 60	88	10	2.8	31	48	37	15
Martins et al 61	46	26	2.8	31	24	46	30
Faerber and Richardson 62	68	38	5	36	10	10	80
Griebling et al 63	25	13.3	2.6	35.5	0	40	60
Cummings et al 64	19	10.4	1.8	13.8	21	37	42
Elsergany and Ghoneim 65	35	17.6	2	10	20	31	48
Tiguert et al 66	21	12.5	2.9	18.2	5	57	38

Table 4 B : Results of antegrade injection collagen injection therapy for postprostatectomy incontinence

Investigators	No. Patients	Mean Follow-up (mo)	Mean No. Injections	Mean Volume (cc)	% Cured	% Improved	% Failed
Wainstein and Klutke 67	48	8.5	-	14.5	25	45	30
Appell et al 68	24	12	1	7.1	37.5	62.5	-
Klutke at al 69	20	28	1	14.5	10	35	55

the men. Of those who are improved only a minority actually becomes dry with short-term follow-up. Therefore, bulking is of equivocal value in these men.

4. Problem of strictures in the sphincteric region

These should be treated actively if the patient is incontinent or if UTI, obstruction of the upper tracts or chronic retention are involved in the problem. Urethroplasty in combination with an AUS has been described by Mundy 77 with a relatively high chance on cuff erosion. Treatment of the stricture by incision followed by placement of a Wallstent and subsequent implantation of an AUS has been reported as well 78.

5. Summary of outcomes and recommendations

The data that were reviewed for this section were extracted from uncontrolled non-randomized observational studies only. RCT's in these patient groups are virtually non-existent. Based on the available literature on the subject more than 70% of the men treated with the artificial urinary sphincter will be dry or almost dry. Bulking therapy fails in more than 50% of the men. Of those who are improved only a minority seems to become dry with short-term follow-up.

The artificial urinary sphincter is the treatment of choice in appropriately selected cases with incontinence after prostatectomy for benign disease.

IV. INCONTINENCE AFTER EXTERNAL BEAM RADIOTHERAPY AND SURGERY FOR PROSTATE CANCER

The risk of incontinence after external beam radiotherapy for prostate cancer is low at 0-11%. Lawton et al. [79] (1) reported a risk of urinary complications of 7.7% in more than 100 patients, proportional to dose. Perez et al. [80] (2) found incontinence in only 5 of 738 patients. Shipley et al. [81] (3) reviewed more than 2500 cases with an incontinence rate of 0.5%. Similar incidences have been reported in more recent series. Madalinska et al. [82] (4) reported an incidence of 6-7%. With three-dimensional conformal radiotherapy, Weil and colleagues [83] (5) reported no incontinence in 168 consecutive patients and Hanlon et al. [84] (6), in a series of 195 men, found that post treatment urinary symproms were no different than a control group without cancer.

Pre-radiotherapy transurethral prostatectomy appears to be a risk factor for incontinence. Jonler et al. [85] (7) reported an incontinence rate of 11% with pretreatment TURP. Green et al. [86] (8) and Lee at al. [87] (9) also reported a higher risk of incontinence with pretreatment TURP with 5.4% and 2% respectively. With conformal radiotherapy, Sandhu et al. [88] (10) reported a 9% incidence of stress incontinence in 110 patients. Very little data exist on treatment of incontinence following radiotherapy alone.

Adjuvant radiotherapy is frequently given after radical prostatectomy and may not increase the rate of incontinence, although little data have been published. Petrovich et al. [89] (11) reported no difference in incontinence in 2 cohorts of patients, one with and one without adjuvant radiation. On the other hand salvage radical prostatectomy following external beam radiotherapy has been generally reported to have a high incidence of urinary incontinence [90,91,92] (12,13,14) possibly because of radiation induced fibrosis of the external sphincter [92] (14).

1. Surgical treatment

Results of surgical treatment of incontinence in this setting are based on retrospective clinical series. The most commonly published treatment modality is the artificial urinary sphincter as therapy for sphincter damage. The series published contain both patients who had and had not received radiotherapy. Collagen injections have also been reported in retrospectively analysed case series.

There is a higher reported revision rate for the artificial sphincter following radiotherapy (Table 3) compared to low risk patients, 38% versus 22% [47,48,93,94,95]. This is due to a higher incidence of erosion and infection as well as urethral atrophy, possibly secondary to radiation induced vasculitis fibrosis of the urethra [48] (15). Good results are reported, however, and it is generally recommended that the cuff is placed outside the radiated field [97] (21).

Collagen injection has also been reported for incontinence after radical prostatectomy and adjuvant radiation [57,62-66] (22, 23, 24, 25, 26, 27) or after salvage radical prostatectomy following radiotherapy [98] (28). Continence results are poor when compared to those without radiation.

In summary, despite the higher incidence of complications of the artificial sphincter in patients after pelvic radiation, it has provided acceptable treatment benefits. Collagen injections have yielded poor results.

V. INCONTINENCE AFTER OTHER TREATMENT FOR PROSTATE CANCER AND NEOBLADDER FOR BLADDER CANCER

1. Brachytherapy is a form of radiation therapy in which radioactive materials are placed directly into the prostate gland. The incidence of incontinence following this modality is in Table 6. In a systematic review of brachytherapy series Crook et al.(108), reported the incidence of retention to be 1-14%. Many patients require prolonged or permanent alpha blocker or TURP. The main risk factor for incontinence after brachytherapy is TURP. Hu and Wallner [105] (35) reported on the incidence of urinary incontinence after TURP/TUIP following prostate brachytherapy for prostate cancer. Of the 10 patients who underwent an outlet relaxing procedure (TURP/TUIP) for refractory urinary obstruction, 7 developed some degree of permanent urinary incontinence. They surmised that the cause may be multifactorial and may include physical damage to the urinary sphincter and the radiation dose to the urethral region. Surgical therapy has included the artificial sphincter, when required [106] (36). Urethro-rectal fistula is another complication that has been reported in 1.8% of patients in a large U.S. medicare retrospective review [106] (36).

2. Cryosurgical ablation of the prostate is used for clinically localized prostate cancer as primary treatment or after unsuccessful external beam radiation therapy. The frequency of the main lower urinary tract complications are listed in Table 7. The artificial sphincter has been mentioned as one of the treatments

for incontinence [120] (50). However, cryotherapy is an adverse factor for collagen injections. Urethrorectal fistulae can also occur in up to 5% of treated patients after cryosurgery. Severe incontinence and fistulae that occasionally result may have to be treated with extirpative surgery and diversion [121] (51).

3. Incontinence after Neobladder Construction

The incidence of incontinence after neobladder construction following radical cystectomy for bladder cancer ranges from 90 to 100% during the day and 55 to 94% at night (Table 8). Most patients achieve daytime continence after one year and nightime continence is reported after 2 years. Most of the published reports do not comment on specific surgical management and imipramine is mentioned as treatment in only the occasional paper. Martins and Boyd [48] (15) reported on 8 patients treated with the AUS. Six of these underwent revisions, 3 for infection and/or erosion and 3 for inadequate cuff compression. They cautioned against the use of the AUS and suggested alternatives such as intermittent catheterization at night. Collagen has been reported in women following neobladder construction [133] (63).

In summary there are not enough data upon which to recommend definitive surgical therapy although the artificial sphincter is probably the most commonly used method.

Table 5 : The artificial sphincter for incontinence after radiotherapy

Study	Pts. with Radiation Total number	Revision rate after radiotherapy	Continence
Martins and Boyd [48]	34/81	38% for whole group	88%
Wang and Hadley [93]	16	25% (Infection and Erosion - 12.5%)	87%
Perez and Webster [47]	11/75	55%	63%
Gundian et al. [94]	15/56	22%	90%
Elliott and Barrett [95]	46/313	22%	-
Manunta et al. [96]	15/72	53% (Infection and Erosion – 20%)	73%

Table 6 : Incontinence after brachytherapy for prostate cancer

Author	% Incontinence	% Post TURP	% No TURP
Beyer et al. [99]	1	-	-
Blasko et al. [100]	6	17	0
Stock et al. [101]	0	-	-
Wallner et al. [102]	0	-	-
Kaye et al. [103] *	4	11	1
Blasko et al. [104]	13	0	-
Hu and Wallner [105]	6	70	-
Benoit et al. [106]	6.6	-	-
Merrick et al. [107]	0	-	-
Crook et al. [108]	5.6	13	-

* Implant plus external beam radiation

Table 7 : Lower urinary tract complications after cryosurgery for prostate cancer

Author	N	% Incontinent	% Bladder outlet obstruction
Shinohara et al. [109]	102	15	23
Bahn et al. [110]	210	3	9
Cox and Crawford [111]	63	27	29
Wieder et al. [112]	83	2.5	13
Cohen et al. [113]	239	4	2.2
Coogan and McKiel [114]	95	3.5	6
Sosa et al. [115]	1467	11	6.8
Long et al. [116]	145	83/2.0*	17.2
Pisters et al. [117]	150	60	43
Derakhshani et al. [118]	48	10.4	22.9
Long et al. [119]	975	7.5	13
De la Taille et al. [120]	43	9	4

*Previously radiated/not previously radiated

Table 8 : Continence after neobladder construction for bladder cancer

Author	Number of patients	Follow-up (mo)	Continence (%) Day	Night
Alcini et al. [122]	34	12	100	83
Cancrini et al. [123]	89	24	97 (22% with SUI)	83
Elmajian et al. [124]	266	24	85	85
Studer et al. [125]	100	24	92	80
Benson et al. [126]	32	25	94	74
Abol-Enein and Ghoneim [127]	60	24	90	80
Rogers and Scardino [128]	20	24	90	55
Hautmann et al. [129]	211	36	85	85
Hautmann et al. [130]	363	57	95	95
Steven and Poulsen [131]	166	32.4	100 (After 5 years)	100
Abol-Enein and Ghoneim [132]	353	38	93.3	80

VI. TRAUMATIC INJURIES OF THE URETHRA AND PELVIC FLOOR

Incontinence following posterior urethral injuries occurs in 0-20% of patients [133,134] (64,65) and is thought to be due to the extent of injury rather than to the method of management.

The data on surgical treatment are all retrospective case series and the most commonly published surgical therapy is the AUS. The series published contain both patients with and without traumatic injuries. Perez and Webster [47] (17) reported on 27 patients after urethral or bladder neck strictures. The revision rate was 41% and the continence rate was 85%. In Montague's [46] (66) (series 22 out of 166 patients had incontinence after trauma. He did not separate the results of this group from those of the other patients. Martins and Boyd [48] reported on only one patient out of 81 with a traumatic urethral injury. This patient was dry and required no revisions. Venn at el. [97] (21) reported on 2 with pelvic trauma out of a total of 70.

Bladder neck reconstruction by excising the scar and narrowing the calibre was reported by Iselin and Webster [136] (67) in 6 patients who had incontinence with an open bladder neck on cystourethrography, following urethroplasty for traumatic strictures. Bladder neck closure with a Mitrofanoff catheterizable abdominal stoma has also been reported as treatment following severe urethral or bladder trauma, [137] (68).

For patients with severe bladder neck strictures and incontinence after radical prostatectomy Meulen et al. [138] (69) and Elliot and Boone [139] (70) reported on the use of a Urolume stent with a bulbar artificial sphincter.

In summary, while other treatments are possible the AUS provides a reasonable outcome in appropriate cases.

VII. UNRESOLVED PAEDIATRIC PROBLEMS: THE EXSTROPHY-EPISPADIAS COMPLEX

Despite a surprising number of publications on the exstrophy-epispadias complex over the last three years, there have been no major changes in management. Some new innovations have emerged both in primary treatment and in the management of persisting incontinence (as outlined below), and reports of good results from major centres continue. [140,141,142,143,144,145]. A significant rate of incontinence persists across the board although it depends to some extent on how continence is defined [140,145]. Controversy continues regarding its management [140,145,146,147].

Deficiencies persist in the areas of long-term follow-up, the use of urodynamic assessment, the absence of clinical trials, and the continuing need for patients with exstrophy-epispadias complex to be managed in centres of excellence [146,147,148]. Recommendations regarding these issues are made.

1. New innovations

a) Initial management of exstrophy-epispadias complex

Several authors have advocated a reduction in the number of procedures in the standard staged surgical management of exstrophy-epispadias complex (early closure, repair of epispadias and bladder neck reconstruction) though this regime of three separate operations remains the backbone of treatment in most centres. The importance of careful selection of such patients is emphasized by Gearhart and Mathew [143], and the short time of follow-up in most series where a one-stage primary repair is used makes the long-term results uncertain [141,149,150,151]. Improvements in surgical techniques and experience justify continuation of these efforts in selected 'centres of excellence' along with the mandatory reporting of long-term outcomes [152]. The pivotal importance of the initial operation on a successful outcome is reinforced by several papers [140,142,144,148].

b) Management of persisting incontinence

While there appears to be a general acceptance that initial treatment with primary closure and (co-incident or separate) repair of epispadias is the basis of initial management in exstrophy-epispadias complex [142,144,153] (with the notable exception of the Mainz group [145]), considerable differences of opinion remain regarding the management of persisting incontinence or failed primary repair [140,145,146,147]. Various options are shown in Table 9.

The Johns Hopkins group and others continue to champion the use of the 'native' bladder, with augmentation reserved for those whose capacity is decreased or bladder activity is increased that makes this necessary to achieve continence [142,143,144,146]. Their main arguments supporting this approach are the good continence that can be achieved in the hands of experienced surgeons, and the potential risks associated with the use of bowel reservoirs including malignancy, urolithiasis [154], deterioration of the upper tracts [155] and

Table 9 : Options for management of incontinence after unsuccessful exstrophy-epispadias surgery

Revision of bladder neck reconstruction
Augmentation enterocystoplasty
- Stomach
- Ileum
- Colon
Continent stoma
- with augmentation
- bladder neck transection and closure
Bladder replacement
Artificial urinary sphincter
Transurethral injections
Urinary diversion
- conduit
- continent reservoir • colon • ileal-cecal • rectal reservoir

decreased linear growth [156]. Others headed by those from Mainz, believe that all, but especially those who have 'failed' previous treatment, are best served by conversion to a rectal reservoir or ileocaecal pouch with a catheterizable stoma [140]. This belief is based on the excellent continence achieved compared with the incidence of 'complete' control with bladder neck reconstruction [145], the stability of the upper tracts and the likelihood of not needing any further surgery. The solution to this dilemma is the use of matched, comparative, quality of life trials between the differing centres of excellence [147]. For the patients involved, a full reassessment including upper tract studies and urodynamics is mandatory to allow individualization of treatment to optimize the chance of a successful outcome [148 152, 157 158].

The armamentarium available for treatment of continuing incontinence is largely unchanged as set out in the original manuscript [1], though gastrocystoplasty has been advocated, particularly in cloacal exstrophy with its short bowel syndrome. The risk of complications of this procedure, such as the hematuria-dysuria syndrome, particularly with longer-term follow-up, was emphasized by several authors [159 160, 161], though Plaire et al. believed it to be a good option in selected patients [162]. A possible solution to this problem may be the gastrointestinal composite urinary reservoir [163]. The problem of persisting nocturnal incontinence can be helped by desmopressin [164]. Finally, it has been shown that the presence of any neurological abnormality greatly reduces the chance of continence with standard reconstruction, even with augmentation, in cloacal exstrophy [158].

2. Deficiencies

a) Definition of continence

Most authors take a daytime three-hour voiding (or catheterization) interval without loss of urine at night as signifying continence, though even this is not universally accepted [141]. Even this achievement often requires the use of pads or other incontinence devices, and Hohenfellner quotes Jeffs as saying that only 20% of 5-10 year olds are completely dry [145].

There are still no apparent attempts to quantify the degree of wetness eg., pad tests. This assessment continues to rely on the history given by the patient or parents.

b) Lack of long-term follow-up

Many studies only quote relatively short periods of follow-up, and even those with longer median time intervals often contain a significant number who are excluded from assessment of continence because they are awaiting the attainment of an adequate bladder volume or a further procedure [141, 143, 148, 149, 150]. Given the risks of urodynamic deterioration with bladder neck reconstruction (vide infra), and the potential problems with the use of bowel (vide supra), long-term (preferably life long) follow-up reports are essential.

c) Lack of urodynamic assessment

There is a dearth of urodynamic studies in exstrophy-epispadias complex patients even though many abnormalities are reported [141, 152, 157 160 165, 166]. Its usefulness in making treatment decisions for those with persisting incontinence is commonly accepted, but even in those patients apparently doing well, urodynamic monitoring may be very helpful in detecting problems at an earlier stage [165, 166]. Whether these patients ever void normally is uncertain, with bladder neck reconstruction being a delicate balance between preventing incontinence while avoiding obstruction [157, 166, 167].

d) Absence of trials

All the published material consists of reports of experience at various centres, and many of these are retrospective reviews. While even major institutions struggle to have large enough series to mount controlled trials, it should be possible to at least arrange comparative trials, including quality of life measurements, to assess different forms of treatment [147]. Until this happens we will be left with level 3 & 4 evidence at best and be no closer to establishing the best way to treat individual patients with this major disability.

RECOMMENDATIONS

- Patients with exstrophy-epispadias complex should be dealt with in centres of excellence
- The standard definition of incontinence and its assessment should be applied
- Life long follow-up including urodynamics should be undertaken
- Persisting incontinence should be fully investigated and its treatment tailored to the individual
- Comparative studies, including quality of life, should be established between units.

VIII. DETRUSOR OVERACTIVITY AND REDUCED BLADDER CAPACITY

1. REFRACTORY URGE INCONTINENCE AND IDIOPATHIC DETRUSOR OVERACTIVITY

According to the recent ***Terminology report of the International Continence Society*** the overactive bladder syndrome refers to the symptoms of urgency, with or without urge incontinence, usually with frequency and nocturia [168]. *Detrusor overactivity* has also been redefined to indicate a urodynamic observation characterized by involuntary detrusor contractions during the filling phase that may be spontaneous or provoked. *Idiopathic Detrusor Overactivity* exists when there is no defined cause. This term replaces "detrusor instability". *Neurogenic Detrusor Overactivity* is seen when there is a relevant neurological condition. This term replaces the term "detrusor hyperreflexia". Although the old terms will eventually be replaced they are still in common usage.

Idiopathic detrusor overactivity is a normal situation early in life. Children have urge incontinence as a stage in acquiring bladder control. The incidence of detrusor overactivity during the middle years (20 to 60) has been estimated as 10% [169]. In the asymptomatic elderly, detrusor overactivity once again becomes common, occurring in 50% of men over 70 [170]. In the symptomatic elderly, over 75 years old, it can reach 90% in men [171]. Detrusor overactivity may be a cause of severe storage symptoms such as frequency, nocturia, urgency and urge incontinence. Conservative treatment of these symptoms such as bladder training and pharmacotherapy is discussed in other sections. For symptoms that are refractory two interventional treatments have been reported: neuromodulation and bladder augmentation.

a) Electrical stimulation and neuromodulation

Electrical stimulation of the genital area was first used to control incontinence due to detrusor overactivity on an empirical basis [172], for different etiologies. Later, it was suggested that reflex sphincteric contraction induced by electrical stimulation can promote an inhibitory effect on detrusor activity, thus suppressing detrusor overactivity [173]. Many studies on external electrical stimulation for bladder inhibition on idiopathic urge incontinence have been published, mainly in female patients [174 - 179, 182, 183]. The results vary from 45 % to 85 % of success, with a mean of 38 %, and 26% improved. Electrodes implanted in the pelvic floor, did not yield good results [179].

Neuromodulation of sacral nerves has been reported as an alternative therapy for incontinence, urinary retention and chronic pelvic pain. Good results have been published in treating neurogenic bladder dysfunction [180, 181]. Its use in refractory idiopathic urge incontinence has been limited to few patients, mostly women. Bosch and Groen [184] presented results of chronic implantation in 15 women and 3 men, with an average age of 46 years. Significant improvements in voiding frequency, average voided volume, number of incontinence episodes, and number of pads used were found, with no deterioration in response to stimulation with time. However, with subsequent experience in 14 men only 2 patients had a partial response [185]. Shaker and Hassouna [186] implanted 18 patients with refractory urinary urge incontinence, but only 2 were in men. Other studies are not clear about the etiology of the detrusor overactivity, neurogenic and non-neurogenic causes are grouped together [187, 188]. Table 10 shows some recent prospective studies.

b) Surgical treatment by bladder myectomy and augmentation

Previous treatments by means of surgical bladder denervation, open bladder transection, cystolysis, endoscopic phenol injections, hydrostatic bladder distention did not produce good results.

Bladder autoaugmentation or myectomy has been reported as an alternative to augmentation in neurogenic and non-neurogenic dysfunction. Table 11 presents recent results of this treatment in patients with non-neurogenic detrusor overactivity. Additional and longer-term experience is still required to properly assess this modality.

Enterocystoplasty results are in Table 12, which includes male and female patients. Good results vary from 58% to 88%, with an average of 77%. A minimum of 10% of patients requires intermittent catheterization for bladder emptying. Ileum was the most frequently used bowel segment followed by sigmoid colon,

Table 10 : Neuromodulation for treatment of refractory urge incontinence due to detrusor overactivity (males and females)

Author	N	success (dry)	improved	control group	
Schmidt et al. 189	34	47%	29%	42	prospective randomized
Weil et al. 190	21	56%	19%	23	prospective randomized
Bosch et al. 191	34 (females) 6 (males)	38% 16%	21% 16%	-	prospective longitudinal

Table 11 : Detrusor myectomy for treatment of refractory urge incontinence due to detrusor overactivity (both sexes)

Author	Detrusor overactivity N	Good results N
Swami et al. 192	17	12
Leng et al. 193	8	7
Total	**25**	**19 (76%)**

Table 12 : Enterocystoplasty for treatment of refractory urge incontinence due to detrusor overactivity (males and females)

Authors	Detrusor overactivity	Good or moderate result	Bowel segment
Hasan et al. 194	33	19	46 ileum 2 colon
McInerney et al. 195	50	44	
Bramble 196	15	13	3 colon 2 ileum
Sethia et al. 197	11	9	ileum
Mundy and Stephenson 198	40	30	ileum, clam
Leng et al. 193	2	2	
Total	**151**	**117 (77 %)**	

although no scientific reason for use of any particular segment was given. The surgery, as reported in other sections, has a significant complication rate and should be evaluated carefully when applying it to these patients.

c) Reduced bladder capacity

Fibrosis of the wall produces a low-volume low-compliant bladder, leading to diminished functional capacity. Symptoms of frequency and urgency occur with progressive decreases in volume but urinary incontinence may also be a consequence of a very small capacity, especially if accompanied by urethral weakness. The diagnosis can be suggested by the micturition chart and confirmed by cystogram and or urodynamics. The causes can be congenital or acquired. Acquired causes include multiple surgeries, inflammatory processes (chronic cystitis, interstitial cystitis, tuberculosis, schistosomiasis, chemical cystitis) or post radiation. Bilharzial contracted bladder is a problem that is primarily limited to endemic areas in Africa and the Middle East. Schistosoma haematobium migrates to the veins of the vesical and pelvic plexuses, where the female begins to lay eggs, promoting an initial inflammatory response. As a result, granulomatous lesions form in the lamina propria. Mucosal reactions vary from hyperplasia to polypoid cystitis. A contracted bladder occurs in 2% of cases 199. Bladder augmentation seems to offer a reasonable result in these cases. Similarly small fibrotic bladders of other etiologies, can be treated successfully with enterocystoplasty. The results of this surgery are presented in Table 13.

These results are similar in all etiologies except radiation cystitis. The poorer results after radiation may be due to other tissue damage in the surgical area. New conformal techniques for radiotherapy may improve in the future, such that the need for and, the results of, augmentation improve.

Almost all of these studies do not distinguish bowel segments or separate males from females in reporting results. Therefore, it is not possible to correlate any particular aspect with the chance of success or failure. However, overall the results seem to be reasonable good with the exception of radiation.

Table 13 : Enterocystoplasty results for reduced bladder capacity

Authors	**Bilharziasis cystitis**		**Tuberculous cystitis**		**Radiation cystitis**		**Unknown cause**	
	Total	**Success**	**Total**	**Success**	**Total**	**Success**	**Total**	**Success**
Smith et al. 200	-	-	7	4	9	3	12	7
Kerr et al. 201	-	-	12	12	-	-	-	-
Zinman and Libertino 202	-	-	2	2	1	?	1	1
Dounis et al. 203	-	-	31	27	-	-	1	1
Lunghi et al. 204	-	-	15	15	4	4	3	3
Shawket and Muhsen 205	8	8	-	-	-	-	-	-
Whitmore and Gittes 206	-	-	7	7	-	-	2	1
Chan et al. 207	-	-	-	-	-	-	10	9
Shirley et al. 208	-	-	10	10	4	2	-	-
Goodwin et al. 209	-	-	3	2	-	-	3	3
Winter and Goodwin 210	-	-	1	1	3	1	-	-
Fall and Nilsson 211	-	-	1	1	-	-	1	1
Goldwasser and Webster 212	-	-	-	-	-	-	7	7
Weinberg et al. 213	-	-	2	2	1	1	1	1
Novak 214	-	-	11	11	-	-	-	-
Sayegh and Dimmette 215	2	0	-	-	-	-	-	-
Beduk et al. 216	-	-	-	-	-	-	1	1
Kuo 217	-	-	-	-	1	1	-	-
Kawamura et al. 218	-	-	-	-	-	-	1	1
Hradec 219	-	-	-	-	27	23	-	-
Lima et al. 220	-	-	1	1	-	-	-	-
El Otmany et al. 221	-	-	1	1	-	-	-	-
Yamada et al. 222	-	-	1	1	-	-	-	-
Total	**10**	**8 (80%)**	**105**	**97 (92%)**	**50**	**35 (70%)**	**43**	**36 (84%)**

IX. URETHRO-CUTANEOUS AND RECTO-URETHRAL FISTULAE

Urethrocutaneous or rectourethral fistula may have congenital, inflammatory, neoplastic or traumatic origin. It is important to recognize this diversity of etiology because each type requires a different surgical strategy. All reports are still only retrospective case series.

1. URETHROCUTANEOUS FISTULA (UCF)

a) Congenital

Sharma et al reported a case of congenital urethral fistula with an intact glandular urethra without chordee which was repaired in one-stage [224]. Harjai et al. managed the congenital urethral fistula in a 3-year-old male child with a life-long history of passing urine from the undersurface of penis and the meatus. A fistula was present on the ventral midshaft of penis through which a catheter could be passed [224]. Caldamone et al. reported a case of congenital anterior urethrocutaneous fistula. This is a rare anomaly that may present in an isolated fashion or in association with other penile abnormalities, such as chordee or hypospadias. To our knowledge the embryological events that cause anterior urethrocutaneous fistula are unclear but are likely to result from a defective urethral plate or an abnormality of the infolding of the urethral groove. There have been 18 cases of congenital anterior urethrocutaneous fistula reported in the literature. He treated 14 additional cases of congenital anterior urethrocutaneous fistula of whom 9 were uncircumcised at presentation. Two patients had evidence of chordee and 4 had distal hypospadias. The type of repair was determined by the anatomic variations of this anomaly. All cases were corrected electively by various techniques based on the degree of the defect, including primary closure via a Thiersch-Duplay urethroplasty, pedicle flap urethroplasty, hinged flap urethroplasty and interpositioned island pedicle tube, or onlay urethroplasty [225].

b) Acquired UCF

Hidden foreign bodies have been described as a rare cause of both strangulation of the glans penis and urethrocutaneous fistula. Tash and Eid [226] presented the case of a 30-year-old man who developed a urethrocutaneous fistula and penile shaft necrosis after a condom broke during intercourse. Neither the patient nor several physicians could identify the retained ring of condom, which had been buried under newly epithelialized skin. He underwent removal of the foreign body under general anaesthesia, followed 5 months later by a formal urethrocutaneous fistula repair.

Urethroperineal fistula, as a complication of open perineal prostate cryosurgery, occurs as an immediate perioperative complication in 10.7 % [227]. Thomas et al. retrospectively evaluated 250 patients after radical perineal prostatectomy and revealed only 1 (0.4%) urethroperineal fistula [228]. Fahal et al. [229] published an unusual complication of ***mycetoma***. The patient had an infection with Actinomadura madurae that involved abdominal wall, perineum and urethra. This resulted in urinary extravasation with a urethrocutaneous fistula.

c) Management of UCF

The diagnosis of UCF is made by physical examinations and retrograde urethrography, urethroscopy, fistulography, urethral ultrasound or color Doppler imaging. Urethral sonography provides additional information about an involvement of the surrounding tissue, location of vessels and associated abnormalities such as a periurethral abscess [230].

Treatment of UCF usually requires urethroplasty techniques with modifications involving fistula excision and multiple layer closure [231].

2. RECTOURETHRAL FISTULAS (RUF)

Culp and Calhoon described five basic groups of RUF according to the etiology [232]:

congenital, iatrogenic, traumatic, neoplastic, and inflammatory.

a) Congenital RUF

Endo et al. [233] described the results of the Japanese Study Group of Anorectal Anomalies (JSGA) to determine the relative incidence of specific types of these anomalies in Japan. They included discussion of RUF regarding the relationship between the fistula levels and blind end of the rectum, low type deformity, rare types, and associated anomalies. A total of 1,992 patients (1,183 boys and 809 girls) registered from 1976 to 1995 were analysed according to the pathogenesis of anorectal malformation in the field of molecular genetics**.** They reported that more than 20% of RUF should be categorized as intermediate or low deformity from the position of the rectal pouch. A significant preponderance of Down's syndrome in the deformities without fistulae suggests that investigation of associated anomalies and congenital diseases may provide further insights.

The purpose of Rintala´s study was to compare the long-term outcome of sacroperineal-sacroabdominoperineal pull-through (SP-SAP) to that of posterior sagittal anorectoplasty (PSARP). In boys with high anorectal anomalies, PSARP was superior to SP-SAP pull-through in terms of long-term bowel function and faecal continence [234].

b) Acquired RUF

In 1972 Smith and Venema [235] reported their 20-year experience with 160 patients undergoing radical retropubic prostatectomy (RRP) with the incidence of 15 rectal injuries. Only 4 fistulas developed in this group.

The most common single cause of RUF in the series of 23 male patients published by Tiptaft et al. [236] was a fracture of the pelvis and iatrogenic causes (two cases after transurethral prostatic surgery, two cases after open prostatectomy, and three cases after urethral instrumentation. Noldus et al. [237] reported 23 (3.9%) rectal injuries during 589 RRP and cystoprostatectomy. Eastham and Scardino [238] summarized the incidence of rectal injury during RRP in 3834 patients with an average of 0.7% (range 0.2-2.9%). The incidence of RUF, as an immediate perioperative complication of open perineal prostate surgery, is 1.4 %.

Nyam et al. [239] reviewed records of all patients who were diagnosed with rectourethral fistula between January 1981 and December 1995 and 16 males were identified. All patients were interviewed by telephone to establish follow-up. The mean age was 68 years and the mean follow-up was 80 months. Adenocarcinoma of the prostate in 15 patients and recurrent transitional cell carcinoma of the bladder in one patient were the underlying malignant diseases. Nine patients had had a RRP with 2 after radiation, 2 after brachytherapy, and 3 after a combination of radiation and brachytherapy. One patient formed a fistula after cystectomy and dilation of a stricture. This heterogenous group of patients received multiple therapies including initial colostomy (7 patients), transanal repair (2 patients), parasacral repair (2 patients), transperineal repair (2 patients), coloanal anastomosis (3 patients), and muscle transposition (3 patients). Four of the patients required a permanent stoma.

Zippe [240] reviewed preliminary results of prostate cryosurgery and reported a 2-5% incidence of RUF. Porter [227] found a 2.5% rate of RUF in 210 patients after TRUS-guided prostate cryosurgery and no urethroperineal fistulae.

Montorsi et al. [241] reported one complication of prostatorectal fistula after transrectal prostatic hyperthermia (43 degree C) in patients with advanced prostatic cancer after multiple treatment sessions. The fistula was cured after a urethral catheter was left in place for one month.

Kleinberg et al. [242] summarized results of 31 patients with stage T1 or T2 prostatic carcinoma following CT-guided transperineal (125) I implants and reported that only one patient developed a prostatorectal fistula managed with an ileal conduit.

Fengler and Abcarian [243] published their experience of eight patients with recto-urinary fistulae in the course of treatment of prostate cancer (3 fistulae after radiation therapy alone, 3 after prostatectomy and 2 after both surgery and radiation therapy).

Chang et al. [244] published a case of prostatic malakoplakia masquerading as a rectal tumor due to formation of a fistulous tract to the rectal muscular layers. Cools et al. [245] reported a very uncommon type of fistula between the large bowel and the prostatic urethra due to Crohn's disease. Felipetto et al. [246] described a prostato-cutaneous fistula as a complication of pseudomonas prostatitis.

c) Diagnosis of RUF

RUF may be strongly suspected from the patient's history (fecaluria, abnormal urethral discharge, pneumaturia, leakage of urine from the rectum during micturition). Rectal examination, proctoscopy, careful urethroscopy, intraurethral injection of methylene blue dye, radiopaque contrast agent placed into the bladder and then voided usually appears in the rectum on X-ray, are the most important diagnostic steps [230, 247].

d) Therapy of RUF

Small fistulae may resolve "spontaneously" with urinary and/or fecal diversion. Therefore, an initial trial of conservative therapy is reasonable. Selected patients with chronic fistulas who are poor surgical candidates may also be managed conservatively with antiobiotics, pads and symptomatic care. Timing of repair is often individualized, mainly according to the etiology, delay in diagnosis, size of fistula, whether it is the first or subsequent repairs, and the general condition of patient. Diversion of urine (suprapubic cystostomy) is generally recommended as well as correction of any urethral stricture distal to the fistula. Fecal diversion, with colostomy is used by some as a mandatory part of double diversion or selectively by others. Gibbons [248] stressed the need for a diverting colostomy for 3-4 months.

However, as surgeons obtained more experience, bowel preparations became standardized, and effective antibiotics were developed, the enthusiasm for colostomy diminished. Currently, colostomy is recommended in circumstances where antibiotics alone cannot control the inflammation and infection associated with the fistula or when the fistula involves radiated tissue. Low residue diet is also useful for healing. Suitable drainage (perineal and urethral splinting) is stressed. Two-layer closure of the urethra and rectum with suture lines at right angles and with interposition of soft tissue (eg. omentum [249], gracilis muscle [250], or scrotal flap [251]) has been described. Surgical approaches include transabdominal, transvesical, direct exposure of RUF

through a transperineal incision, transanal, transrectal with a transsphincteric approach or a flap technique with an intact anal sphincter [252],[253], or the Latzko procedure [254]. The approaches to RUF repair are listed in Table 14.

Table 14 : Surgical approaches to Rectourethral fistula repair

Perineal	References
Posterior-sagittal	255-257
- Posterior (parasacrococcygeal) - transsphincteric	258
Transanal	236, 237, 247, 262
Anterior transanorectal	263
Endoscopic	264, 265
Other	246, 266

e) Surgical Approaches

1. PERINEAL

In 1926, Young [255] dissected the rectum away from sphincters, divided the fistula, closed the urethra, and mobilized the rectum further cephalad in such a fashion as to pull the affected rectum caudally out of the anus where it was then transected and discarded, suturing the proximal rectum to the anal skin. Subsequently Lewis, in 1947 [256], described suturing the levator muscle fibers together in the anterior midline when possible. Goodwin et al. [257] reported a series of 22 RUF approached perineally. They extensively mobilized the rectum posteriorly and the bladder anteriorly through wide perineal exposure allowing interposition of the levator ani muscles between the urinary tract and rectum.

2. POSTERIOR SAGITTAL

Kraske in 1885 described a posterior midline incision extending to the left paramedian aspect of the coccyx and sacrum that involved partial removal of the sacrum in addition to coccygectomy. His method did not involve division of the sphincters, but rather sweeping the rectum laterally to ultimately facilitate resection and reanastomosis of a tumour-bearing rectal segment, thereby preserving fecal continence. In 1962, Kilpatrick and Thompson [258] used this approach when the rectum was completely mobilized circumferentially proximal and distal to the fistula. The RUF was then divided, sparing as much as possible on the urethral aspect. The rectal opening was excised and closed in two layers, and the urethra was repaired and stented with a catheter.

3. POSTERIOR (PARASACROCOCCYGEAL) TRANSSPHINCTERIC

In 1969 Kilpatrick and Mason [258] updated this method and advocated a more radical method of dividing the rectal sphincters to give direct access to the RUF. The procedure (the York-Mason approach) is simpler than some complicated transabdominal or transperineal approaches to RUF. It is still used because it allows direct visualization of the fistula via parasacrococcygeal (transsphincteric) incision especially to fistulae in the mid to lower rectum [259]. After the skin incision the mucocutaneous junction is marked with sutures and internal sphincter is exposed. Division of the sphincter mechanism and posterior rectal wall allows exposure of the fistula. Each sphincter muscle is tagged with color-coded sutures. The next step of this procedure is the incision around fistula, followed by excision of the fistulous tract exposing the catheter in prostatic urethra. The undermining of rectal wall allows sufficient mobilization. After closure of prostatic urethra it is recommended to close the full-thickness rectal wall flaps in a "vest over pants" technique. It is important to note that the suture lines do not overlie each other. The procedure is completed by suture of rectal wall and approximating the sphincter muscles (Figure 2). Fengler et al. [259] reported healing of RUF in all of 8 patients with the York-Mason approach. Bukowski et al. [260] managed 7 acquired recurrent RUF (3 after prostatectomy, 3 after trauma and 1 after perineal abscess) using York-Mason technique and similar experience was described by Fournier et al. [261] in the management of a case of the urethro-prostato-rectal fistula after a gunshot wound.

4. TRANSANAL

Parks and Motson [262] popularized the addition of a full thickness local flap of anterior rectal wall as an adjunct to fistula repair through the intact anal canal (Figure 3). They modified the transanal technique by

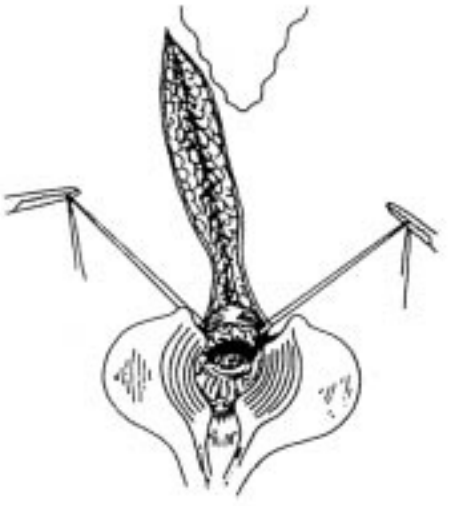

Figure 2 : York-Mason approach to a rectourethral fistula via a parasacrococcygeal (transsphincteric) incision. Sutures are used to mark the sphincters The speculum has been placed at the bottom of the incision and the anterior rectal wall is visible.

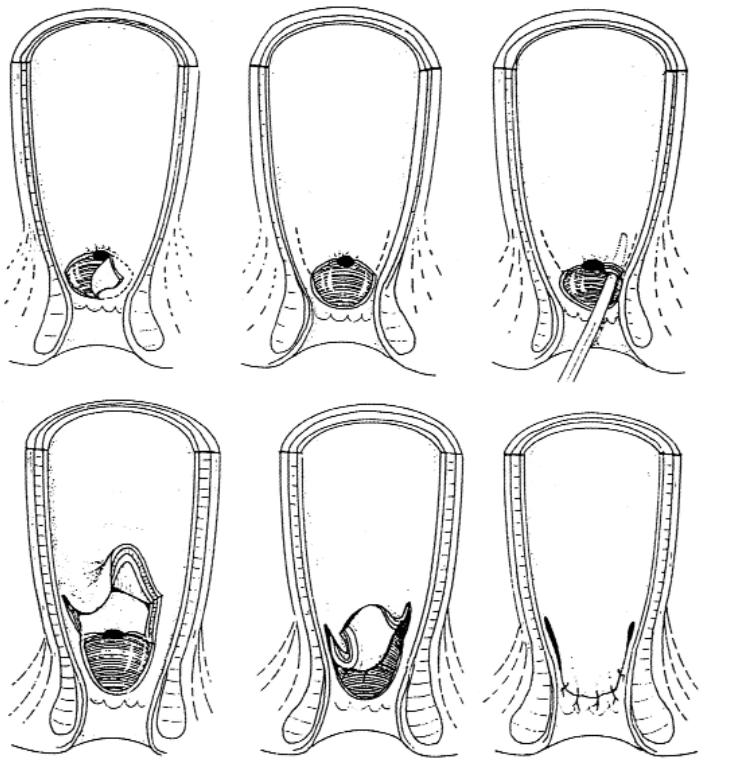

Figure 3 : Rectourethral fistula repair. Full thickness rectal wall is mobilized to close in a "vest over pants" technique to close the fistula.

denuding the rectal mucosa lateral and distal to the fistula, and mobilized the rectal wall away from Denonvilliers' fascia proximal to the fistula for four centimeters. Tiptaft et al. [236] also used a special anal retractor for this surgery.

With the Latzko procedure the RUF is closed in three layers with absorbable suture. A transurethral catheter is placed for 3 weeks. Noldus et al. [237] reported 23 patients (3.9%) with rectal injury during 589 RRP and cystoprostatectomy. Of these 23 patients, 12 developed a RUF. Seven fistulas closed spontaneously with prolonged catheter drainage. The remaining 5 fistulas were all successfully closed with the transanal Latzko procedure.

Al-Ali et al. [247] treated 30 men with RUF caused by war wounds. He used the method of posterior transsphincteric anterior rectal wall advancement as the treatment of choice. Double diversion (end sigmoid colostomy and suprapubic cystostomy) for one month was performed in all patients. Double diversion alone resulted in "spontaneous" RUF healing in 47% of patients but 53% required reconstruction. Early repair was recommended for large fibrous fistulas. Undiversion was done after two months when the urethra and anorectal canals were normal.

5. Anterior transanorectal

In 1973 Gecelter [263] performed a midline perineal incision to gain access to the urinary tract after placing the patient in exaggerated lithotomy position. The sphincter was incised anteriorly, tag sutures carefully placed, and the rectal incision was carried to the fistulous tract, which was excised and repaired in multiple layers with transposition of tissue as available.

6. Endoscopic

Wilbert et al. [264] reported two patients with RUF who were repaired endoscopically transanally. The patients were positioned prone and the rectoscope mounted to the operating table was inserted into the rectum .The fistula was visualized and the opening excised to the level of the perirectal tissues with cautery. The rectal wall was mobilized full thickness with scissors and closed primarily in two layers with a microscope. The patient was then placed in lithotomy position and the urethral side of the fistula was coagulated and injected with fibrin.

Recently Bardari et al. [265] used biological glue (Glubran,) to close one prostato-perineal fistula complicating an abdominoperineal resection of rectum and one persistent neobladder-ileal fistula. The biologic sealant was administrated endoscopically through an open-end 6F ureteral catheter.

7. Other Modifications

Youssef et al. [266] successfully treated 12 male patients who presented with urethrorectal fistula from

1990 to 1997 using the perineal subcutaneous dartos flap procedure. Urethrorectal fistulas resulted from crush pelvic injury in 6 cases, gunshot wounds in 2, and post prostatectomy in 4. The fistula was associated with a urethral stricture in 4 cases. A perineal approach was used and combined with a transsymphyseal approach in the 4 patients with posterior urethral stricture. They interposed a subcutaneous dartos flap as a tissue flap between the repaired rectum and urethra. No leakage or perineal collection developed and there was no fistula recurrence. Follow-up ranged from 9 to 42 months. This technique of a perineal subcutaneous dartos flap may fulfill the principles for successful repair of urethrorectal fistulas.

Felipetto et al. [246] closed a prostato-cutaneous fistula (as a complication of pseudomonas prostatitis) with human fibrin sealant (Tissucol®). Venkatesh and Ramanujam [267] prospectively studied the efficacy of autologous fibrin glue application for closure of recurrent anorectal fistulas. Overall success rate was 60 percent however patients with fistulas associated with acquired immunodeficiency syndrome and the urinary tract failed to respond.

f) Summary

A review of recent literature shows an increasing number of papers describing treatment. All available studies are retrospective cases and case series. There are many causes of these fistulas described in the literature but there is a lack of valid epidemiologic data about the incidence of UCF and RUF. The diagnostic algorithm has not changed in many years. The aim of the surgical approach is the closure of all types of fistulas. While spontaneous closure and success with a one-stage procedure has been reported most cases to date involve 3 stages (double diversion, closure technique, undiversion). An endoscopic approach using biological sealants is promising. Only a few urologists and general surgeons have gained wide experience in the management of UCF or RUF. No single procedure has yet proved to be best or universally applicable.

X. THE ARTIFICIAL URINARY SPHINCTER (AUS)

A series of photographs depicting the artificial urinary sphincter (AUS) implant technique is shown in Figure 4.

1. Complications

Complications following implantation of the AUS can be divided into the broad categories of incontinence, erosion and/or infection.

a) Incontinence

Incontinence following implantation of an AUS can result from (1) alteration in bladder function, (2) atrophy of the urethra, or (3) mechanical failure of the device. These causes may co-exist.

1. Alteration in bladder function

This situation has been reported principally in patients with neurogenic bladder dysfunction, especially in children [268-273]. These changes include, de novo involuntary detrusor contractions, decrease in bladder compliance, and the development of a high pressure system, causing incontinence, hydronephrosis and ultimately renal failure. Modifications in detrusor behavior (including its consequences on the upper urinary tract) occur in up to 57% of cases [268-279]. It should be pointed out, however, that there has never been a published report of hydronephrosis following implantation of an artificial sphincter for incontinence after prostatectomy [280]. The best candidates for sphincter implantation are those with a low pressure, relaxed, and compliant bladder but an incompetent urethral sphincter [277].

2. Atrophy of the urethra

This occurs at the cuff site secondary to long-term mechanical compression of the periurethral and urethral tissues. It is not often reported and some authors do not even mention it as a possible cause of AUS failure [97, 280, 281]. About 4 months following implantation, cuff efficiency diminishes, presumably because pressure atrophy occurs in every patient to some extent [282]. The incidence of urethral atrophy leading to revision varies from 3% to 9.3% [46, 278, 283-287].

3. Mechanical failure

This includes perforation of one of the components with loss of fluid from the system, air bubbles or organic debris within the system causing inadequate function of the pump, kinking of the tubes, or disconnection of the tubes. The incidence of these complications varies widely with ranges from 0% [283] to 52.5% [288] with the longest follow-up. In this latter study, the cuff seemed to be the most vulnerable part of the system (22 cuff failures in 18 patients, most of them occurring during the first 2 or 3 years following implantation), followed by pump failure (6 times in 4 patients). Blockage is an exceptional event, occurring only once in 61 patients followed for 10 to 15 years [288]. An unusual mechanical complication has been reported recently. The locking tab became displaced distally into the cycling portion of the cuff preventing the fluid from flowing into the cuff surrounding the urethra [289].

b) Erosion and/or infection

Erosion and infection are two major complications that almost invariably necessitate removal of the prosthesis.

Figure 4 a : With the patient in lithotomy position, a perineal incision is made behind the scrotum to expose the bulbar urethra

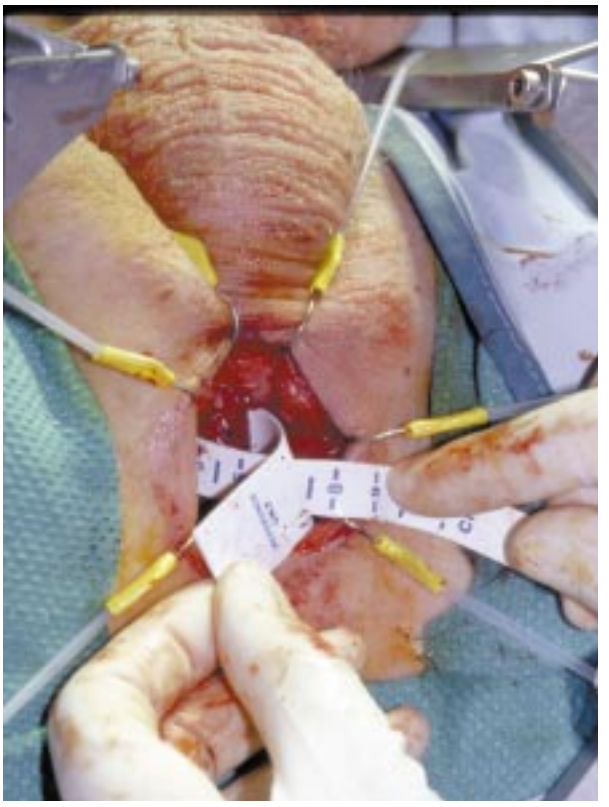

Figure 4 b: The urethra is mobilized circumferentially within the bulbospongiosus muscle and the measuring tape is used to obtain the cuff size.

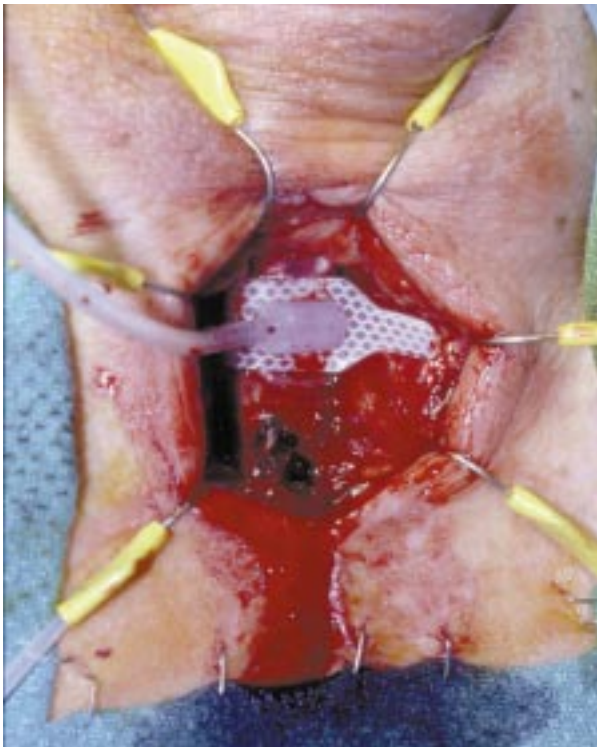

Figure 4 c : The belt-like cuff is positioned around the urethra.

Figure 4 d : A right lower quadrant (RLQ) abdominal incision is made and the extraperitoneal space is entered lateral to the rectus muscle for insertion of the reservoir.

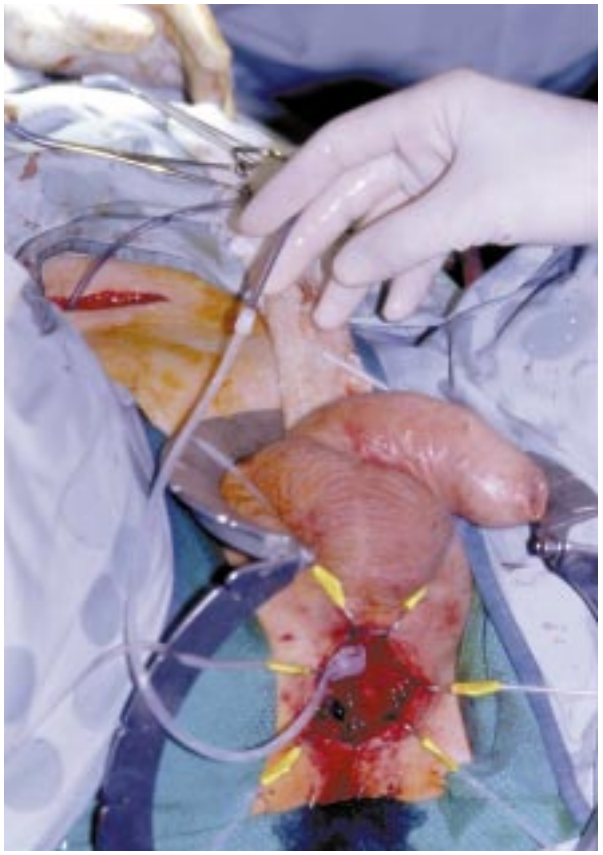

Figure 4 e : After reservoir insertion the cuff is pressurized with fluid

Figure 4 f : A scrotal space is created under the dartos and the pump is inserted (held with a Babcock clamp).

Figure 4 g : The cuff tubing is brought from the perineal incision to the RLQ incision with a tubing passer.

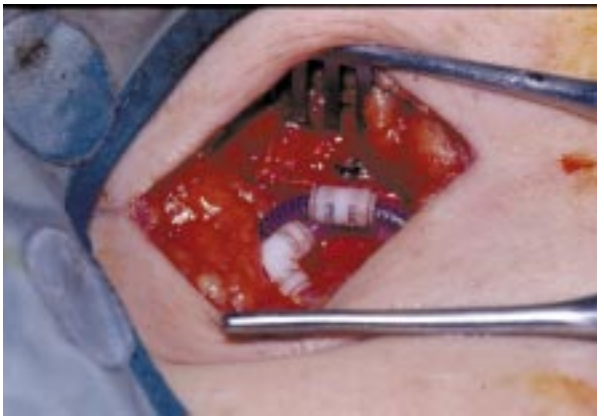

Figure 4 h : Connectors are placed to join the tubes from the cuff and reservoir to the corresponding tubes from the pump in the RLQ incision.

Their incidence is usually reported as a single complication.

The incidence of this complication varies from 0% to 24.6% [46,97,271,277,278,283,284,286,287,290,291]. As would be expected, the highest incidence has been reported with the longest follow-up (10 to 15 years) [283]. Two-thirds of the erosions occurred during the first year. Previous surgery [292] at the site of cuff placement increases the risk of erosion. This, however, can be decreased by delayed activation [293]. Some authors, however, did not find an increased incidence of complications when a new cuff was implanted at the site where several months previously a cuff was removed for infection or erosion [294]. Other risk factors include urethral catheterization and urethral endoscopic manipulations with an activated sphincter in place [295]. Whether or not previous radiation therapy constitutes a risk factor is still controversial although there is some compelling evidence [48,93,96,281].

The number of procedures done in a given center does not seem to be a determining risk factor. Comparable erosion/infection rates have been reported from centres with fewer than 50 or more than 100 cases [1]. This suggests that erosion and infection are more closely related to the physiological state of the host rather than the experience of the surgical team, provided that standard precautions are strictly applied.

2. Durability of AUS components

When defining durability of one of the components or the AUS as a whole, one should distinguish between explantation of the device due to device malfunction (e.g. leak in one of the components) or complications caused by an otherwise properly functioning sphincter unit (e.g. erosion by the cuff, infection at the site of implantation, etc.). This distinction is rarely made in the literature. Durability of a device is defined as time elapsed during which no mechanical problem alters the normal function of the device. This should exclude the second group from further analysis.

There are very few references in the literature pertaining to the length of time a device functioned normally before its removal due to mechanical failure. In a recently published multicenter trial, for neurogenic bladders, conducted in France [278], the authors mention that the "mean operational life" of the sphincter was 56 months (range 3-118 months). Haab et al [289] analyzed 68 patients and noted that the mechanical failure rate dropped from 44.4% to 12.4% since modifications were made to the device, mainly the cuff component. Survival time of these components was not provided. Similar conclusions can be drawn from a recent series from the Mayo Clinic [95] where the modification of the cuff design (narrower back) resulted in a significant drop of the reoperation rate at 5 years. In the narrow backing group 17% (31/184) required a first reoperation. Mean time to the first reoperation was 26.2 months (mean 2 to 68 months). Using Kaplan-Meier statistical analysis for this group of patients, the overall 5 year expected product survival was 75%.

In a recent review Venn et al [97] analysed the outcome of 100 patients in whom an artificial urinary sphincter was implanted more than 10 years before. Thirty-six percent of them still had the original sphincter and were continent at a median follow-up of 11 years. The bulbar cuff, as compared to the bladder neck cuff provided a slightly better continence rate at 10 years, 92% and 84%, respectively. The lowest erosion rate occurred with the bulbar cuff. Device survival rate at 10 years was 66% in this series.

It might be useful to consider patients with "primary adequate function" (PAF) when no revision is necessary to achieve continence separately from those with "additional procedure-assisted adequate function" (APA-AF), where one or more revisions are necessary to obtain favorable outcome. Applying Kaplan-Meier curves to this concept, Klijn et al [51] showed that in their series the median time to failure for the PAF group was 48 months, the mean time to the first failure following the initial implant was 14 months (range: 0-48 months).

In the APA-AF group at 72 months, the median time to definite failure could not yet be established while the mean time to a second failure after a revision was 15 months (range: 0-61 months).

3. Diagnostic procedures related to sphincter failure

The diagnostic evaluation of urinary incontinence after the placement of the AUS is critical for the management of these patients and represents a challenging problem for the urologist. Several diagnostic and management algorithms have been proposed, some relatively simple, others more complex [1,27,28,96,279,296,297]. Figure 5 shows a simple algorithm to investigate and treat the male patient with previously functioning AUS and who became incontinent.

Physical examination should exclude infection at the site of the cuff or the scrotal/labial pump. Difficulty compressing the pump suggests tube kinking, fluid loss or an obstructed system.

Cystometrogram or complete urodynamic study will demonstrate changes in bladder behavior following insertion of the AUS as described above.

Plain X-rays of the abdomen or pelvis may show fluid loss, if the system is filled with radio-opaque solution [298,299] (Figure 1).

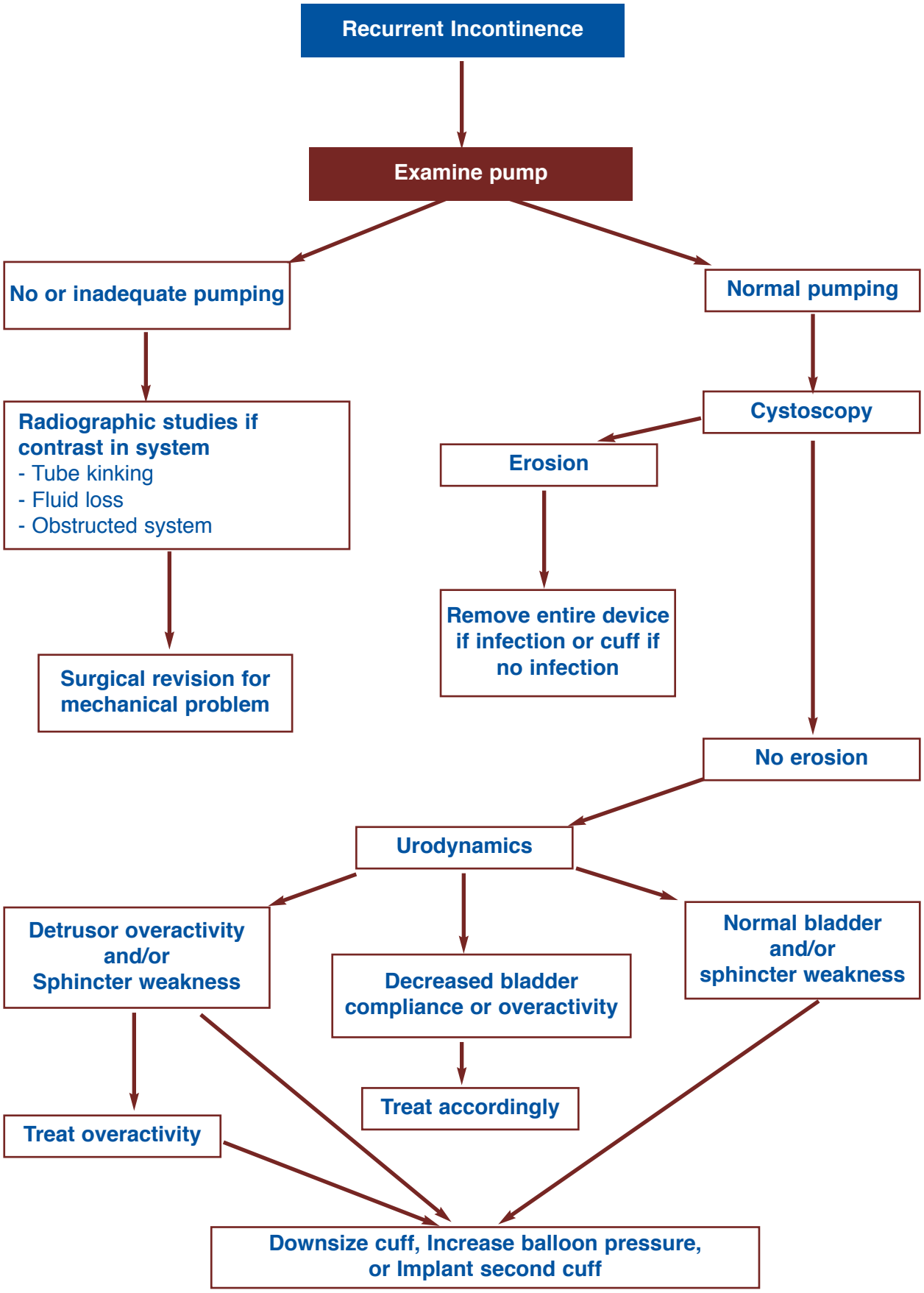

Figure 5 : Algorithm for managing incontinence after AUS placement

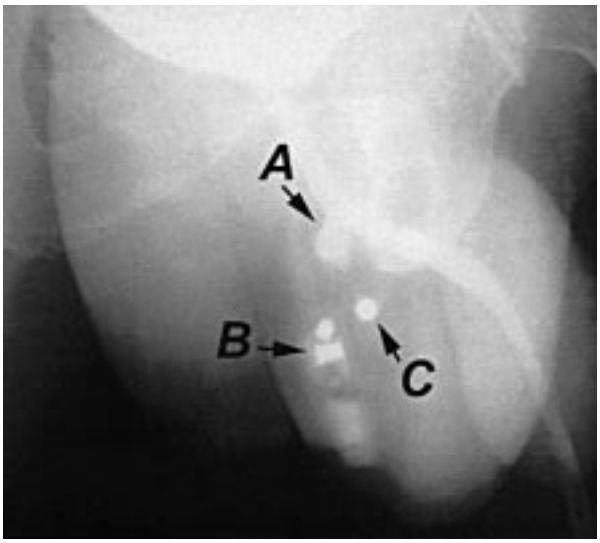

Figure 6 : Urethrogram of patient who underwent cuff removal for erosion into the urethra. A. Site of urethral diverticulum. B. scrotal pump. C. Tubing plug over tube from pump

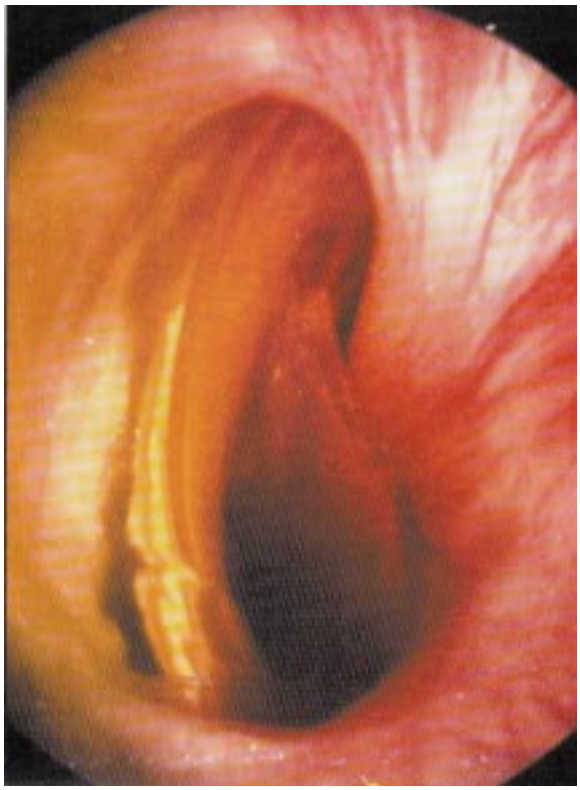

Figure 7 : Endoscopic view of AUS cuff erosion into the bulbar urethra. The patient had undergone radiation after radical prostatectomy.

Cystourethrography could eventually demonstrate a urethral diverticulum at the site of a previous cuff erosion (Figure 6).

Endoscopy will disclose any urethral erosion by the cuff (Figure 7).

Retrograde perfusion sphincterometry has been reported to diagnose the loss of compressive pressure in the urethral cuff [27]. This technique can also be used intraoperatively to detect urethral perforation or to adjust the pressure in the cuff [30]. This seems to be more useful than urethral pressure profile (UPP) [275].

Intraoperative electrical testing, using an ohmmeter [291] [296] has been described to determine the site of fluid leakage from the system. This avoids the need to change the whole system, and allows replacement of the leaking part only.

4. Treatment of complications

As outlined above, complications directly related to the presence of an artificial urinary sphincter can be divided into categories: incontinence from alteration in bladder function, urethral atrophy, and/or mechanical failure, and infection/erosion. The treatment of each of these complications deserves comment, as no detailed reference can be found in the literature dealing with the treatment of these complications.

a) Alterations in bladder function

De novo (or pre-existing) detrusor overactivity can be treated with parasympatholytics. In a small proportion of patients systemic side effects will prevent the use of these drugs; there might also be some medical contraindications, or the drug may be ineffective. Other options such bladder autoaugmentation or enterocystoplasty may be considered. To date no report can be found where implantation of an artificial urinary sphincter resulted in a deterioration of the upper urinary tract in a post-prostatectomy or neurologically normal patient [280] [300]. It has been reported that enterocystoplasty performed together with the placement of an AUS in the same operative session does not increase the morbidity of the procedure and does not affect the success rate [301]. However, in a recent review of 286 patients Furness et al. [302] demonstrated an infection rate of 14.5% and 6.8% with simultaneous and staged procedures, respectively. No clear urodynamic guidelines exist to select patients who need bladder augmentation in combination with an AUS [282].

b) Atrophy of the urethra

Several therapeutic options exist to increase cuff pressure around the atrophied urethral wall: changing the balloon reservoir for one generating a higher pressure, downsizing the cuff diameter initially by 0.5 cm [48],

303, or increasing the amount of fluid in the system. Some authors advocate the implantation of a second cuff around the urethra 304. Others prefer the initial perineal implantation of a double-cuff AMS 800 in patients with total or severe incontinence 305. It does not appear that morbidity increases with the double-cuff as compared to the single cuff system 305.

c) Mechanical failure

As with any device, mechanical failure can be expected with the AMS800 AUS. The treatment involves surgical replacement of the failed component and reconnecting the system.

d) Infection

With overt infection the accepted treatment option is removal of the entire device and appropriate antibiotics. A second system can be subsequently implanted with equally good results 293.

e) Erosion

In case of urethral erosion by the cuff, the "offending" cuff must be removed. No clear guidelines exist whether removal of the whole system is superior to removal of the cuff alone but it must be assessed for infection. If infection is present the whole device should be removed. Reservoir erosion into the bladder has been described following removal of an eroded cuff 306. Furthermore, it is not known whether it is necessary to allow the urethra to heal over a catheter versus surgical repair. The former risks diverticulum formation (Figure 6) and the latter may increase the amount of periurethral fibrosis. This may compromise success of a new cuff. However, the new cuff should be positioned away from the erosion site. In case of erosion of one of the cuffs of a double cuff system removal of the eroded cuff can successfully convert a double-cuff system to a single cuff system 307.

5. Consensus protocol for follow-up of patients with AUS

As complications continue to be seen for years after implantation 308, it is helpful to have a structured follow-up plan. However, no standardized recommendations are available in the literature.

The consensus upon which the members of this subcommittee agreed and which is based on expert opinion (level of evidence 5) are as follows:

1. Antibiotics following implantation should be continued for 2 or 3 days, gram-negative enteric and Staphylococcus epidermidis being the most frequently encountered microorganisms in infected prostheses 295.
2. Hospital stay should be kept as short as possible to minimize the chances of nosocomial infections.
3. Urethral catheter should be withdrawn within 48 hours of surgery.
4. In general, the sphincter device should not be activated immediately postoperatively. In the initial period scrotal edema and pain prevent patients from manipulating the pump adequately. When this subsides after 6 to 8 weeks the device can be activated. Earlier activation may also be acceptable. Irradiated patients may benefit from a longer initial period of deactivation, up to 12 weeks [48]. Nocturnal deactivation should be considered in high-risk patients 46.
5. Patients are reviewed at 3 months after activation to ensure the device is working adequately, and to assess the continence status.
6. Long-term follow-up is different in the neurogenic and in the non-neurogenic patient. With time, alteration in bladder function can jeopardize renal function in the neurogenic patients. Periodic ultrasound evaluation of the upper urinary tract is advisable. If changes occur, urodynamic studies should be done to rule out detrusor overactivity. In non- neurogenic patients, periodic renal ultrasound may not be necessary.
7. When change in the continence status occurs diagnostic procedures related to sphincter failure (Figure 5) should be considered.

XI. NEW TECHNOLOGY - SLINGS

As a result of the cost of the AUS and the associated revisions non-prosthetic procedures are being evaluated. Shoukry and el-Salmy 309 used a rectus fascia sling to suspend the bulbar urethra to the abdominal wall in 12 men. After a mean of 13 months, 10 out of 11 patients were totally dry. One eroded sling had to be removed. Minowada et al. 310 described a sling procedure in one patient following an ileal neobladder. Elsharaby et al. 311 described an abdominal procedure for post-prostatectomy incontinence in which they lysed the pelvic urethra with preservation of the neurovascular bundles and suspended the prostatic capsule to the anterior abdominal wall in 21 men. After a mean of 19 months 17 patients were dry (81%). Kozizaki et al. 312 reported using a fascial sling around the bladder neck in 8 men and around the bulbar urethra in 2 of these men. Two males without neurogenic bladders were dry and voided normally after a mean of 36

months, while the remaining patients underwent augmentation cystoplasty and were dry or improved on intermittent catheterization.

Schaeffer et al, [313] reported a 75% success rate (67% cured, 8% improved) after a median of 18.1 months, with a bulbourethral sling suspended to the abdominal wall, in 64 men with post radical prostatectomy incontinence. The revision, erosion, and infection rates were 27, 6, and 3% respectively. Madjar et al. [314] described a bulbar sling suspended by bone anchor to the inferior pubic rami. After a mean of 12.2 months 12 of 14 patients with post radical prostatectomy incontinence were dry and 2 were improved.

XII. SUMMARY AND RECOMMENDATIONS

1. Evaluation

Prior to surgery a basic patient evaluation should consist of history and physical examination, urinalysis and postvoid residual urine. A voiding diary and pad test are very helpful. Blood testing (BUN, creatinine, glucose) is recommended if compromised renal function is suspected or if polyuria (in the absence of diuretics) is documented. Additional testing with cystoscopy and appropriate imaging of the urinary tract are also helpful in guiding therapy. Multichannel urodynamics are essential prior to invasive treatment for incontinence. A, B

2. Postprostatectomy incontinence

After a period of conservative treatment, which may be from 6 to 12 months, the artificial sphincter is the treatment of choice in appropriately selected patients with incontinence after prostatectomy for benign disease. Bulking agent therapy is of equivocal value. B, C

3. Postradical prostatectomy incontinence for prostate cancer

After a period of conservative treatment, which may also be from 6 to 12 months, the artificial sphincter is the preferred treatment for properly selected men who have stress incontinence after radical prostatectomy. Injectable agents are a less effective option for some men with mild to moderate incontinence. B, C

4. Incontinence following other treatments for prostate cancer

The artificial sphincter is most widely used but radiation may be a risk factor for an increase in complications. Injectable agents have not been successful in this setting. C

5. Incontinence following pelvic trauma

The artificial sphincter is most widely reported. Bladder neck reconstruction has also been reported on a limited basis. C

6. Incontinence in adult epispadias-exstrophy complex

Patients should be treated in centres of excellence. A patient-directed approach should be taken. The choices include further bladder neck reconstructive surgery (+/- AUS) or diversion with bowel. The data are insufficient for a specific recommendation. C, D

7. Refractory urge incontinence and detrusor overactivity

Neuromodulation is a treatment option with success reported in a limited number of patients. Detrusor myectomy has also been reported to be successful in a small number of patients. Augmentation cystoplasty is potentially successful in controlling symptoms but may be associated with unacceptable side effects. Urinary diversion is a final option. C, D

8. Reduced capacity bladder

Augmentation cystoplasty has been successful in most etiologies apart from radiation. C, D

9. Urethrocutaneous fistula and rectourethral fistula

Etiologic factors causing acquired urethrocutaneous fistulae are demonstrated by clinical, endoscopic and imaging studies. Surgical reconstruction is applied as required. Similar diagnostic maneuvers are applied to rectourethral fistulae. In those that do not close with or without temporary urinary and fecal diversion, surgical reconstruction may be carried out. Various techniques are available for closure and can be done in collaboration with colorectal surgeons. C, D

10. Management of AUS complications

Incontinence may result from alteration in bladder function, urethral atrophy, or mechanical malfunction. Infection and/or erosion of components demand surgical removal of all or part of the prosthesis. A treatment algorithm is presented to aid in management and in follow-up of patients. C, D

11. New technologies

Sub-urethral slings for postradical prostatectomy incontinence show early success. C, D

12. Recommendations for future research

- New technologies, bulking agents, sling materials, prosthetic devices should continue to be evaluated
- Clinical trial recommendations
  - Randomized trials
  - Standardized workup and outcome measures
  - Complete reporting of complications
  - Long-term results (>2 years)
  - Standardized reporting of durability

Take Home Messages

- Despite the significant revision and failure rate, the artificial sphincter is still the 'gold standard' for postprostatectomy incontinence.
- Bulking agents have an overall lower success rate than the artificial sphincter. Radiation, TURP, and cryotherapy negatively impact on the success of injectables.
- Treatment of complex incontinence problems, such as adult presentation of exstrophy epispadias complex and rectourethral fistulae, is difficult and has to be approached on an individual patient basis.
- The best surgical procedure for detrusor overactivity is still to be elucidated. Furthermore, the future of surgical treatment will depend on new developments in non-surgical therapy.
- New procedures and devices should only be introduced within the context of clinical trials.

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