CHAPTER 19

Committee 15

Surgical Treatment of Urinary Incontinence in Men

Chairman

S. HERSCHORN (CANADA)

Co-Chair

J. THUROFF (GERMANY)

Members

H. BRUSCHINI (BRAZIL),

P. GRISE (FRANCE),

T. HANUS (CZECH REPUBLIC),

H. KAKIZAKI (JAPAN),

R. KIRSCHNER-HERMANNS (GERMANY),

V. NITTI (USA),

E. SCHICK (CANADA)

CONTENTS

Surgical Treatment of Urinary Incontinence in Men

S. Herschorn, J. Thuroff

H. Bruschini, P. Grise, T. Hanus, H. Kakizaki, R. Kirschner-Hermanns, V. Nitti, E. Schick

I. INTRODUCTION AND SUMMARY

Surgery for male incontinence is an important aspect of treatment with the changing demographics of society and the continuing large numbers of men undergoing 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 important 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 in the short term and fewer in the long term.

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 significant minority will require surgical treatment. The artificial sphincter has provided a satisfactory cure in most cases with a positive impact on quality of life. Sling procedures have also been reported to have a good outcome. Injectable agents have had a lower success rate and continue to be 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.

Although the literature is replete with well done cohort studies, there is a continuing 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 Second 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. A new surgical modality 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
Prostatorectal (urethrorectal)
Urethrocutaneous

II. EVALUATION PRIOR TO SURGICAL THERAPY

Before surgical treatment of the incontinent male is undertaken, the following evaluations should be done [2]. Basic evaluation includes history, physical examination (including neuro-urological examination: perineal sensation, anal tone, voluntary contraction and relaxation of the anal sphincter, bulbocavernosus reflex [3], urinalysis, and postvoid residual urine. A frequency-volume chart [4], or voiding diary (indicating daytime and nighttime frequency of micturition, incontinence episodes, voided volumes, 24-hour urinary output, etc.) is also helpful. No clear guidelines can be found in the literature indicating the minimum number of days necessary to furnish reliable data for a voiding diary. According to Wyman et al. [5] the 7-day diary can be considered as the gold standard for voiding diaries. Recently Schick et al.[6] demonstrated that a 4 day frequency-volume chart is the shortest one which still gives reliable results, as compared to the 7 day diary. The pad test quantifies the severity of incontinence. The 24-hour home test is the most accurate pad test for quantification and diagnosis of urinary incontinence because it is the most reproducible.[7] The 1-hour pad test is widely used because it is more easily done and standardized. A pad test may be helpful in quantifying leak in AUS failures. Postvoid residual urine is a good estimation of voiding efficiency [8, 9]. These basic investigations should be done in every incontinent male when surgical therapy is planned.

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 [10].

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 [11], 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 include plain film of the abdomen (KUB or Kidneys, Ureters, Bladder), in cases of incontinence following artificial sphincter implantation when during the original procedure the hydraulic system was filled with contrast medium. A KUB immediately following sphincter implantation serves as a reference point for subsequent comparisons [12]. **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. Second KUB compared to previous one clearly demonstrated fluid loss from the system. Contrast studies include cystography which may demonstrate an open bladder neck when bladder denervation is suspected [13] (e.g.: following abdominoperineal resection of the rectum). Cystourethrography may be used to demonstrate a fistula, stricture or urethral diverticulum, eg., following healing of the urethral wall erosion caused 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 postvoid residual urine. The sensitivity of 66.7% and specificity of 96.5% when post-void residual is 100 ml or more is ade-

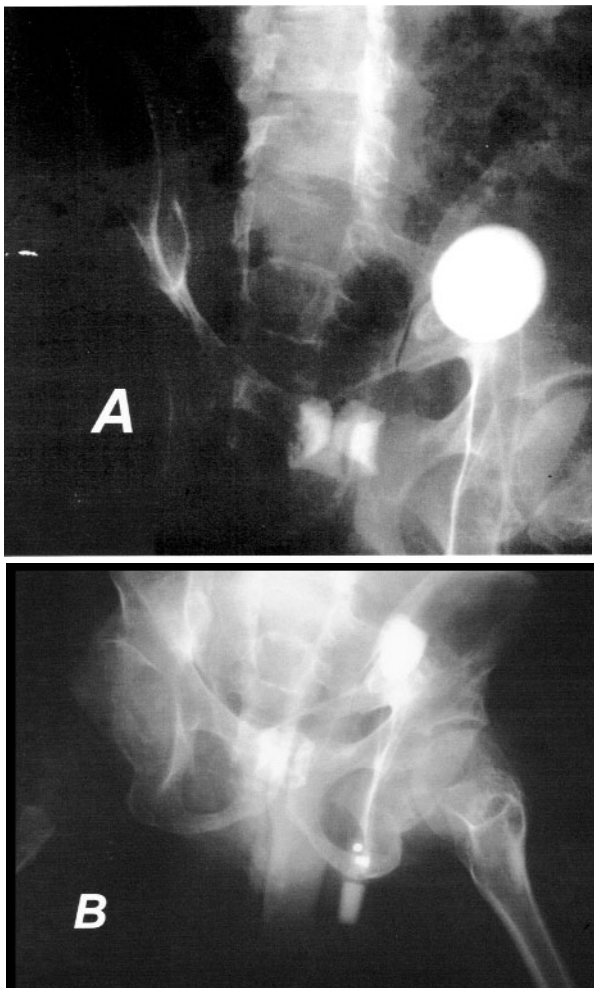

Figure 1. Young spina bifida patient who had a bladder neck artificial sphincter implanted. After more than 10 years, he became incontinent. Early abdominal plain film, A, shows a full reservoir. After leakage started abdominal plain film, B, demonstrates loss of fluid from the reservoir.

quate for routine clinical use[14]. It has been shown to be cost-effective when compared to catheterization [15]. Other modalities (transurethral ultrasound [16], magnetic resonance imaging of the external sphincter, etc.) are still under development.

Urodynamic Testing

In the opinion of the Committee a thorough urodynamic evaluation to characterize the underlying physiopathology is important to perform prior to invasive theapy.

However, there are factors that must be considered. 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 the Valsalva [17] or cough [18] abdominal leak point pressure, although not by urethral pressure profilometry. A recent study suggested that Valsalva leak point pressure is significantly lower than cough leak point pressure [19]. However, 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 pressure when the same size of catheter is used [20, 21].

In male patients, abdominal leak point pressure should be evaluated via a rectal catheter because urethral catheter is much more likely to invalidate Valsalva leak point pressure measurements than it does in female[22]. It has become evident that bladder volume influences Valsalva leak point pressure, i.e. it decreases with bladder filling [23-25]. This observation is not unanimous [26]. Unfortunately, no standardization of the technique and agreement upon it exist at the present time which somewhat limits its usefulness [27]. Measurement of leak point volume may also provide information on the functional capacity of the bladder [28]. Retrograde leak point pressure has been used to study incontinence following placement of an artificial sphincter [29, 30]. It correlates with the lowest abdominal leak point pressure[31]. The intraoperative use of this technique has been proposed and this allows early recognition of intraoperative urethral injury and mechanical malfunction [32]. Electrophysiologic studies, mainly sphincter electromyography, may be useful to document denervation of the pelvic floor when nerve injury or neuropathology is suspected [33]. Detrusor function is best evaluated by multichannel urodynamics. Its main purpose is to detect **detrusor overactivity and/or decreased compliance.** It can be coupled with fluoroscopic imaging, video-urodynamics. It has also been proposed by some to replace fluoroscopy with transrectal ultrasound [34, 35]. Ultrasound measurement of bladder wall thickness appeared to be a better predictor of bladder outlet obstruction such as an anastomotic stricture, than uroflowmetry [36].

Non-invasive pressure-flow urodynamic evaluation based on Doppler ultrasound seems to have potential for diagnosing bladder outlet obstruction [37]. However invasive, pressure-flow studies are still the gold standard in the incontinent male to rule out bladder outlet obstruction accompanied by detrusor overactivity [38]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 :
  - Multichannel urodynamics:
    - to characterize the incontinence and to detect detrusor overactivity, decreased compliance, and/or outflow obstruction

III. INCONTINENCE AFTER RADICAL PROSTATECTOMY FOR PROSTATE CANCER

1. Prevalence

Urinary incontinence occurring after radical prostatectomy (RP) is still a significant problem. Although its rate has lessened [39] in these last few years primarily due to a better understanding of the pathophysiology and improvements in surgical technique, its prevalence has probably increased due to the dramatic increase of RP in developed countries which has lead to overall increase in the number of patients affected. The reported rates vary according to incontinence definition as reported in **Table 3** [40-51]. Several recent series use definitions that include "total control", "occasional leakage but no pad", and "less than one pad". In addition, the tools used to evaluate incontinence vary from validated questionnaires, interviews from a data manager, or response to the surgeon's inquiry. Health related quality of life is strongly correlated with the level of incontinence and wearing one pad more significantly affects the quality of life than wearing no pad [52].

2. Risk factors

Reported risk factors for incontinence following radical prostatectomy include patient age at surgery, stage of disease, surgical technique, preoperative continence status, prior radiation therapy, preoperative length of the membraneous urethra and prior transurethral resection of the prostate (TURP). However, various studies have come to conflicting conclusions on specific risk factors. Risk factors for incontinence after TURP have not been as clearly defined, probably because the incidence is so low, making the accumulation of large prospective series of this type of incontinence difficult.

Advancing age as a risk factor is supported by several studies [53-58]. Steiner, et al found no correlation between age and continence status, but only 21 of the 593 patients were 70 years or older [59]. Others have found advancing age and number of co-morbidities to have a negative impact on recovering delay of continence during the first year post radical prostatectomy [60] but the rate at one or two years did not seem to be significantly affected 60].

Most large series have found no correlation between the stage of disease and incontinence rates [55, 56, 62, 63]. However, in certain cases, the stage of disease may affect the surgical technique (i.e. nerve sparing) and rates may be higher, but this appears to be a reflection on surgical technique and not disease stage [57]. Regarding surgical technique, the many parameters involved in continence may explain difficulties in understanding the benefit of certain technical points. The bladder neck preservation has been reported to improve continence at 3 months [63] but no difference was found at 6 and 12 months [64, 65]. Nerve sparing has no significant impact according to Steiner et al. [59] and Lepor and Kaci [42] recently confirmed this. Others did find benefit [66]. Recently, some authors have advocated laparoscopic and robotic radical prostatectomy. At this time the body of available data on continence is limited, but it would appear that continence rates are similar between open and laparoscopic/robotic approaches. Several studies have compared the techniques either retrospectively, [67] with meta-analysis [51] and found similar continence rates. One prospective, non-randomized study also showed similar rates of incontinence at 1 year [68]. Further prospective comparative studies with open surgery are needed. Perineal prostatectomy is done by only a limited number of urologists but is still advocated for obese patients and the continence rate was reported as similar to the retropubic route [69].

3. Pathophysiology

As in incontinence in general, post prostatectomy incontinence may be caused by bladder dysfunction,

Table 3. Continence rates after radical prostatectomy according definition of continence, Definition 1: total control without any pad or leakage, Definition 2: no pad a day but few drop of urines, Definition 3: use no or one pad per day.

RRP: radical retropubic prostatectomy; RPP: radical perineal prostatectomy; LRP: Laparoscopic radical prostatectomy; Rx: radiotherapy

Author	No. pts.	Mean age (years)	Continence follow-up at 12 months def 1	def 2	def 3	Type of surgery
Kielb et al [40]	90	59.6	76%		99%	RRP
Sebesta, et al [41]	675	<65	43.7%	69.2%	82.2%	RRP
Lepor and Kaci [42]	92	58.7	44.6%		94.6%	RRP
Olsson, et al [43]	115	65.2	56.8%	78.4%	100%	LRP
Madalinska, et al [44]	107	62.6	33%	65%		RRP
Deliveliotis , et al [45]	149	66.5		92.6%		RPP
Harris, et al [46]	508	65.8		96%		RPP
Maffezzini, et al [47]	300	65.5		88.8%		RRP
Hofmann, et al [48]	83			74.7%	88%	RRP+/-Rx
Ruiz-Deya, et al [49]	200	63			93%	RPP
Augustin, et al [50]	368	63.3			87.5%	RRP
Rassweiler et al [51]	219	65			89.9%	RRP
	219	64			90.3%	LRP

sphincter dysfunction or a combination of both. Complimentary investigations are helpful to rule out bladder outlet obstruction or significant bladder dysfunction. In addition to incontinence symptoms, storage and voiding symptoms may be associated [69, 70]. Urodynamics demonstrated that the sphincter incompetence occurs as the sole cause in more than two thirds of patients, while isolated bladder dysfunction (detrusor overactivity, poor compliance, detrusor underactivity during voiding) is uncommon occurring in less than 10% [71, 72]. However, sphincter and bladder dysfunction can coexist in at least one third of incontinent patients. Bladder dysfunction may occur de novo after prostatectomy perhaps induced by bladder denervation; may be caused by outlet obstruction, or may be related to pre-existing factors such as the age. Impaired detrusor contractility and poor compliance resolved in the majority of patients within 8 months [73]. Decreased sphincter resistance may be due to tissue scarring in some cases and reflected by a low urethral compliance, however this parameter is difficult to measure[71]. This scarring may lead to an anastomotic stricture evidenced by endoscopy or urethrography, and is clinically suspected when both incontinence and decreased force of stream coexist.

The pre-operative length of the membranous urethra determined on MRI has been shown to be related post-operative continence. When urethral length was greater than 12 mm, 89% of the patients were continent at one year versus 77% with or less than this length. Urodynamic studies revealed that a reduced functional urethral length was a predictive parameter of incontinence [66, 74, 75].

Different components of the urethra may be involved. The urethral intrinsic component responsible for passive continence as well as the extrinsic component responsible for active continence may be involved as demonstrated in a prospective urodynamic alpha blockade test [76].

This may explain paradoxal passive incontinence despite a high voluntary urethral pressure. Post-operative disruption of the innervation of the posterior urethra may also be involved and can affect both motor and sensory functions [77, 78]. In clinical practice, urodynamic evaluation of a urethral weakness may be assessed by resistance to antegrade leakage (ALPP or VLPP), retrograde leakage, or profilometric measurement (MUCP) [79]. However no such parameters have been correlated to outcomes of treatments for the correction of post prostatectomy incontinence.

The state of a patient's pelvic floor may also influen-

ce continence or return to continence after RP. Physiotherapy and pelvic floor rehabilitation have been shown to improve or enhance continence (decreased time to final continence level) in the post operative period in two randomized studies, if such measures are instituted before or immediately after catheter removal [80, 81].

Maximum difference between physiotherapy and no treatment is achieved at 3 months, with almost no difference at 12 months. Another study showed that providing patients with instructions for pelvic floor muscle exercise alone was equivalent to biofeedback or electrical stimulation [82]. A randomized study in which randomization occurred 6 weeks after surgery showed no difference in continence at 6 months [83]. On the same note studies in which physiotherapy was used as a treatment modality for established incontinence have shown more variable results [84-87].

4. Surgical and minimally invasive treatments

a) Urethral bulking agents

Urethral bulking is a minimally invasive treatment proposed for post prostatectomy incontinence, and theoretically works by adding bulk and increasing coapatation at the level of the bladder neck and distal sphincter. It can be done in an office or outpatient setting in a retrograde or antegrade fashion. Several different agents have been used for urethral bulking in men including bovine collagen (Contigen), and silicone macroparticles (Macroplastique). All agents share the similar problems including the need for multiple injections, deterioration of effect over time, and very low cure rates.

For collagen, "success rates" for post-prostatectomy incontinence range from 36-69%, with 4-20% of patients reporting being dry [88-95]. Unfortunately, the end points in most of these studies are subjectively based, making comparisons difficult; however, it is clear that cure rates (total dryness) are low, and multiple injections are required to achieve modest rates of subjective improvement. There is no advantage of delivery technique (retrograde vs. antegrade). Several authors have identified factors which negatively affect results include extensive scarring or stricture formation, previous radiation, and high grade stress incontinence and low ALPP [89, 91, 92, 95]. One study reported more favourable results for collagen in treating incontinence after transurethral prostatectomy as opposed to radical prostatectomy (35.2% 'social continence' versus 62.5%) [92]. It appears that collagen injection does not adversely affect outcomes of artificial sphincter implantation and does not increase the complication rate [96]. However, inconsistent or marginal benefits induce direct costs and residual pad costs, therefore a potential savings has to be considered if a majority of the patients finally treated with an artificial sphincter.

Other bulking agents such as polydimethylsiloxane (Macroplastique®) have shown some initial success, but results also deteriorate over time. Bugel and coworkers treated 15 patients. They noted rapid deterioration after initial improvements with success rates of 40%, 71%, 33%, and 26% at 1,3,6, and 12 months respectively [97]. They also noted that a urethral closure pressure of at least 30 cmH_2O was essential for success.

Several other bulking agents are currently used or are under investigation for female stress urinary incontinence. Although there is minimal data on the use of these agents in men with post RP incontinence, it is certainly hoped that their effect will be better than currently available agents. These agents include carbon coated zirconium oxide beads (Durasphere®), hyaluronic acid and dextranomer (Zuidex®), dimethyl sulfoxide/ethylene vinyl alcohol copolymer (Uryx™), and hydoxylapatite spheres in carboxylmethylcellulose carrier (Coapatite).

Conclusion

Bulking agents remain the most minimally invasive treatment for post RP incontinence after conservative measures. All agents for which there is peer-reviewed data available, show only modest success rates with very low cure rates. Effects tend to deteriorate over time. It remains to be seen if improvements in outcomes can be achieved with alternative agents, or if the concept of urethral bulking has achieved its maximal benefit with the agents available now. **(Level of evidence 3; Grade of recommendation C)**

b) Male sling

The male sling procedure utilizes the concept of passive external urethral compression, and has recently emerged as treatment for post prostatectomy incontinence. The male sling is actually based on the concept similar to that described by Kaufman and associates in the early 1970's [98-100]. At that time a high rate of failure, septic complications and pelvic pain as well as the advent of the mechanical artificial

urinary sphincter (AUS) led to the abandonment of the Kaufman prosthesis. Now with the higher prevalence of post prostatectomy incontinence and patient wishes for less invasive surgery and a non-mechanical device the concept has been revisited. Procedures have been developed based on principles used to treat female stress urinary incontinence using biological and synthetic graft materials. These procedures rely on compression from the ventral side of the urethra rather than the circular compression caused by a natural or artificial sphincter.

Schaeffer and Stamey described the bulbourethral sling which uses Dacron bolsters placed under the urethra and suspended to the anterior rectus fascia by sutures [101]. Data on this procedure are limited to retrospective analyses from the two authors who described the procedure and it never gained widespread popularity. In the initial report from 2 centers, 64 patients were included and 56% were "dry" and 8% "improved" at a mean follow up of 22.4 months [101]. Almost one-third needed secondary retightening procedures and patients with radiation fared poorly. Subsequently, Clemens, et al reported a questionnaire-based study of 66 men from a single institution and 41% were cured and 51% improved but mean follow up was only 9.6 months [102]. They also reported that the bulbourethral sling did not cause significant outlet obstruction [103]. Others have described a bulbourethral sling using a polypropylene mesh graft with or without a porcine dermis backing to reduce the risk of erosion [104]. In two small studies of 9 [105] and 16 [104] patients cure rates range from 56-69% and failure rates from 22-25% at a mean follow up of 14 months. Recently, John described the bulbourethral composite suspension where porcine dermis is secured to the bulbospongiosus muscle and a 1 cm wide polypropylene sling is placed over this and passed through the retropubic space to emerge from two suprapubic incisions (similar to the tension free vaginal tape procedure in women) [104]. He reported a 69% cure and additional 6% improvement in 19 patients, with a mean follow up of 14 months. Eight intraoperative bladder perforations healed without complication.

More recently the bone anchored perineal sling has become popular. There have been several abstracts on the technique, but the peer reviewed literature is limited. In 2001, Madjar, et al reported on 14 patients with post RP incontinence that underwent the procedure with a synthetic or cadaveric fascial sling [106]. At a mean follow up of 12.2 months, 86% were "cured" wearing none or 1 pad. Comiter reported a 76% cure and 14% "substantially improved" rate in 21 men with post prostatectomy incontinence using polypropylene mesh with a mean follow up of 12 months [107]. A recent update, with a mean follow up of 25 months in 36 men, reported 67% were pad free and 14% used one pad/day [108]. Additionally, 80% of men reported from small to no bother (UCLA/RAND questionnaire) from incontinence after sling. Urodynamic follow up in 22 men, revealed that the sling had no significant effects on voiding function and no man was obstructed postoperatvely [109]. Onur and colleagues reported on 46 men with a mean followup of 17 months (6-26) [110]. They used different materials for the sling (allograft dermis, allograft fascia lata, porcine small intestine submucosal (SIS) graft, synthetic mesh, and a composite of synthetic and dermis). Overall they reported 41% of patients dry and 35% improved (50% reduction in the number of pads). All patients in whom allograft or xenograft alone were used failed.

Additionally, patients with mild (1-2 pads) or moderate (3-5 pads) incontinence fared better than those with severe (> 5 pads) incontinence. In a followup study the same group reported on the use of the UCLA/RAND questionnaire to assess outcomes [111]. Seventy-two percent of patients stated that postoperative urinary leakage was a small to no problem: 59% were completely satisfied with the procedure while 11% were halfway satisfied.

Conclusion

In the short term, in a limited number of small series, the male sling appears to perform reasonably well. However, interpretation of results must be guarded as definitions for cure or success vary greatly. In addition most studies include patients with less than one year follow up. Selection criteria for who are the best candidates have not yet been defined, but preliminary data reported in abstract form would suggest that patients with lower and moderate grades of incontinence will fare better.

Longer followup is obviously needed before definitive recommendations can be made. Nevertheless, in countries where the cost of an artificial urinary sphincter (AUS) is a critical issue or for patients demanding a less invasive procedure or non-mechanical device, a sling procedure could be an interesting alternative to artificial sphincter for minor or mild incontinence. **(Level of evidence 3; Grade of recommendation C)**

c) Artificial urinary sphincter

The artificial urinary sphincter remains the most effective long term surgical treatment for post RP incontinence due to sphincteric insufficiency. However, due to the cost of the device, patient reluctance to have or inability to use a mechanical impant, and fear of complications, it is not ideal for all patients. In addition the development of less invasive techniques (as described above) has given patients new options for treatment. Ultimately the choice of AUS will be based upon patient dexterity, economics, degree of incontinence and patient expectations from surgery.

The AUS has the longest track record of success in the treatment of PPI. Two studies have reported that about half of the patients with severe incontinence will undergo AUS implantation [112-113]. However, these studies were conducted before male slings are bulking agents became popular. The success rates for AUS as defined by a continence status of zero to one pad per day range from 59% to 87% [114, 115], as shown in **Table 4** [114, 116-123]. The lowest rates are from patient administered questionnaire. Pad free rates range from 10-72% [117, 124-128]. Nevertheless, high satisfaction rates 87% to 90% are consistently reported, even without total continence [118, 122, 124].

One potential downside of the AUS is the need for periodic revisions in a number of patients. Revision and explantation rates due to mechanical failure, urethral atrophy, infection and erosion vary considerably among studies with respectively reports of 10.8-44.6% and 7-17% [128]. Actuarial freedom from revision at 5 years is estimated at 50% [121].

The long term efficacy of the AUS was demonstrated by Fulford et al who reported that at 10-15 year followup, [129] 75% of patients with an implanted AUS either still had or died with a functioning device. Revisions include replacement of the malfunctioning part, cuff replacement, repositioning or downsizing due to urethral atrophy, a second or tandem cuff [130, 131] or transcorporal cuff placement [132].

Transcorporal cuff placement, which involves inserting the cuff through the corporal bodies to avoid perforating the dorsal aspect of the urethra, can be particularly useful for patients with prior radiation or urethral erosion; however potency if present will be compromised. Some have advocated tandem cuffs not only as a salvage procedure, but also as a primary procedure for men with severe incontinence [133, 134]. An increased revision rate has been reported for patients who received pelvic radiation [117, 135] but was not found in a recent series [115].

The results for continence for radiated patients are variable with some studies showing lower success rates [114, 135] while others do not [127]. It has been recommended that such patients have a lower pressure reservoir and/or longer period of deactivation time [117].

CONCLUSION:

The AUS remains the gold standard for the treatment of PPI secondary to sphincteric insufficiency. Long term success rates and high patient satisfaction seem to outweigh the need for periodic revisions in some patients. Until similar experience is seen with newer, less invasive treatments, the AUS remains the reference standard to which all other treatments must be compared. **(Level of evidence 2; Grade of recommendation B)**

Table 4. Results of the artificial urinary sphincter in post-radical prostatectomy incontinence.

Author	No. pts.	Follow-up (yrs.)	0-1 pad/day
Montague [116]	66	3.2	75%
Perez and Webster [114]	49	3.7	85%
Martins and Boyd [117]	28	2	85%
Fleshner and Herschorn [118]	30	3	87%
Mottet, et al [119]	96	1	86%
Madjar, et al [120]	71	7.7	59%
Klijn, et al [121]	27	3	81%
Haab, et al [122]	36	7.2	80%
Goldwasser [123]	42	1.2	82%

5. Timing of surgical intervention

There are no clear data on timing of a surgical intervention for the treatment of PPI, either with benign or malignant disease. Therefore, at present 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. **(Level of evidence 4; Grade of recommendation C)**

IV. INCONTINENCE AFTER PROSTATECTOMY FOR BENIGN DISEASE

1. Incidence and risk factors

The incidence of urinary incontinence after prostatectomy for benign disease has been reviewed and described in the AHCPR Benign Prostatic Hyperplasia Clinical Practice Guidelines [136]. 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 and 2nd International Consultations on Incontinence [1, 137]. 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. [137]

In summary, the incidence 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%.

2. Timing of surgical intervention

There are no clear data on timing of a surgical intervention for the treatment of incontinence, as mentioned above in the section on post-radical prostatectomy. Therefore, at present 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. **(Level of evidence 4; Grade of recommendation C)**

3. Surgical treatment options

a) artificial sphincter

The literature on this subject was reviewed for the 1st and 2nd International Consultation on Incontinence [1, 137]. Candidates for treatment with the artificial urinary sphincter (AUS) are patients with incontinence due to intrinsic sphincter deficiency that have normal bladder compliance [138]. 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 and around the bladder neck [139].

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. However, most series on the AUS lump together post-prostatectomy incontinence after treatment for benign and malignant disease [137].

In summary, the AUS is a successful surgical treatment option for post-prostatectomy incontinence. It is the treatment of choice in patients with incontinence after prostatectomy for benign disease. **(Level of evidence 2; Grade of recommendation B)**

b) Injectable agents

Most series lump together post-prostatectomy incontinence after treatment for benign and malignant disease. For collagen, "success rates" for post-prostatectomy incontinence range from 36-69%, with 4-

20% of patients reporting being dry. [88-95] As mentioned above, other bulking agents such as polydimethylsiloxane PDMS (Macroplastique®) have shown some initial success, but results also deteriorate over time. Bugel and co-workers treated 15 patients. They noted rapid deterioration of on initial improvements with success rates of 40%, 71%, 33%, and 26% at 1,3,6, and 12 months respectively [97].

Bulking therapy fails in up to 75% of men. Of those who are improved only a minority actually becomes dry with short-term follow-up. Therefore, bulking is of limited value in these men. **(Level of evidence 3; Grade of recommendation C)**

c) Male sling procedures

Since Frangenheim described his first successful urethral sling suspension for post-traumatic stress urinary incontinence in 1914, various sling materials and surgical methods have been reported [140]. Rectus fascia, as described by Frangenheim, has distinct advantages over alloplastic materials with respect to erosion and infection risks. Homologous off-the-shelf-materials like lyophilized fascia lata have a higher infection risk, whereas the use of alloplastic materials like polypropylene mesh or polytetrafluoroethylene slings are associated with a higher incidence of urethral erosion [141]. According to various published techniques, the sling can be placed either underneath the bladder neck, the urethral bulb or the membraneous portion of the urethra. The principle of continence support is similar for all sling procedures and comprises passive compression of the urethra, which is dependent on the applied sling tension [142]. This mode of action favours sling procedures as a treatment option for intrinsic sphincter deficiency. However, the sling tension needed for restoration of continence cannot be standardized in any way, and therefore the success of the procedure probably depends heavily to the surgeon's experience. Overcorrection with consequent urinary retention and undercorrection with persistent recurrent incontinence are separated only by a narrow margin, which ensures continence, adequate bladder emptying, and patient satisfaction. Published success rates are shown in **Table 5 [**101, 104, 105, 109, 142-144]. A new innovation, the readjustable sling procedure (REEMEX), has recently been introduced and its durability needs to be proved. [144]

V. SURGERY FOR INCONTINENCE IN ELDERLY MEN

With an increase in the aging population and improvements in anesthesia, availability of less invasive and shorter surgical procedures, reduced blood loss and infection risk more aged patients are candidates for surgical treatment. Every surgeon should be aware of special risks in elderly patients which might require special perioperative care.

Table 5. Results of sling procedures in males with stress urinary incontinence.

Authors	No. Patients	Mean Follow-up (months)	Sling type	Cured (%)	Improved (%)	Failed(%)
Thüroff [142]	22	10.3	Fascia sling with suprapubic and perineal approaches	63.6	9	27.3
Ullrich & Comiter [109]	36	25	Perineal (Invance®)	67	25	8
John [104]	16	14	Polypropylene suspended suprapubically plus porcine skin collagen around urethra	69	6	25
Migliari et al. [105]	9	14	Polypropylene needle suspension	55.6	22.2	22.2
Cespedes & Jacoby [143]	9	13	Perineal (Invance®)	66.7	11.1	22.2
Schaeffer et al. [101]	64	18	Vascular graft bolsters with needle suspension	56	8	36
Sousa-Escandon et al. [144]	6	18	Readjustable synthetic suprapubic and perineal	83.3	16.7	-

A comprehensive literature search in geriatric urology was performed to examine age related outcome for surgical treatment of benign prostatic obstruction (BPO) and prostate cancer and surgery for incontinence including the artificial sphincter, sling procedures, injection of urethral bulking agents and intravesical botulinum toxin and resiniferatoxin. The search was conducted on the National Library of Medicine's PubMed database. The period covered was from 1985 to June 1st, 2004. Several guidelines and consensus reviews on surgical management of BPH and urinary incontinence such as a review on geriatric urology literature, published in 2003 by the American Society of Geriatrics [145] were included.

Data available are sparse, so the search did not differentiate between fit and frail elderly. Since the latter are defined as patients with continous severe impairment and/or comorbidity they are usually not candidates for surgical treatment.

Conflicting data are reported on age as an independent risk factor for incontinence after radical prostatectomy. In most reports the patient's age and preoperative urine leakage are predictive of postoperative urinary incontinence, whereas some come to the opposite conclusion. [146] Advancing age as a risk factor is supported by a number of studies. [53-58] Steiner, et al [59] found no correlation between age and continence status, but only 21 of the 593 patients were 70 years or older.

Others have found that advancing age and number of co-morbidities have a negative impact on the speed of recovery of continence during the first year post radical prostatectomy [39, 60], but the rate at one or two years does not seem to be significantly affected [42].

Two of the most frequently used options for incontinence in men after protatectomy are injection therapy with bulking agents such as collagen and the placement of an artificial urinary sphincter. Although the artificial phincter is the current 'gold standard' for the surgical treatment for incontinence after radical prostatectomy [147], one could argue that therapy with bulking agents are better suited for older patients since the procedure is less invasive. Age however should not be the main reason to choose a procedure which has been proven to be much less effective especially in patients who have moderate and severe stress incontinence after radical prostatectomy. Before implanting an artificial sphinter in a fit aged patient, mental status and dexterity have to be evaluated and discussed with the patient. No data could be found on how aging patients are able to manually operate and remember to use the artificial sphincter.

Most studies looking at these options for incontinence after treatment of localized prostate cancer did not look at age as an independent factor associated with certain complications [93, 96, 115, 148, 149]. Some investigators came to the conclusion that age does not predict treatment efficacy of bulking agents. [94, 150] **(Level of evidence 3)**

Recent series of slings with <2-year follow-up have shown satisfactory improvement rates, with results similar to those of the artifical urethral sphincter, although patient selection may be different. However, no stratification for age is available from the data.

1. Treatment of detrusor overactivity

Therapy with intravesical neuromodulatory drugs such as capsaicin and resiniferatoxin as well as injection therapy with botulinium toxin has been extended to the treatment of nonneurological overactivity of the bladder after other treatment failed. These options are discussed in the section on Refractory Overactive Bladder (see below). No data were found on how these techniques work in aging bladders. Since detrusor contractiliy decreases with age [151] the incidence of bladder emptying problems might be expected to be higher in the elderly.

2. Conclusions

Age by itself should not preclude any patients from treatment. Although bulking agents are less invasive they have not yet been shown to be very effective. If co-morbidtiy, mental status and dexterity of the patient permit an invasive approach the implantation of an artifical sphincter, or a sling, should be offered to the patient. **(Level of evidence 3; Grade of recommendation C)**

VI. INCONTINENCE AFTER EXTERNAL BEAM RADIOTHERAPY ALONE AND IN COMBINATION WITH SURGERY FOR PROSTATE CANCER

The risk of incontinence after external beam radiotherapy (EBRT) for prostate cancer is low at 0-11%. Lawton et al. [152] reported a risk of urinary complications of 7.7% in more than 100 patients, proportional to dose. Perez et al.[153] found incontinence in only 5 of 738 patients. Shipley et al. [154] reviewed more than 2500 cases with an incontinence rate of 0.5%. Similar incidences have been reported in more recent series. Madalinska et al. [44] reported an incidence of 6-7%. With three-dimensional conformal radiotherapy, Weil and colleagues [155] reported no incontinence in 168 consecutive patients and Hanlon et al.[156] , in a series of 195 men, found that post treatment urinary symptoms were no different from a control group without cancer. With conformal radiotherapy, Sandhu et al. [157] reported a 9% incidence of stress incontinence in 110 patients. In recent series the impact of EBRT followed by prostatic boost, for a total of 66-70 Gy, was evaluated. Scalliet and co-workers[158] reported urinary incontinence in 16% of 230 patients, however, Fransson and colleagues [159] reported an increase in urinary incontinence on a patient-administered symptom bother scale 3 years after treatment in 153 men compared to pretreatment status. The increase was from a mean of 0 at the start to 2 out of 10 at 3 years.

Pre-radiotherapy transurethral prostatectomy appears to be a risk factor for incontinence. Jonler et al.[160] reported an incontinence rate of 11% with pretreatment TURP. Green et al .[161] and Lee at al.[162] also reported a higher risk of incontinence with pretreatment TURP with 5.4% and 2% respectively. There are no series reported on the treatment of patients who only have incontinence after EBRT.

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. [163] reported no difference in incontinence in 2 cohorts of patients, one with and one without adjuvant radiation.

Furthermore, in a follow-up study the same group reported no late toxicity. [164] On the other hand salvage radical prostatectomy following external beam radiotherapy has been has been generally reported to have a high incidence of urinary incontinence [165, 166] possibly because of radiation induced fibrosis of the external sphincter. [166]

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 has been a higher reported revision rate for the artificial sphincter following radiotherapy (**Table 6** 114, 115, 117, 126, 135, 167, 168) compared to low risk patients, 38% versus 22%. Although a recent report disputed the higher rate [115]. However, gene-

Table 6. The artificial sphincter for incontinence after radiotherapy

Study	Number of patients	Revision rate after radiotherapy	Continence
Martins and Boyd [117]	34/81	38% for whole group	88%
Wang and Hadley [167]	16	25% (Infection and Erosion - 12.5%)	87%
Perez and Webster [114]	11/75	55%	63%
Gundian et al. [168]	15/56	22%	90%
Elliott and Barrett [126]	46/313	22%	-
Manunta et al. [135]	15/72	53% (Infection and Erosion – 20%)	73%
Gomha and Boone [115]	28/86	25% (Similar to a non- Radiated control group)	64%

rally this is due to a higher incidence of erosion and infection as well as urethral atrophy, possibly secondary to radiation induced vasculitic fibrosis of the urethra. [117] Good results are reported, however, and it is generally recommended that the cuff be inserted outside the radiated field. [169]

Collagen injection has also been reported for incontinence after radical prostatectomy and adjuvant radiation [90, 94, 170-173] or after salvage radical prostatectomy following radiotherapy [107,174] Continence results are poor compared to those without radiation. Very few patients have been reported on with the use of Macroplastique following radical prostatectomy and adjuvant radiotherapy.

The male sling has been reported in patients following adjuvant RT. In Comiter's group with the perineal compression sling 3/21 had radiation with no adverse sequelae. [107] However Schaeffer et al. reported that prior irradiation was the only identified factor that predisposed to failure. Their success rate following a single sling procedure was only 29% (2 of 7) for irradiated patients, and the corresponding rate for nonirradiated patients was 68% (39 of 57) [101] They postulated that the sling acts by compressing and elevating the urethra, thereby increasing urethral resistance to abdominal pressures. Theoretically, radiation-induced fibrosis of the urethral and periurethral tissues would make compression and elevation more difficult by reducing tissue compliance and mobility.

In summary, despite the frequently reported higher incidence of complications of the artificial sphincter in post-prostatectomy patients after adjuvant radiation, it has provided acceptable treatment benefits. Collagen injections have yielded poor results. Although the data are limited a perineal compresssion device may also be acceptable but suprapubic suspension bulbourethral slings may be less efficaceous. **(Level of evidence 3; Grade of recommendation D)**

VII. INCONTINENCE AFTER OTHER TREATMENT FOR PROSTATE CANCER

1. Brachytherapy

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 7** [175-185] and generally appears to be related to the treatment of post-brachytherapy retention. In a systematic review of brachytherapy series Crook et al. [184] 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 [181] reported on the incidence of urinary incontinence after TURP/TUIP following prostate bracytherapy for prostate cancer. Of the 10 patients who underwent the outlet relaxing procedures 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 sphincters and the radiation dose to the urethral region. Surgical therapy has included the artificial sphincter, when required. [182] High dose brachytherapy that is administered over a short period of time may have reduced toxicity. [186] Urethrorectal fistula is another complication that has been reported in 1.8% of patients in a large U.S. medicare retrospective review. [182]

2. Cryosurgical ablation of the prostate

Cryosurgical ablation of the prostate is used for clinically localized prostate cancer as primary treatment or after unsuccessful external beam radiation therapy. The frequencies of the main lower urinary tract complications are listed in **Table 8** [187-198]. The artificial sphincter has been mentioned as one of the treatments for incontinence. [198] Cryotherapy is an adverse factor for collagen injections. Urethrorectal fistulae can also occur in up to 5% of treated patients. Severe incontinence and fistulae that occasionally results may have to be treated with extirpative surgery and diversion. [199]

3. Incontinence after neobladder construction

The incidence of continence after neobladder construction following radical cystectomy for bladder cancer ranges from 85 to 100% during the day and 55 to 100% at night (**Table 9**) [200-211]. Most patients achieve daytime continence after one year and nightime continence after 2 years.

Most of the published reports do not comment on specific surgical management and imipramine is mentioned as treatment only occasionally. Martins and Boyd [117] reported on 8 patients treated with the AUS for persistent sphincter weakness incontinence. Six of these underwent revisions, 3 for infec-

Table 7. Incontinence after brachytherapy for prostate cancer

Author	% Incontinence	% Post TURP	% No TURP
Beyer et al. [175]	1	-	-
Blasko et al. [176]	6	17	0
Stock et al. [177]	0	-	-
Wallner et al. [178]	0	-	-
Kaye et al. [179]	4	11	1
Blasko et al. [180]	13	0	
Hu and Wallner [181]	6	70	-
Benoit et al. [182]	6.6	-	-
Merrick et al. [183]	0	-	-
Crook et al. [184]	5.6	13	-
Talcott et al. [185]	45	83	39

* Implant plus external beam radiation

Table 8. Lower urinary tract complications after cryosurgery for prostate cancer

Author	N	% Incontinent	%Bladder outlet obstruction
Shinohara et al. [187]	102	15	23
Bahn et al. [188]	210	3	9
Cox and Crawford [189]	63	27	29
Wieder et al. [190]	83	2.5	13
Cohen et al. [191]	239	4	2.2
Coogan and McKiel [192]	95	3.5	6
Sosa et al. [193]	1467	11	6.8
Long et al. [194]	145	83/2.0*	17.2
Pisters et al. [195]	150	60	43
Derakhshani et al. [196]	48	10.4	22.9
Long et al. [197]	975	7.5	13
De la Taille et al. [198]	43	9	4

*Previously radiated/not previously radiated

Table 9. Continence after neobladder construction for bladder cancer

Author	Number of patients	Follow-up (mo)	Continence (%)	
			Day	Night
Alcini et al. [200]	34	12	100	83
Cancrini et al. [201]	89	24	97 (22% with SUI)	83
Elmajian et al. [202]	266	24	85	85
Studer et al. [203]	100	24	92	80
Benson et al. [204]	32	25	94	74
Abol-Enein and Ghoneim [205]	60	24	90	80
Rogers and Scardino [206]	20	24	90	55
Hautmann et al. [207]	211	36	85	85
Hautmann et al. [208]	363	57	95	95
Steven and Poulsen [209]	166	32.4	100 (After 5 years)	100
Abol-Enein and Ghoneim [210]	353	38	93.3	80
Carrion et al. [211]	56 ileum 57 colon	41 41	91 86	68 68

tion 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. However, O'Connor and colleagues [212] reported a successful outcome, after AUS, with no complications in 5/5 men with incontinence after neobladder, with a mean follow-up of 22 months. Collagen has only been reported in women following neobladder construction. [213]

In summary there are not enough data upon which to recommend definitive surgical therapy, although the artificial sphincter looks promising. **(Level of evidence 3; Grade of receommendation C-D)**

VIII. TRAUMATIC INJURIES OF THE URETHRA AND PELVIC FLOOR

Incontinence following posterior urethral injuries occurs in 0-20% of patients [214, 215] 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 [114] reported on 27 patients after urethral or bladder neck strictures. The revision rate was 41% and the continence rate was 85%. In Montague's [116] 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 [117] reported on only one patient out of 81 with a traumatic urethral injury. This patient was dry and required no revisions. Venn at el. [169] reported on 2 with pelvic trauma out of a total of 70. **(Level of evidence 2; Grade of recommendation B)**

Bladder neck reconstruction by excising the scar and narrowing the calibre was reported by Iselin and Webster [216] 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. [217] **(Level of evidence 3; Grade of recommendation C)**

For patients with severe bladder neck strictures and incontinence after radical prostatectomy Meulen et al. [218] and Elliot and Boone [219] reported on the use of a Urolume stent with a bulbar artificial sphincter. **(Level of evidence 3; Grade of recommendation C)**

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

IX. CONTINUING PEDIATRIC PROBLEMS INTO ADULTHOOD: THE EXSTROPHY-EPISPADIAS COMPLEX

Achieving continence and protecting the upper urinary tract are important goals of reconstruction in patients with exstrophy-epispadias complex. However, these tasks remain a formidable challenge for pediatric urologists. Urinary incontinence [220, 221] and other voiding problems [222, 223] due to these congenital anatomical abnormalities are continuing problems into adulthood. Although quite a few publications on the exstrophy-epispadias complex have appeared in the literature over the past 3 years, the long-term follow-up data into adulthood are still lacking [220], and there have been no significant changes in the management of urinary incontinence. Besides, definition of continence differs between studies. Despite the devastating nature of this disease, there has been no study addressing quality of life issue and psychological assessment in patients with exstrophy-epispadias complex. All the published materials consist of retrospective reviews of experience at various centers. Even major institutions are struggling to gather large series of patients. **Thus, we are still left with mostly level 4 and at most level 3 evidence.**

The management of the exstrophy-epispadias complex includes 2 principal aspects; initial management (primary treatment) and subsequent management of persisting incontinence. These 2 aspects are discussed separately. Based on the evaluation of the literature, recommendations are made at the last part.

1. Initial management of the exstrophy-epispadias complex

a) Staged repair versus one-stage primary repair

Staged surgical management of the exstrophy-epispadias complex (early closure with or without pelvic osteotomy, repair of epispadias and bladder neck reconstruction) has been the standard approach [221, 224-228] although the staged approach has undergone significant changes since first advocated by Jeffs et al. [224] Success rates for staged functional closure are high with continence rates reaching 75% to 90% [224-226]. However, these results were based on highly select groups of patients and others failed to achieve such results. Continence rates of only 10% to 30% were reported with the staged approach [229, 230]. Complete primary repair described by Grady and Mitchell combined primary bladder closure with epispadias repair in one stage in neonates [231]. The idea was to optimize the chance for early bladder cycling and potentiate bladder development. It may also obviate the need for multistage repair of bladder exstrophy including bladder neck reconstruction. Although acceptable short-term results were achieved, the procedure has been criticized in view of 50% incidence of antireflux surgery needed for breakthrough urinary tract infections. A recent report from another institute has also shown that complete repair of exstrophy is feasible in neonates and older children after failed initial closure with acceptable morbidity [232]. Ureteral reflux was noted in 63% of renal units but did not require surgery in this series. There is short-term evidence of favorable outcome in newborns compared with older children [232]. However, we have to wait for long-term results from medical centers using this one-stage technique to know whether it is consistent in producing urinary continence and satisfactory sexual function.

The Mainz group has recommended primary urinary diversion (ureterosigmoidostomy, sigmoid rectal pouch, ileocecal pouch) with closure of the abdominal wall [233, 234]. The posterior urethra is closed as a seminal receptacle. While this approach is hardly used in North America, long-term reports have demonstrated excellent continence and upper tract preservation [233, 234]. Low pressure rectal reservoirs in children with bladder exstrophy have also provided excellent long-term outcome in continence (100%) and upper tract (97%) [235]. However, prophylactic alkalization does not prevent the long-term metabolic consequences. Subclinical metabolic acidosis and decreased linear growth are to be anticipated in more than 50% of patients, and moreover, significant bone demineralization is to be expected in all of these patients [235]. Thus, it is concluded that low pressure rectal reservoirs should be reserved for failed surgical reconstruction or patients presenting beyond the age suitable for reconstruction [235].

b) Bladder neck reconstruction

In a staged repair, bladder neck reconstruction is usually performed at age 4 to 5 years when the bladder gains enough capacity to provide for safe filling with good compliance and the child is ready to be dry and participate in a postoperative voiding program [224, 225]. The classic Young-Dees-Leadbetter technique has been modified in several ways [225, 228, 236]. The success of bladder neck reconstruction in both continence and emptying is highly dependent on the delicate balance between the bladder and outlet. Bladder capacity, contractility and outlet resistance are determinants of continence after bladder neck reconstruction [223]. A report from the Johns Hopkins group [225] describes that 77% of patients are completely dry day and night and voiding through the urethra without need for bladder augmentation or clean intermittent catheterization, and that another 14% have social continence (dry more than 3 hours during the day but still wet at night). Analysis of bladder capacity measurements under anesthesia prior to bladder neck reconstruction revealed that patients with a bladder capacity greater than 85 cc had a better outcome [225]. However, subjective success with continence and emptying does not necessarily correlate with objective findings [223]. Despite near or total subjective continence (dry intervals of at least 2 to 3 hours) and "good voiding" in 18 patients, there were clinical (recurrent urinary tract infections, epididymitis and bladder stone) and urodynamic voiding problems in 72%, including flow rate less than 10 ml/sec in 70%, postvoid residual more than 33% of capacity in 50% and acute urinary retention in 17% [223]. Another report from the Toronto group also highlights the extreme difficulty in achieving volitional voiding in an unselected exstrophy population. Of 43 patients only 3 (7%) were voiding spontaneously through the native reconstructed urethra [237]. Thus, perseverance in the pursuit of volitional voiding is more likely to result in repeatedly failed bladder neck reconstruction and delay in the age at which continence is finally attained. Earlier recognition of the need for other storage procedures such as bladder augmentation and/or appendicovesicostomy and bladder neck closure may facilitate the timing of achieving continence and self-esteem, and achieve a satisfactory result with fewer operative procedures [237].

c) Urodynamic evaluation

There are several reports on urodynamic evaluation in patients who underwent bladder neck reconstruction [238-240]. The majority of closed exstrophy bladders have normal filling dynamics before bladder neck reconstruction [239]. However, bladder abnormalities are very common after bladder neck reconstruction, with about 50% incidence of poor compliance and detrusor overactivity [238-240]. Detailed urodynamic investigation in patients with bladder exstrophy, after the first operation to create a functional bladder, is vital to guide the next step of management and to compare objectively the surgical outcome of reconstruction using different approaches.

d) The fate of the upper urinary tract

Preservation of the upper urinary tract is the most important goal in any form of lower urinary tract reconstruction. In several series of exstrophy patients, significant upper tract deterioration was noted in 22% to 26% of patients [221, 241, 242]. Because any type of outlet procedure that elevates the outlet resistance can be a potential cause of upper tract deterioration, upper and lower tracts should be monitored by ultrasound to measure the efficacy of bladder emptying and to look for subtle upper tract changes even in patients with a good bladder storage function who are undergoing any kind of outlet procedure.

2. Management of persisting incontinence

Regarding the management of persisting incontinence, there still remain considerable differences of opinion [233-235, 237, 242-247]. Various options are shown in **Table 10**. When planning the management of persisting incontinence, possible causes of incontinence should be thoroughly evaluated. Bladder and outlet storage function should be examined by detailed urodynamic investigation that allows individualization of treatment to optimize the chance of a successful outcome [240].

a) Augmentation cystoplasty

The late 1980s and early 1990s witnessed the more liberal use of bladder augmentation coupled with the option of catheterizable appendicovesicostomy (Mitrofanoff procedure). Overall rate of bladder augmentation in patients with exstrophy-epispadias complex has been 22% to 40% [221, 223]. Preservation of the native bladder template has been emphasized by The Johns Hopkins group and others [226, 248]. This has two advantages whether in the younger or older patients. First, using the template may decrease the amount of bowel needed for reconstruction. Second, if ureteral reimplantation is required, the bladder template is a better substrate for reimplantation than a subtaenial tunnel of the bowel [226].

Table 10. Options for management of persisting incontinence after failed exstrophy-epispadias surgery

Revision of bladder neck reconstruction
Augmentation cystoplasty
- Stomach
- Ileum
- Colon
Continent stoma (appendicovesicostomy)
- with augmentation
- with bladder neck closure
Urinary diversion
- continent reservoir
colonic reservoir
ileocecal reservoir
rectal reservoir
gastrointestinal composite reservoir
- conduit
Other outlet procedures
- Kropp, Pippi Salle
- Artificial urinary sphincter
- Transurethral injections

Stomach, ileum or colon can be used for bladder augmentation. Each type of augmentation has disadvantages that are inherent to the use of gastrointestinal segments, including metabolic derangement, urolithiasis [249], decreased linear growth [250], and hematuria-dysuria syndrome (in the case of stomach) [251]. A recent paper concludes that ileocystoplasty is safe and does not impact negatively on the linear growth or bone densities of patients with bladder exstrophy [252]. Gastrointestinal composite reservoir may be considered to offset the limitations of gastric and intestinal segments [243].

b) Continent stoma

There are many surgical procedures other than bladder neck reconstruction to increase bladder outlet resistance, including injection of bulking agents and placement of bladder neck slings and artificial urinary sphincter [247]. Unfortunately, these outlet procedures have variable degrees of success with none being successful in all patients. It is not uncommon for some patients to undergo multiple procedures in an attempt to achieve continence. When these attempts fail, the creation of a catheterizable continent stoma with or without bladder neck closure is the preferred procedure to achieve continence [253]. Continence rate of 100% was achieved by bladder neck closure compared with continence rates of 56% by bladder neck reconstruction only and 67% by bladder neck reconstruction with augmentation and/or appendicovesicostomy [237]. However, success of bladder neck closure is dependent in part upon patients' compliance with intermittent catheterization [247]. In addition, those who have undergone bladder neck closure are at an increased risk for bladder stones [247].

c) Urinary diversion

Regardless of the type of continent urinary diversion used, most series demonstrate excellent success rates around 95% [253]. Based on the excellent continence rates achieved by urinary diversion compared with those by staged or one-stage primary repair, the Mainz group has recommended that all, but especially those who have failed previous treatment, are best served by conversion to a rectal reservoir or ileocecal pouch with catheterizable stoma [233, 234]. However, taking into account the long-term negative impact of rectal reservoir on metabolic milieu and bone density [235] and a high risk of neoplasia in those who have been exposed to mixing of urine and faeces in a colorectal reservoir [254], urinary diversion should be reserved as a last resort after failed surgical reconstruction.

d) Outlet procedures

If the initial bladder neck reconstruction (original or modified Young-Dees-Leadbetter in many cases) fails and a low outlet resistance is the only cause of persisting incontinence, another outlet procedure is worth attempting. Option includes Kropp or Pippi Salle bladder neck reconstruction, injection of bulking agents, placement of bladder neck slings and artificial urinary sphincter [247]. The presence of scarred tissue due to a previous surgery at the bladder neck may compromise the outcome. The value of the artificial urinary sphincter in dynamic control of outlet resistance in exstrophy patients is also questioned [221]. Vascularized gracilis muscle sling to wrap around the compromised bladder neck of incontinent patients has been reported as salvage surgery [245].

RECOMMENDATION

The published studies to date are retrospective case series with levels of evidence at best 3 with a grade of recommendation of C. The Committee has the following receommendations regarding the evaluation and treatment of persistin incontinence in adulthood.

- Patients with exstrophy-epispadias complex should be evaluated and managed in specialized centers
- A universal definition of continence should be established
- Persisting incontinence should be evaluated with urodynamics and its treatment should be individualized based on urodynamic findings
- Life-long follow-up is mandatory in terms of continence, voiding efficiency, upper tract status and other urological complications
- Comparative studies, including quality of life and psychological assessment, should be undertaken if possible.

X. DETRUSOR OVERACTIVITY AND REDUCED BLADDER CAPACITY

1. Refractory urgency incontinence and idiopathic detrusor overactivity

According to the recent **Terminology 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 [255]. *Detrusor overactivity* has also been redefined to indicate the 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 and replaces the term "detrusor hyperreflexia". Although the old terms will be eventually be replaced they are still in common usage. The criterion for considering detrusor overactivity as idiopathic is questioned, as recently Ahlberg et al found that 82% of patients initially considered idiopathic on careful searching actually had pathology potentially leading to the problem [256].

Idiopathic detrusor overactivity is a normal situation early in life. Children have urgency incontinence as a stage in acquiring bladder control. The incidence of detrusor overactivity during mid-life years (20 to 60) has been estimated as 10% [257]. In the asymptomatic elderly, detrusor overactivity once again becomes common, occurring in 50% of men over 70 [258]. In the symptomatic elderly, over 75 years old, it can reach 90% in men [259]. Detrusor overactivity may be a cause of severe storage symptoms such as frequency, nocturia, urgency and urgency incontinence. Conservative treatment of these symptoms such as bladder training and pharmacotherapy is discussed in other sections.

The use of intravesical neuromodulatory drugs such as capsaicin and resiniferatoxin was extended to detrusor overactivity of nonneurologic origin after the suggestion that its etiology involved the enhancement of the C fiber mediated spinal micturition reflex [260] and emerged as a minimally invasive procedure, with preliminary results shown in **Table 11** [261-265]. **(Level of evidence 3 – 4; Grade of recommendation C)**

For symptoms that are refractory, three interventional treatments have been reported: botulinun-A toxin detrusor injections, neuromodulation, and bladder augmentation.

a) Botulinum-A toxin injection in bladder

The minimal invasiveness makes this method very attractive but long term results in idiopathic detrusor overactivity are lacking (**Table 12)** [266-271]. The effects of its use are still not fully recognized, with possible systemic consequences [272] – generalized muscle weakness in two patients treated for neurogenic bladder overactivity and development of resistance to the drug [273, 274]. Most of the initial results come from its use in neurogenic bladders [275-278], with favorable results.

Data are lacking on dose, concentration, site(s), numbers of injections and long-term efficacy and side effects.. The studies with botulinum toxin detrusor injection are unclear about results and contradictory on the presence of residual urine and the need for intermittent catheterization. The reports do not discriminate gender precisely and two out of three mix neurogenic with idiopathic etiologies. **(Level of evidence 3; Grade of recommendation D)**

b) Electrical stimulation and neuromodulation

Electrical stimulation of the genital area was first used to control incontinence due to detrusor overactivity on an empirical basis [279], 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 [280]. Many studies on external electrical stimulation for bladder

Table 11. Intravesical capsaicin and resiniferatoxin for detrusor overactivity (males and females)

Author	No.	Improvement	Duration of effect	Drug and dose	Side effects
Cruz et al. 1997 [261]	3 idiopathic (total of 16, including 3 males)	71% continence (overall total of 14) and 21% improvement	Up to 18 months	**Capsaicin** 125 ml of 30% alcohol in saline containing 1mM	Intense burning sensation
Kuo, 2003 [262]	13 idiopathic detrusor overact (41 total)	5 (38,5%)	2 to 9 months	**RTX** 10 ml of 100 nM RTX in 10% ethanol for 40 min	
	18 previous TURP	11 (61,1%)	Average 5 months		
Palma et al, 2004 [263]	25 females with idiopathic urge-incontinence	10 (40%) disapearance of urge-incontinence	1 month evalluation only	50 nM **RTX**	No mention of retention
Rios et al, 2004 [264]	60 females	Improvement equal to Ethanol 10% saline solution	1 month first evaluation	50nM **RTX** or 10% ethanol saline	solution Randomized double-blind placebo controlled
Silva et al, 2002 [265]	13 idiopathic (2 men 11 women) (12 incont)	11 improved (91%) in incontinence 3 (25%) dry	3 months follow up	100 ml 50nM **RTX** solution 10% ethanol in saline for 30 min	No retention or other problems

Table 12. Botulinum-A Toxin detrusor injection

Author	No.	Type of patients	Dose	No. punctures	Results	Comments
Harper et al, 2003 [266]	39 (13 men and 26 women)	Neurogenic and idiopathic origin (not described separately)	200 idiopath 300 neurog	20 to 30 sparing the trigone Flex. cysto.	Increase max bladder volume 174 to 589 ml	
Loch et al, 2003 [267]	30	Neurogenic and idiopathic	200 U	20 injections sparing the trigone	Significant improvement in 67% of the patients - > residual urge	No description of gender or whether neurogenic
Radziszewski et al, 2002 [268]	12 (6 female and 6 male)	Only idiopathic	Up to 300 U	10-15 injections sparing the trigone	1 months follow up 100% success no residual	Short follow up Inexact criterion of success
Rapp et al, 2004 [269]	35 (29 females and 6 males)	6 neurogenic	300 U	30 injections including trigone	34% resolution 26% improvement	40% failure
Kuo, 2004 [270]	30 (12 females and 18 males)	12 neurogenic	200 U	40 injections sparing the trigone	26% resolution 46% improvement	26%failure
Chancellor et al, 2003 [271]	10 (2 males and 8 females)	Only idiopathic	100-300 U	20-30 injections only in bladder base and trigone	80% improvement	Control group - 11 neurogenic with 73% improvement

inhibition on idiopathic urgency incontinence have been published, mainly in female patients [281-288]. The results vary from 45 % to 85 % success, with a mean of 38 %, and 26% improved. Electrodes implanted in the pelvic floor, did not yield good results [286].

Neuromodulation of sacral nerves has been reported as alternative therapy for incontinence, urinary retention and chronic pelvic pain. Good results have been published in treating neurogenic bladder dysfunction [289, 290]. Its use in refractory idiopathic urgency incontinence has been limited to few patients, mostly women. Bosch and Groen [291] 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 and the rest ultimately failed [292].

Shaker and Hassouna [293] implanted 18 patients with refractory urinary urgency incontinence, but only 2 were in men. Other studies are not clear about the etiology of the detrusor overactivity as neurogenic and non neurogenic causes are grouped together [293]. Yet, some reports focused on technical or specific aspects of the procedure and the same patients may be included in different publications [294, 295]. **Table 13** [296-303] shows some recent studies.

Some reports are literature reviews [304] or technical modifications [305]. There are some articles with level or evidence 1 [296, 297] and 2 [292, 299], [300], with a grade of recommendation of B. However, due primarily to the cost of the device, relatively few men in the clinical trials, and poor results in one of the prospective trials, its general applicability to men with urgency incontinence is probably limited.

c) Surgical treatment by bladder myectomy and augmentation

Previously used treatments 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 14** [306, 307] shows 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 15** [307-313], which includes male and female patients. Good results vary from 58% to 88%, with and average of 77%. A minimun of 10% of patients require intermittent catheterization for bladder emptying.

Ileum was the most frequently used bowel segment followed by sigmoid colon, 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 considered carefully when applying it to these patients.

2. Reduced bladder capacity

Fibrosis of the wall produces a low-volume low-compliant bladder, leading to diminished functional capacity. Symptoms of frequency and nocturia occur with progressive decrease in volume, but urinary incontinence may also be the 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, inflamatory 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 a 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 [314]. Bladder augmentation seems to offer reasonable results 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 16** [315-338].

These results are similar in all etiologies except for radiation. The poorer results after radiation may be

Table 13. Neuromodulation for treatment of refractory urge incontinence due to detrusor overactivity (males and females)

Authors	N	Success (dry)	Improved	Control group	Study and comments
Schmidt et al. [296]	34	47%	29%	42	prospective randomized
Weil et al. [297]	21	56%	19%	23	prospective randomized
Bosch et al. [298]	34 (females) 6 (males)	38% 16%	21%16%		prospective longitudinal
Siegel et al [299]	41	46%	19%		prospective cohort
Grunewald et al [300]	18	39%	33%		prospective
Aboseif et al [301]	43 (5 males)	77%			not clear about etiology
Hedlund et al [302]	13	61,5%			2 men included, both dry
Roupret et al [303]	6 (all female)	17%	67%		

Table 14. Detrusor myectomy for treatment of refractory urge incontinence due to detrusor overactivity (both sexes)

Author	Idiopathic overactivity	Good results
Swami et al [306]	17	12
Leng et al. [307]	8	7
TOTAL	**25**	**19 (76%)**

Table 15. 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., 1995 [308]	33	19	46 ileum 2 colon
McInerney et al., 1995 [309]	50	44	
Bramble, 1982 [310]	15	13	13 colon 2 ileum
Sethia et al. 1991 [311]	11	9	ileum
Mundy and Sthephenson 1985 [312]	40	30	ileum
Leng et al, [307]	2	2	
Edlund et al [313]	25	19	
Total	**176**	**136 (77 %)**	

Table 16. 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. [315]	-	-	7	4	9	3	12	7
Kerr et al. [316]	-	-	12	12	-	-	-	-
Zinman and Libertino [317]	-	-	2	2	1	?	1	1
Dounis et al. [318]	-	-	31	27	-	-	1	1
Lunghi et al. [319]	-	-	15	15	4	4	3	3
Shawket and Muhsen [320]	8	8	-	-	-	-	-	-
Whitmore and Gittes [321]	-	-	7	7	-	-	2	1
Chan et al. [322]	-	-	-	-	-	-	10	9
Shirley et al[323]	-	-	10	10	4	2	-	-
Goodwin et al. [324]	-	-	3	2	-	-	3	3
Winter and Goodwin [325]	-	-	1	1	3	1	-	-
Fall and Nilsson [326]	-	-	1	1	-	-	1	1
Goldwasser and Webster [327]	-	-	-	-	-	-	7	7
Weinberg et al. [328]	-	-	2	2	1	1	1	1
Novak [329]	-	-	11	11	-	-	-	-
Sayegh and Dimmette [330]	2	0	-	-	-	-	-	-
Beduk et al. [331]	-	-	-	-	-	-	1	1
Kuo [332]	-	-	-	-	1	1	-	-
Kawamura et al. [333]	-	-	-	-	-	-	1	1
Hradec [334]	-	-	-	-	27	23	-	-
Lima et al. [335]	-	-	1	1	-	-	-	-
El Otmany et al. [336]	-	-	1	1	-	-	-	-
Yamada et al. [337]	-	-	1	1	-	-	-	-
Miyano et al. [338]	-	-	-	-	-	-	1	1
TOTAL	**10**	**8 (80%)**	**105**	**97 (92%)**	**50**	**35 (70%)**	**44**	**37 (84%)**

due to other tissue damage in the surgical area. New conformal techniques for radiotherapy may improve results in the future, so that the need for augmentation decreases.

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 reasonably good with the exception of radiation. **(Level of evidence 3; Grade of recommendation C)**

XI. URETHROCUTANEOUS AND RECTOURETHRAL FISTULAE

Urethrocutaneous or rectourethral fistula may have congenital, inflammatory, neoplastic or traumatic origin. It is important to recognize the varying etiology because each type may require different surgical strategy. All reports are still only retrospective case series **(Level of evidence 3; grade of recommendation C).**

1. URETHROCUTANEOUS FISTULA (UCF)

a) 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 [339] 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% [340]. Thomas et al. retrospectively evaluated 250 patients after radical perineal prostatectomy and revealed only 1 (0.4%) urethroperineal fistula [341].

Fahal et al. [342] 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.

b) 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 [343].

Treatment of UCF usually requires urethroplasty techniques with modifications involving fistula excision and multiple layer closure [344] **(Level of evidence 3; Grade of recommendation C)**

2. RECTOURETHRAL FISTULAS (RUF)

Culp and Calhoon described five basic groups of RUF according to the etiology [345]: congenital, iatrogenic, traumatic, neoplastic, and inflammatory.

a) Congenital RUF

Endo et al. [346] 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 pullthrough in terms of long-term bowel function and faecal continence [347].

b) Acquired RUF

Badalament et al. [348] managed one patient (0.4%) with a urethrorectal fistula after cryoablation therapy for prostate cancer.

Benchekroun and co-workers [349] report a series of 11 urethrorectal fistulas observed over a 25-year per-

iod. The aetiologies were surgical trauma (5 cases), fracture of the pelvis (2 cases), inflammatory lesions (3 cases), and one fistula was congenital. Colostomy was performed in 2 patients, surgical closure of the fistula was performed in 7 patients, via an abdominoperineal (3 cases), perineal (2 cases), transperitoneal (1 case) or transanosphincteric incision (1 case).

In 1972 Smith and Veenema [350] 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. [351] 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 (**Table 17**). Noldus et al. [352] reported 23 (3.9%) rectal injuries during 589 RRP and cystoprostatectomy. Eastham and Scardino [353] 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. [354] reviewed records of all patients who were diagnosed with rectourethral fistulae between January 1981 and December 1995 and 16 males were identified. All patients were interviewed by telephone for 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.

Table 17. Causes of Rectourethral fistulae in 23 patients (Tiptaft [351])

Fractured pelvis with ruptured urethra	11
Direct trauma	2
Secondary to urethral stricture and sepsis	3
Tuberculosis	1
Iatrogenic	12
Iatrogenic causes Urethral instrumentation	3
Transurethral prostatic surgery	2
Open prostatectomy	2
Flap urethroplasty	1
Colo-anal anastomosis	1
Abdominoperineal resection of rectum	1
Radiation therapy	2

Zippe [355] reviewed preliminary results of prostate cryosurgery and reported a 2 to 5% incidence of RUF. Porter [340] found a 2.5% rate of RUF in 210 patients after TRUS-guided prostate cryosurgery and no urethroperineal fistulae.

Montorsi et al. [356] reported a 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. [357] 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 that was managed with an ileal conduit.

Fengler and Abcarian [358] 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. [359] 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. [360] described a prostatocutaneous 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 pla-

ced into the bladder and then voided usually appears in the rectum on X-ray, are the most important diagnostic steps [343, 361].

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 362 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 [363], gracilis muscle [363], or scrotal flap [365]) has been described. Surgical approaches include transabdominal, transvesical, or direct exposure of the RUF.

e) Surgical Approaches

Stephenson and Middleton [366],modified the York-Mason repair and reported their experience with posterior sagittal, transanal, transrectal repair of RUF in 15 patients. The transsphincteric, transanal surgical approach provides many advantages, including easy access and identification of the fistula tract, good surgical exposure, adequate resection to well vascularized tissue, and access to several vascularized flaps for interposition between the repaired urinary and gastrointestinal tracts.

Culkin [367] reported preliminary experience with the transsphincteric, transanal surgical approach to correct acquired urethrorectal fistula in five men. Mean patient age was 56.6 years (range 37 to 72). The etiology was surgical (radical prostatectomy) in 3 cases, traumatic in 1 and idiopathic in 1.The time from the diagnosis of urethrorectal fistula to surgery was 4 weeks to 4 years. Five men underwent excision and closure of a urethrorectal fistula with diverting colostomy. In 4 men (80%) urinary continence subsequently returned with adequate sphincter tone, while in 1 (20%) with perineal trauma and active proctitis the fistula recurred 6 weeks after surgery.

The surgical approaches including the numbers of reported patients are listed in **Table 18** [345, 349-352, 358, 361, 365-382].

1. Perineal

In 1926, Young [368] 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 [369], described suturing the levator muscle fibers together in the anterior midline when possible.

Goodwin et al. [370] 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 [383] 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 [373] 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 part of the fistula was excised and closed in two layers, and the urethra was repaired and stented with a catheter.

Table 18. Surgical approaches to rectourethral fistulas

APPROACH	AUTHOR, YEAR	No. PTS
PERINEAL	Young, 1926 [368]	11
	Lewis, 1947 [369]	13
	Goodwin, 1958 [370]	22
	Culp and Calhoon, 1964 [345]	20
	Smith and Veenema,1972 [350]	4
	Youssef,1999 [371] *(perineal dartos flap)*	12
	Benchekroun, 1999 [349]	11
	Ng, 2004 [372]*(buccal graft)*	27
POSTERIOR - SAGITTAL	Kilpatrick and Thompson, 1962 [373]	6
	Stephenson,1999 [366]	15
POSTERIOR – TRANSSPHINCTERIC	Kilpatrick and Mason, 1969 [374]	7
	Culp, 1964 [345]	20
	Fengler,1997 [358]	8
	Fournier, 1996 [375]	1
	Bukowski,1995 [376]	7
TRANSANAL	Vose,1949 [377]	4
	Parks and Motson, 1983 [378]	1
	Tiptaft,1983 [351]	3
	Noldus,1997 [352]	5
	Culkin, 2003 [367]	5
COMBINED*(posterior transsphincteric anterior rectal wall advancement*)	Al-Ali,1997 [361]	16
ANTERIOR TRANSANORECTAL	Geceleter,1973 [379]	19
	Venable,1989 [365]	1
	Zinman, 2003 [380]	22
ENDOSCOPIC	Wilbert, 1996 [381]	2
	Bardari, 2001 [382]	1

3. Posterior (parasacrococcygeal) transsphincteric

In 1969 Kilpatrick and Mason [374] 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 [358]. After the skin incision the mucocutaneous junction is marked with sutures and the 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 (**Figure 3**). 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 4**). Fengler and Abcarian [358] reported healing of RUF in all of 8 patients with the York-Mason approach. Bukowski et al. [376] 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. [375] in the management of a case of the urethro-prostato-rectal fistula after a gunshot wound.

4. Transanal

Parks and Motson [378] popularized the addition of a full thickness local flap of anterior rectal wall as an adjunct to fistula repair through the intact anal canal (**Figures 5** [384] **and 6**). They modified the transanal technique by 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. [351] 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. [352] 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. [361] 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 [379] 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. [381] 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. [382] used cyanoacrilic biological glue 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. [371] successfully treated 12 male patients who presented with RUF from 1990 to 1997 using the perineal subcutaneous dartos flap procedure. The RUF resulted from crush pelvic injury in 6 cases, gunshot wounds in 2, and post prostatectomy

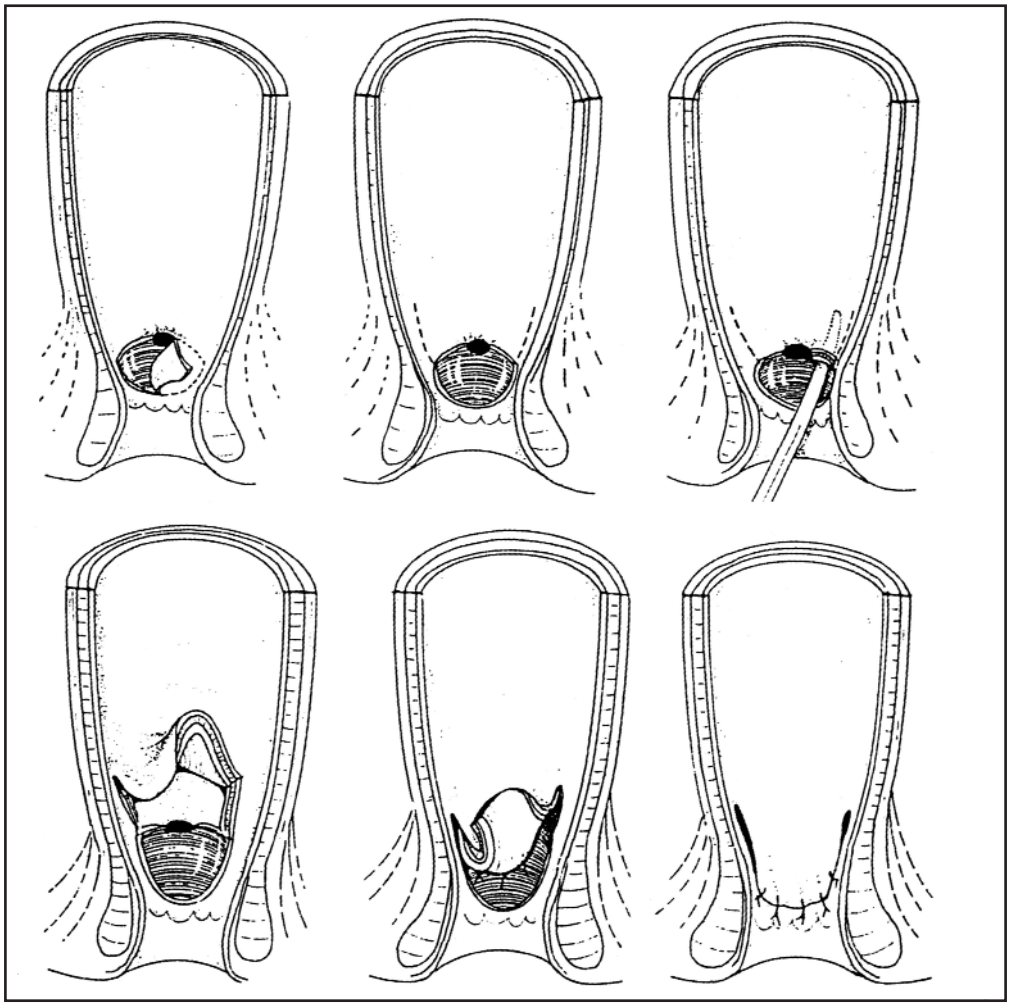

Figure 3. Rectourethral fistula repair. Full thickness rectal wall is mobilized to close in a "vest over pants" technique to close the fistula.

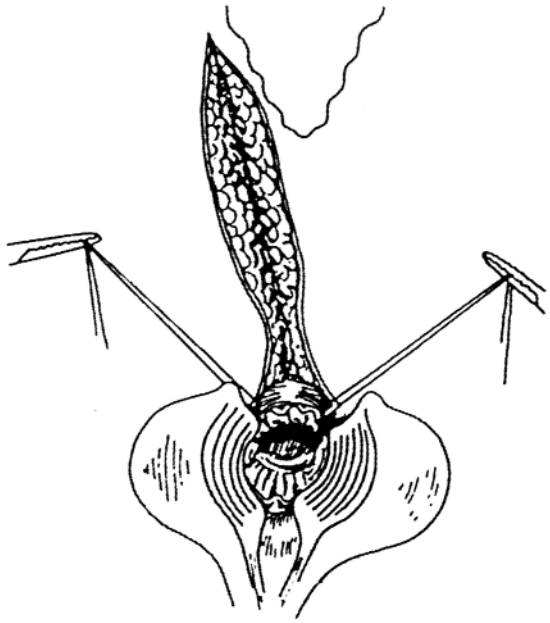

Figure 4. York-Mason approach to a rectourethral fistula via a parasacrococcygeal (transsphincteric) incision. Sutures are used to mark the sphincters. The speculum has been placed at the bottom of the incision and the anterior rectal wall is visible.

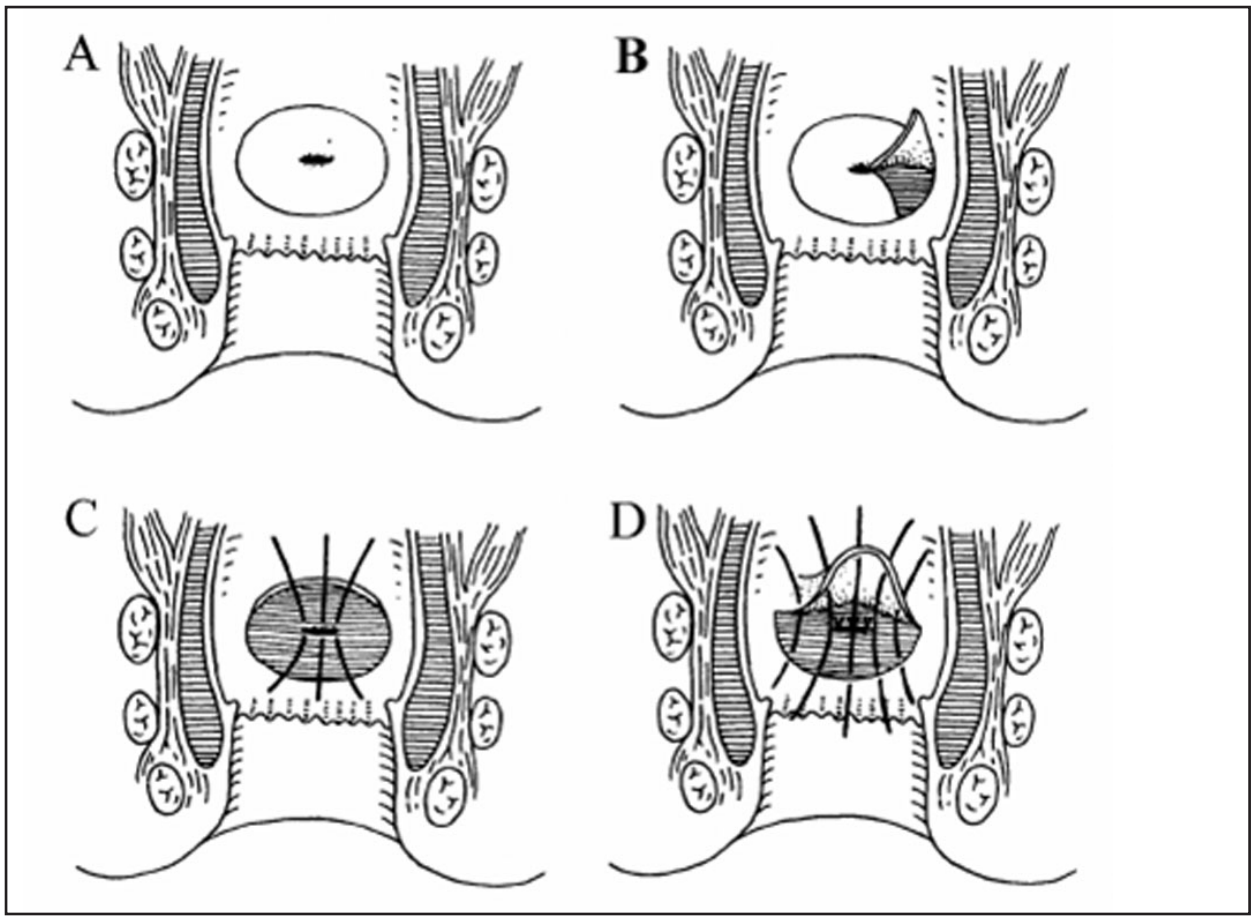

Figure 5. Transanal repair of rectourethral fistula [384]. A. Elliptical incision of the rectal mucosa around the fistula. B. Denudation of the rectal mucosa. C. Fistula closed with absorbable suture. D. Rectal mucosal flap sutured with absorbable suture.

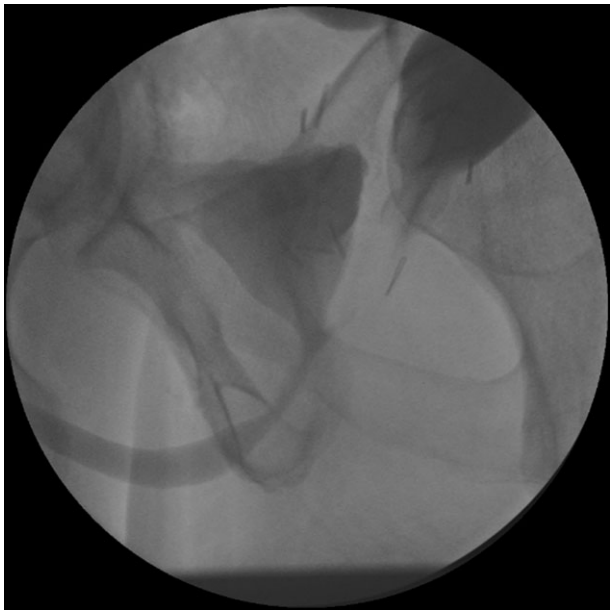

Figure 6. A. Retrograde urethrogram of a 55 year-old man who underwent a radical prostatectomy. He complained of fecaluria and urine per rectum. This shows urethral contrast in the rectum through a rectourethral fistula.

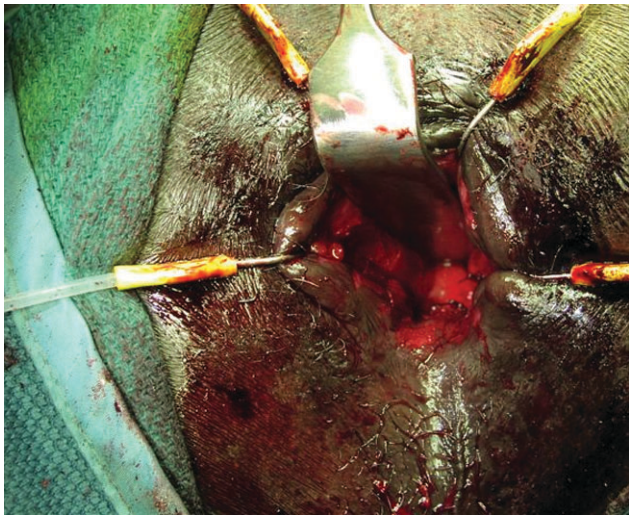

Figure 6. B. Intraoperative photograph of transanal rectourethral fistula repair. The anus is held open by the ring retractor to permit direct access to the fistula.

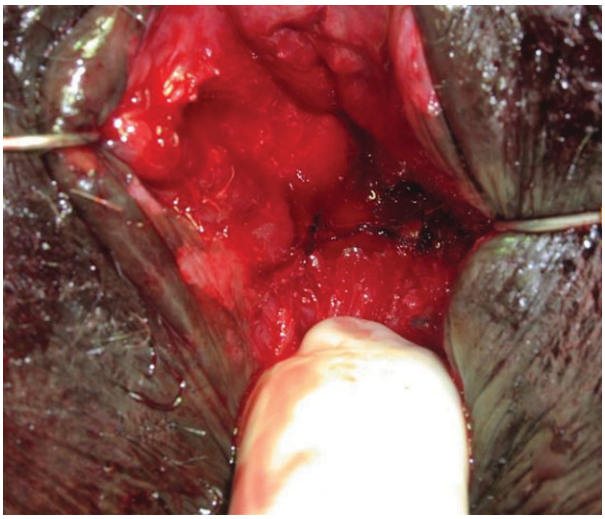

Figure 6. C. Intraoperative view of the rectal mucosal sutures in the rectourethral fistula repair.

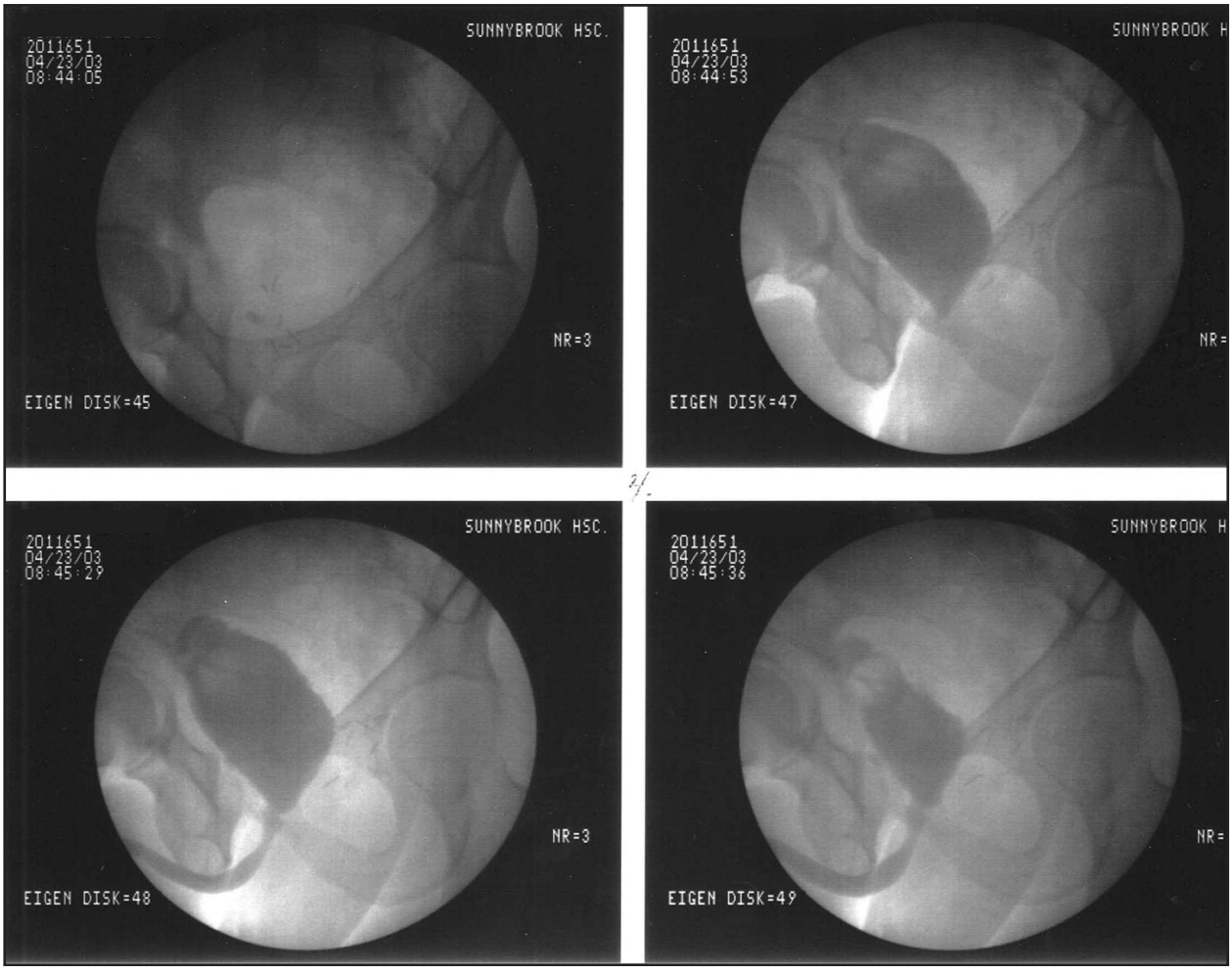

Figure 6. D. Retrograde urethrogram 3 months after transanal rectourethral fistula repair. There is no contrast entering the rectum from the urethra. The patient's suprapubic tube was removed and his colostomy was reversed.

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 RUF.

Felipetto et al. [360] closed a prostato-cutaneous fistula (as a complication of pseudomonas prostatitis) with human fibrin sealant (Tissucol). Venkatesh and Ramanujam[385] 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, and 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. **(Level of evidence 3; grade of recommendation C)**

XII. THE ARTIFICIAL URINARY SPHINCTER (AUS)

Different devices designed to control urinary incontinence in the male go back to the middle of the 18th century [386]. Since then research eventually produced external and implantable devices. The gold standard today is considered to be the artificial urinary sphincter (AUS) designed by F.B. Scott, W.E. Bradley, and G.W. Timm in 1973 [387]. The original model underwent a number of modifications, but the basic principle remained the same. It consists of a fluid filled hydraulic system with a cuff around the urethra, a pressure regulating balloon and an activating device, the pump, placed in the scrotum.

1. AVAILABILITY AND COST

We recently conducted an e-mail survey among urologists and gynecologists, members of the International Continence Society asking them if the AUS was available in their country; and if so, what was the price of the device (in US dollars). About 10% of the members responded by email from 31 countries. According to the responders, in at least 4 countries (Georgia, Hong-Kong, Romania and Saudi Arabia) the device was not available. Furthermore, in some countries, even if the device is marketed, its high price precludes its use, as in the Czech Republic and Hungary. The price varies even within the same country (**Table 19**). The cost variability among countries is shown in **Figure 7**. Very few gynecologists implant the sphincter, probably because the majority of patients receiving the device are male. Although the response to the survey was low and the results may not be scientifically valid they do show substantial variability and give an idea of the current international situation.

2. INDICATIONS

The indication for implantation of an AUS in the male – as in the female – is urinary incontinence to a degree that affects the patient's quality of life. In the vast majority of male patients incontinence is secondary to a prostatectomy; neurogenic bladder dysfunction is the second most frequent etiology. Previous radiotherapy to the pelvic is not a contraindication [388]. The ultimate outcome seems to be similar in patients whether or not they have received radiation therapy [148], although a higher incidence of urethral atrophy, erosion and infection requiring surgical revision has been reported in irradiated patients compared to those not irradiated (41% vs 11%). Despite this observation, long term continence and patient satisfaction appear not to be adversely affected in the irradiated patient 148]. Patients voiding with Valsalva maneuvers because of an idiopathic underactive or neurologically acontractile bladder, do not seem to be at an increased risk of complications [389]. It should also be noted that patients with previous anti-incontinence procedures show a significantly higher explantation rate [390]. Clinical

Table 19. Cost of the AMS 800 artificial urinary sphincter in 29 different countries, data from a survey among urologists and gynecologists, members of the International Continence Society. (Prices in US dollars)

COUNTRY	PRICE	COUNTRY	PRICE
Austria	5,300 – 7,000	Japan	5,400 – 10,000
Australia	7,000 – 8,000	New Zeland	5,000
Belgium	5,000	Norway	7,000 – 10,000
Brazil	3,000 – 12,000	Russia	4,500
Canada	3175 – 4555	Singapore	4,500
Colombia	6,000	South Korea	4,000
Czech Republic	8,600	Sweden	6,000 – 8,500
Denmark	10,000	Switzerland	8,000
Finland	6,000	Taiwan	4,500
Germany	5,000 – 9831	The Netherlands	2,500 – 9,000
Hungary	5,000	Turkey	4,000
India	3,900	United Kingdom	5,000 – 8,000
Israel	4,000	United States	4,000 – 9,000
Italy	7,000 – 11,000		

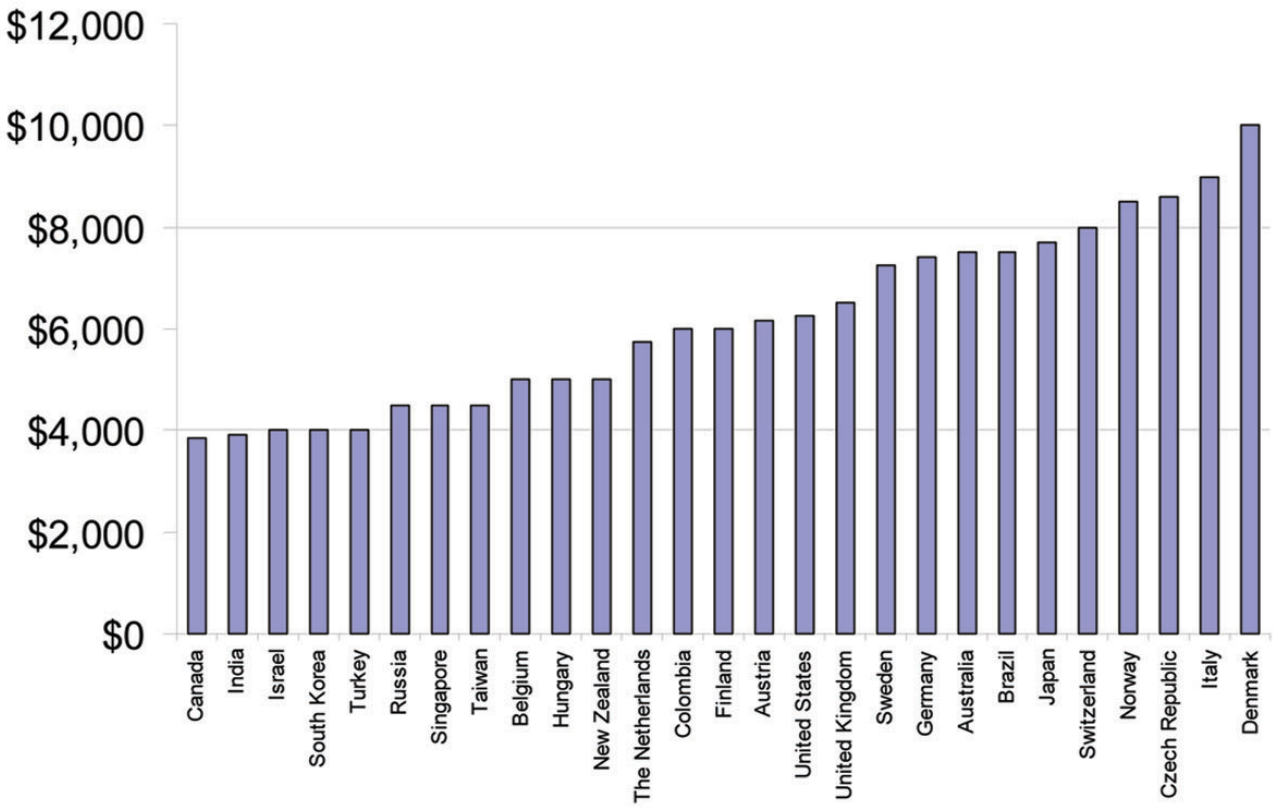

Figure 7. Graph showing range of costs of the Artificial Urinary Sphincter in various countries.

experience suggests that enterocystoplasty or gastrocystoplasty can be done simultaneously with the implantation of the AUS [391, 392]. AUS can also be implanted in patients after bladder substitution [212], and in those with locally recurrent prostate cancer with a relatively good prognosis [393], or those with severe post-radical prostetectomy bladder neck contracture in whom a stent has been placed previously [219].

3. Surgical technique:

The original technique of implantation is illustrated in **Figure 8**. The cuff of the sphincter around the bulbous urethra is placed via a midline perineal incision, while the pressure regulating balloon and the scrotal pump are inserted via a separate inguinal incision.

More recently a new surgical approach has been described using a single, upper transverse scrotal incision which allows the placement of all 3 components of the system, the cuff, the pump in a scrotal pouch, and the reservoir behind the fascia transversalis [394]. The procedure is claimed to be easier and faster to complete. Caution should be exerted, however, before this approach is universally adopted, because the placement of the cuff at the *proximal* part of the bulbous urethra seems to be more difficult, and no long term results are available at this time [395].

One of the pitfalls during surgery is laceration of the urethra when dissecting it from the corpora cavernosa where no real anatomical plan exists. Intraoperative recognition of urethral injury can be facilitated by retrograde perfusion sphincterometry using a flexible cystoscope [32].

4. Complications

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

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 [396-401]. 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 [396-407]. It should be pointed out, however, that there has never been a published report of hydronephrosis following implantation of an AUS for incontinence after prostatectomy [408]. The best candidates for sphincter implantation are those with a low pressure, relaxed, and compliant bladder but an incompetent urethral sphincter [405].

2. Atrophy of the urethra

This may occur 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 [149, 169, 408]. About 4 months following implantation, cuff efficiency diminishes, presumably because pressure atrophy occurs in every patient to some extent [409]. The incidence of urethral atrophy leading to revision varies from 3% to 9.3% [116, 122, 406, 410-413]. This atrophy can be lessened with nocturnal deactivation of the cuff [414].

b) Mechanical failure

This includes perforation of one of the components with loss of fluid from the the system, air bubbles or organic debris within the system causing inadequate function of the pump, disconnection of the tubes, or kinking of the tubes. Introduction of “kink-free” tubing has virtually eliminated this last complication. The incidence of these complications varies widely with ranges from 0% [410] to 52.5% [129] 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 to 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 from 10 to 15 years [129]. 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 [415].

c) Erosion and/or infection

Erosion and infection are two major complications that almost invariably necessitate removal of the prosthesis. Their incidence is usually reported as a single complication.

Figure 8. A. With the patient in lithotomy position, a perineal incision is made behind the scrotum to expose the bulbar urethra.

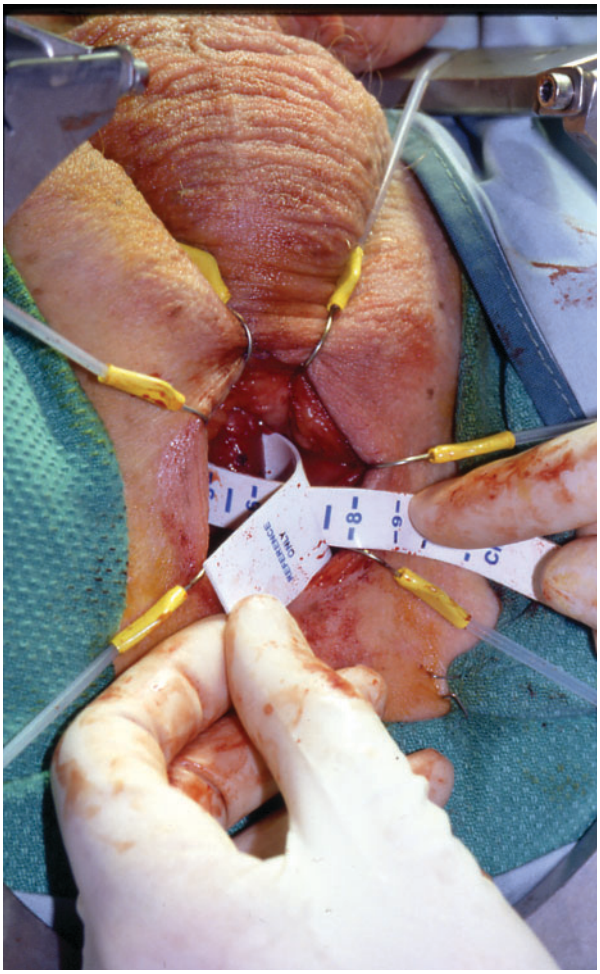

Figure 8. B. The urethra is mobilized circumferentially within the bulbospongiosus muscle and the measuring tape is used to obtain the cuff size.

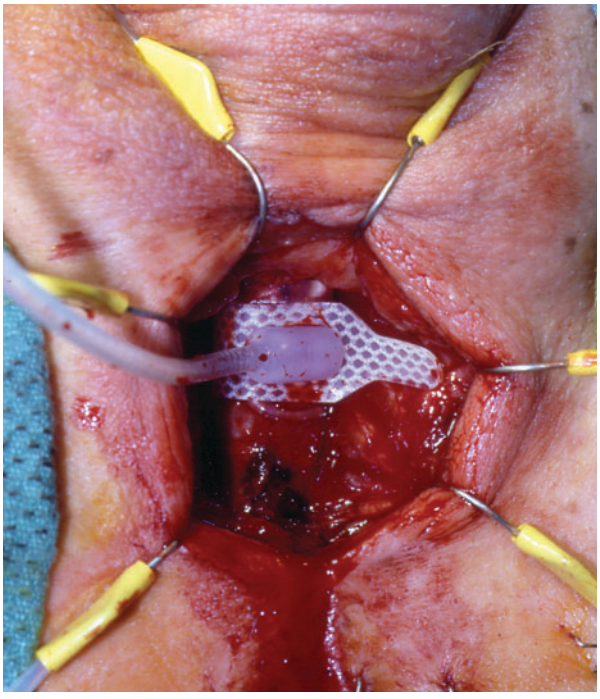

Figure 8. C. The belt-like cuff is positioned around the urethra.

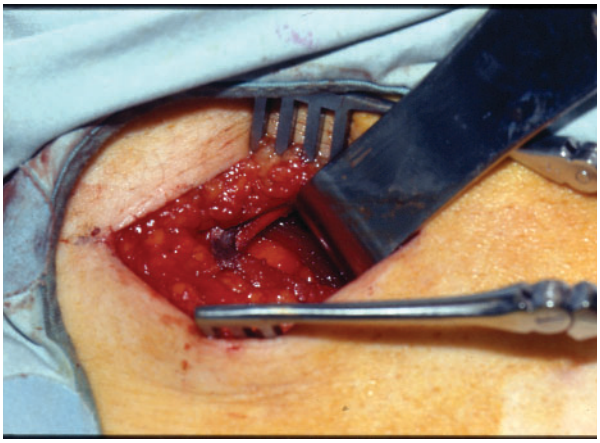

Figure 8 D. A right lower quadrant (RLQ) abdominal incision is made and the extraperitoneal space is entered lateral to the rectus muscle for insertion of the reservoir.

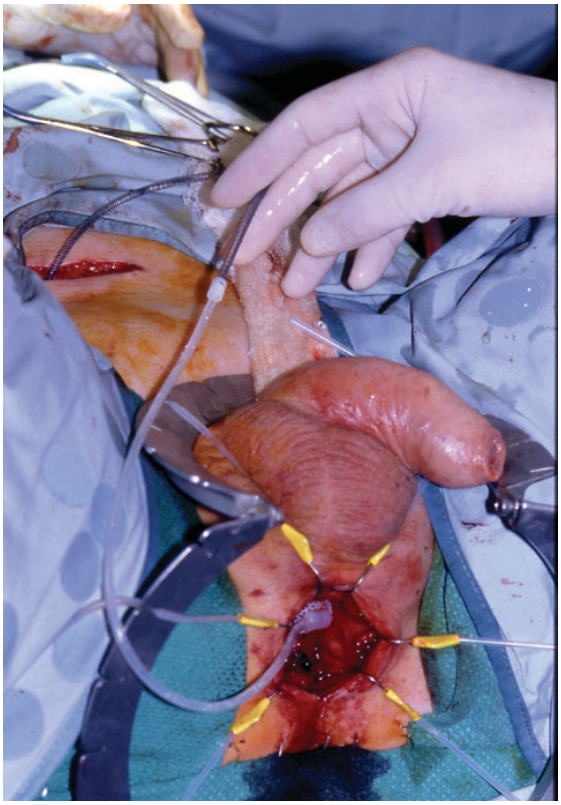

Figure 8 E. After reservoir insertion the cuff is pressurized with fluid

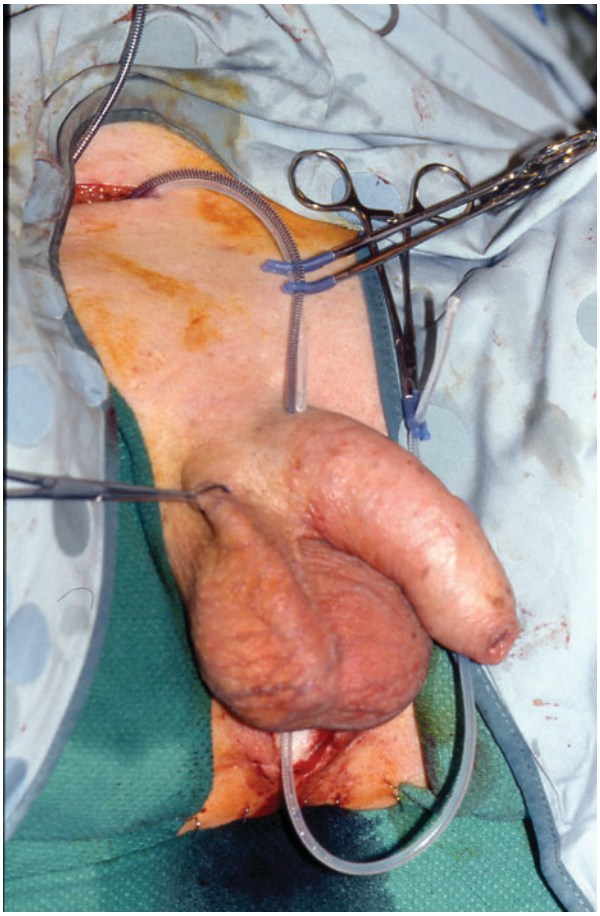

Figure 8 F. A scrotal space is created under the dartos and the pump is inserted (held with a Babcock clamp).

Figure 8 G. The cuff tubing is brought from the perineal incision to the RLQ incision with a tubing passer.

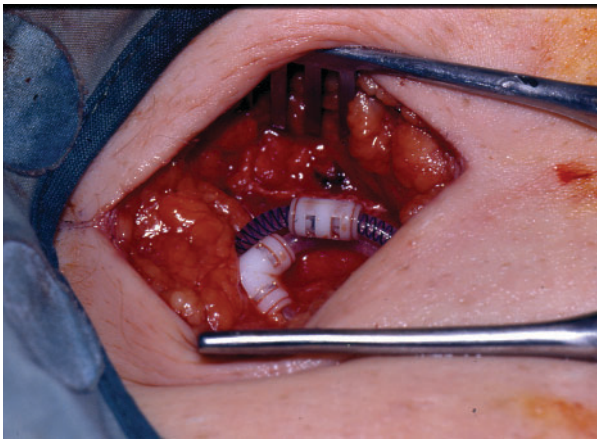

Figure 8. H Connectors are placed to join the tubes from the cuff and reservoir to the corresponding tubes from the pump in the RLQ incision.

The incidence of this complication varies from 0% to 24.6% [116, 169, 399, 405, 406, 410-413, 416, 417]. As would be expected, the highest incidence has been reported with the longest follow-up (10-15 years)[116]. Two-thirds of the erosions occurred during the first year. Previous surgery [418]at the site of cuff placement increases the risk of erosion. This, however, can be decreased by delayed activation [419]. Some authors, however, did not find an increased incidence of complications when a new cuff was implanted at the site where several months before a cuff has been removed for infection or erosion [420]. Other risk factors include urethral catheterization and urethral endoscopic manipulations with an activated sphincter in place[421].

As mentioned above, the majority of authors consider that even if previous radiotherapy constitutes a risk factor in terms of increased complication and revision rates, this does not constitute a contraindication for the implantation of an AUS [115, 117, 135, 148, 149, 167, 422]. Patient satisfaction is similar in those who have been irradiated, compared to those who have not been [115, 124, 148], and the degree of satisfaction does not seem to correlate with the number of surgical revisions [128].

d) Rare complications

Several unusual, although rare complications have been recently reported in the literature, such as the intravesical migration of the reservoir with secondary stone formation in the bladder [423], or a giant urethral diverticulum at the site of a previously removed cuff because of erosion and urinary extravasation [424].

The total number of procedures done in a given center does not seem to be a determining risk factor for complications. Comparable erosion/infection rates have been reported from centers with fewer than 50 or more than 100 cases [137]. This suggests that erosion and infection are more closely related to the physiologic state of the host rather than the experience of the surgical team, provided standard precautions are strictly applied.

5. 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 multicenter trial, for neurogenic bladders, conducted in France [406], the authors mention that the “mean operational life” of the sphincter was 56 months (range 3-118 months). Haab et al [122] 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 series from the Mayo Clinic [126] where the modification of the cuff design (narrower back) resulted in a significant drop of the reoperation rate at 5 years. In the “narrow back” group 17% (31/184) required reoperation. Mean time to reoperation was 26.2 months (mean 2-68 months). Using Kaplan-Meier statistical analysis for this group of patients, the overall 5 year expected product survival was 75%.

In a review Venn et al [169] analysed the outcome of 100 patients in whom an artificial urinary sphincter was implanted for more than 10 years. 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 survi-

val rate at 10 years was 66% in this series.

In a series of 30 boys with spina bifida Spiess et al [425] found that the mean lifetime of all AUS was 4.7 years, with no statistically significant difference in sphincter survival of those inserted at the bladder neck or the bulbous urethra (4.6 and 4.9 years, respectively. A sharp drop was observed at 100 months with only 8.3% of the original sphincters still functioning beyond this point.

It might be useful to consider patients with 'primary adequate function' when no revision is necessary to achieve continence separately from those with 'additional procedure-assisted adequate function', where one or more revisions are necessary to obtain favourable outcome. Klijn et al. [121] showed in their series of 27 men who became incontinent after a radical prostatectomy that at a mean follow-up of 35 months, 81 % of the patients achieved satisfactory continence. The 5 year 'primary adequate function' and 'additional procedure-assisted adequate function' rates, based on the Kaplan-Meier curves, were 49% and 71%, respectively. The median time to failure for the 'primary adequate function' group was 48 months, the median time to definitive failure of 'additional procedure-assisted adequate function' was >72 months.

In the most recent series the global long term (2 to 7.7 years) revision rate, for any of the above mentioned reasons varies between 16% and 50% [127, 128, 426]. Patients with neurological deficit seem to have a higher risk of non-mechanical failure and the overall continence rate may be poorer compared to non-neurologic patients [29].

6. Diagnostic procedures related to artificial 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 [29, 30, 135, 137, 407, 427-429]. **Figure 9** shows an algorithm to investigate and treat the male patient with a previously functioning AUS who becomes 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.

Plain X-rays of the abdomen or pelvis may show fluid loss, if the system is filled with radio-opaque solution [430, 431] (Figure1). It is necessary to obtain a baseline film at the discharge of the patient from the hospital for subsequent comparison because radiographc imaging of the balloon does not detect changes until at least 50% of its volume has been lost [12].

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

Cystourethrography could eventually demonstrate a urethral diverticulum at the site of previous cuff erosion (**Figure 10**).

Endoscopy will disclose any urethral erosion by the cuff (**Figure 11**).

Retrograde perfusion sphincterometry has been reported to diagnose the loss of compressive pressure in the urethral cuff [29]. It is done by infusing fluid from the meatus in a retrograde fashion. If the AUS cuff is functional and the urethral is intact there should be no flow when the pressure equals the AUS balloon pressure. This technique can also be used intraoperatively to detect urethral perforation or to adjust the pressure in the cuff [32]. This seems to be more useful than urethral pressure profile (UPP) [403].

Intraoperative electrical testing, using an ohmmeter [417, 428] has been described to determine the site of fluid leakage from the system. This test can be helpful to avoid the need to change the whole system, and allow replacement of the leaking part only.

7. Treatment of complications

As outlined above, complications directly related to the presence of an artificial 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 as bladder augmentation

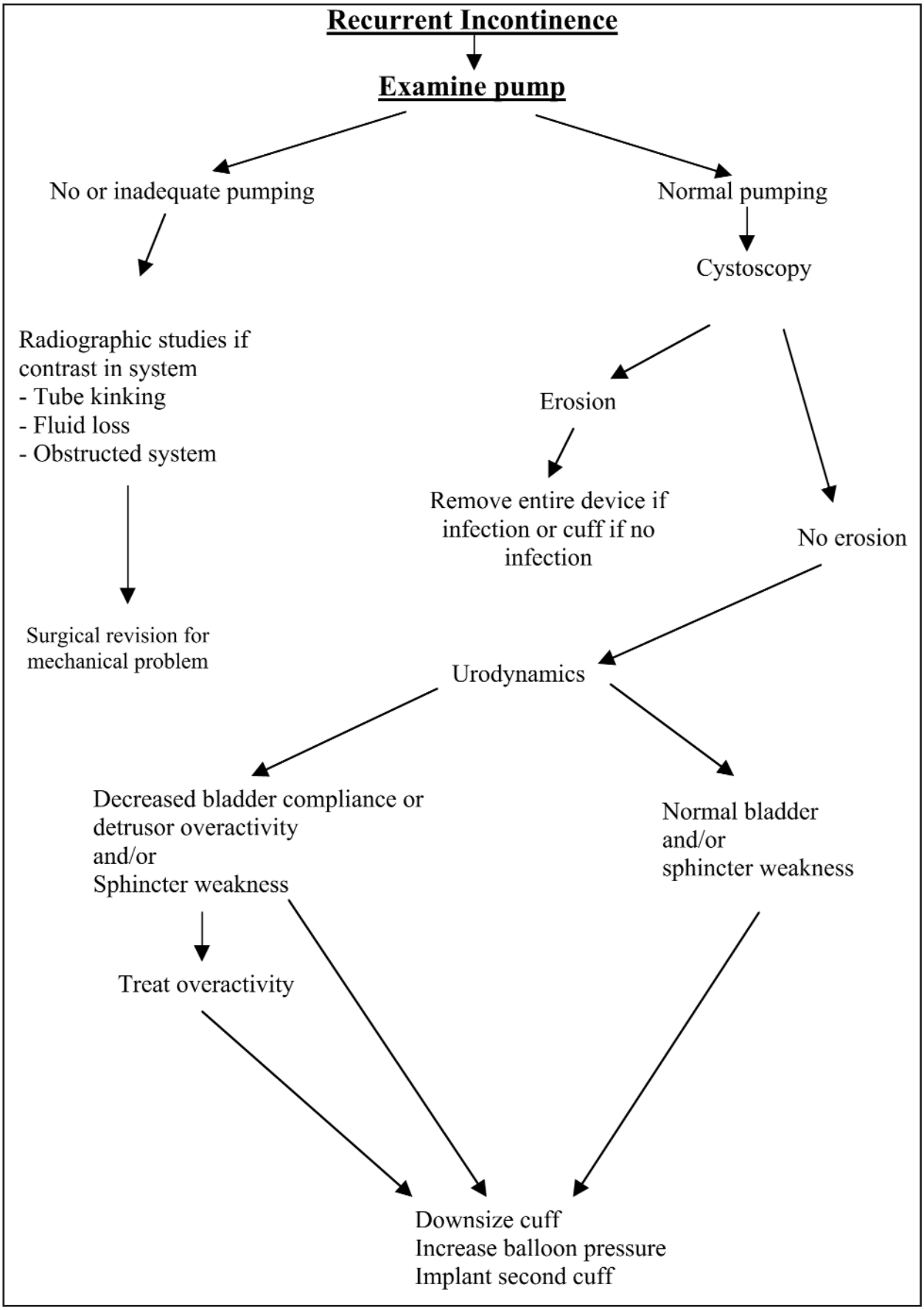

Figure 9. Algorithm for managing incontinence after AUS placement

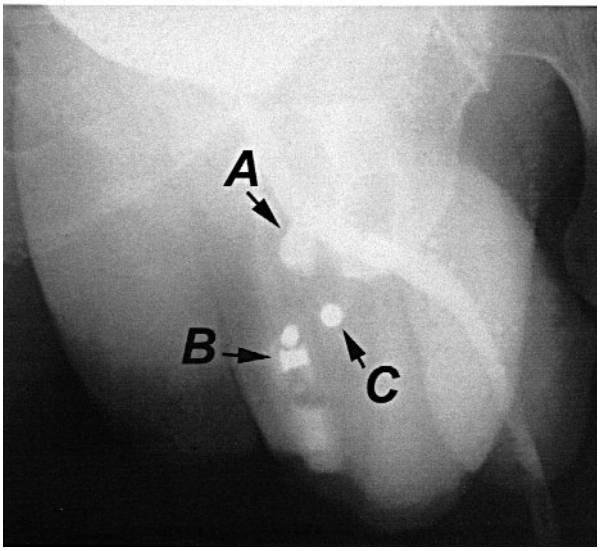

Figure 10. Urethrogram of patient who underwent cuff removal for erosion into the urethra. A. Site of urethral diverticulum B.Tubing plug over tube from pump C.Scrotal pump

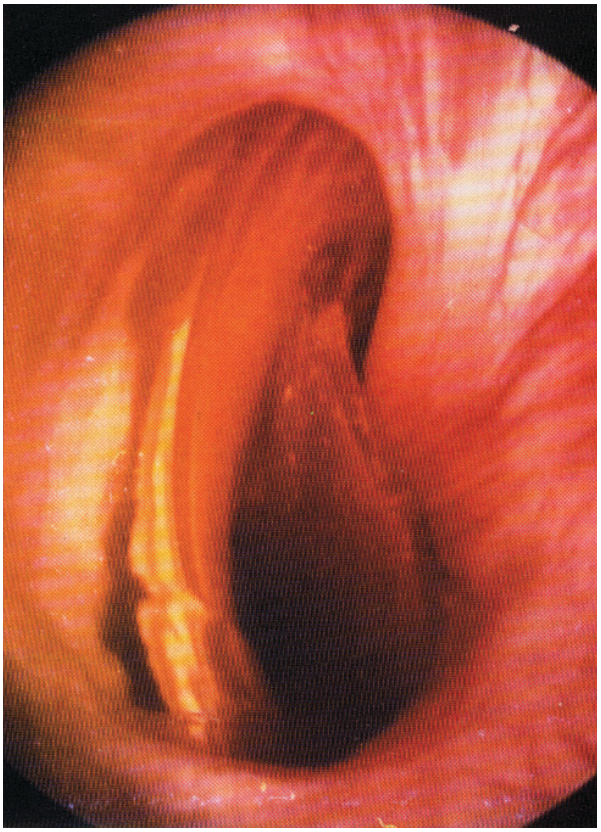

Figure 11 Endoscopic view of AUS cuff erosion into the bulbar urethra. The patient had undergone radiation after radical prostatectomy.

or enterocystoplasty may be considered. To date no report can be found where implantation of an artificial sphincter resulted in the deterioration of the upper urinary tract in a neurologically normal post-prostatectomy patient [124, 408]. 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 [391]. However, in a recent review of 286 patients Furness et al. [432] 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 [409] , although small voided volumes with reduced cystometric capacity, poor compliance, or severe detrusor overactivity after failed medical treatment would suggest the need.

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 [12, 117, 433], or increasing the amount of fluid in the system. Another approach consists of placing the cuff inside the corporal tunica albuginea on the dorsal aspect of the urethra (transcorporal). This allows a safer mobilization of the urethra and adds some supplementary bulk of tissue to the circumference of the urethra, possibly decreasing the risk of erosion [132]. It should be mentioned, however, that there is a risk of reduced erectile function with this technique.

The implantation of a double-cuff AMS 800 has become more popular, as a primary procedure in the totally or severely incontinent patient [133, 434], or as a salvage procedure, by adding a second cuff, following a failed previous single cuff [130, 131, 434]. It does not appear that morbidity increases with the double-cuff as compared with the single cuff system [133], and patient satisfaction also seems to be higher [134].

c) Mechanical failure

As with any device, mechanical failure can be expected with the AMS 800 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 antibio-

tics. A second system can be subsequently implanted with equally good results [419]. It has been demonstrated, however, that immediate reimplantation of a new AUS after the removal of an infected, but not eroded, prosthesis can be a valid option with an overall success rate of 87% [435].

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 the removal of an eroded cuff [423]. 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 10**), and the latter may increase the amount of the periurethral fibrosis. This might compromise success of a new cuff. However, the new cuff should be positioned away from the erosion site. In case of the erosion of one of the cuffs of a double system removal of the eroded cuff can successfully convert a double-cuff system into a single cuff system [436].

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

As complications continue to be seen for years after implantation [437], 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 are as follows:

1. Perioperative antibiotics are recommended. Gram-negative enteric bacteria and Staphylococcus epidermidis are the most frequently encountered microorganisms in infected prostheses [421].
2. Hospital stay should be kept to a minimum.
3. Urethral catheters should be withdrawn within 24-48 hours of surgery and the preoperative continence management continued.
4. In general the sphincter device should not be activated immediately postoperatively. In the initial period scrotal oedema 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 [117]. Nocturnal deactivation should be considered in high-risk patients [116].
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 non-neurogenic patient. With time, alteration in bladder function may jeopardize renal function in the neurogenic patients. Periodic ultrasound evaluation of the upper urinary tract is essential. If changes occur, urodynamic studies should be done to rule out detrusor overactivity. In non-neurogenic patients, periodic ultrasound may not be necessary.
7. When change in the continence status occurs diagnostic procedures related to sphincter failure (**Figure 9**) should be considered.

(Level of evidence 3; Grade of recommendation C)

XIII. NEW TECHNOLOGY

Adjustable continence therapy – ACT – New technology being evaluated

The ACT device for male incontinence was introduced in 2000 and consists of silicone balloons connected to a port that can be punctured percutaneously after implantation for readjustment of balloon volume. Using a minimally invasive perineal approach, the balloons are placed underneath the bladder neck bilaterally under fluoroscopic and endoscopic guidance. Elevation and compression of the bladder neck and the membranous urethra is the functional concept of the ACT device. In contrast to most other procedures, the device can be readjusted numerous times after the operation until continence is fully restored. If urinary retention occurs, it can be easily managed by partial balloon deflation. Since bladder neck compression is not circumferential, urethral atrophy due to impaired perfusion, as frequently seen with the artificial sphincter cuff, is very unlikely to occur. Pelvic irradiation heavily increases the risk of balloon migration and/or bladder erosion. Therefore, radiation therapy of the pelvis should be considered as a relative contraindication for implantation of an adjustable continence therapy device. Like sling procedures, the ACT device is neither intellectually nor

manually as demanding as the artificial sphincter. If the ACT implantation fails for any reason, the device can be explanted easily and every other therapeutic option is still possible. Preliminary treatment outcome results show a 75% cured and improved rate in a total of approximately 100 male patients followed for up to one year [438-440]. Further results are anticipated.

XIV. 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 is helpful. Pad tests may be useful in certain circumstances. 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.

The committee felt that multichannel urodynamics are essential prior to invasive treatment for incontinence. **(Level of evidence 2-4: grades of recommendation A, B, C)**

2. Incontinence post prostatectomy for BPH and Postradical prostatectomy for prostate cancer

After a period of conservative management, 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. Male slings are a proven alternative although long-term data are lacking. Injectable agents are a less effective but an option for some men with mild to moderate incontinence. **(Level of evidence 3; grade of recommendation C)**

3. Age

Age is not a restriction for surgical treatment of urinary incontinence. Cognitive impairment and lack of dexterity may be restrictions for the artificial sphincter and must be determined preoperatively. **(Level of evidence 3-4; grade of recommendation 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. Based upon limited data perineal compression (bone anchor) slings are an alternative. Injectable agents have not been successful in this setting. **(Level of evidence 3; grade of recommendation C)**

5. Incontinence following pelvic trauma

The artificial sphincter is most widely reported. Bladder neck reconstruction has also been reported on a limited basis. **(Level of evidence 3; grade of recommendation 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, bladder neck closure, bladder reconstruction or diversion with bowel. The data are insufficient for a specific recommendation. Transition is important between the pediatric and adult urologist. Life-long follow-up is mandatory in terms of continence, voiding efficiency, upper tract status and other urological complications **(Level of evidence 3; Grade of recommendation C)**

7. Refractory urgency incontinence and detrusor overactivity

Botulinum toxin-A bladder injections is a minimally invasive treatment with some efficacy. Neuromodulation is a treatment option with success reported in a limited number of male patients. Detrusor myectomy has also been reported to be successful in a small number of male patients. Augmentation cystoplasty is potentially successful in controlling symptoms but may be associated with unacceptable side effects. Urinary diversion is a final option. **(Level of evidence 3; grade of recommendation C)**

8. Reduced capacity bladder

Augmentation cystoplasty has been successful in most etiologies apart from radiation. **(Level of evidence 3; grade of recommendation C)**

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. Most repairs are now carried out after prior fecal diversion. Various techniques are available for closure and can be done in collaboration with colorectal surgeons. **(Level of evidence 3; grade of recommendation C)**

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. **(Level of evidence 3; grade of recommendation C)**

11. New Technologies

Evidence for the ACT balloon is required before specific recommendations can be made.

(Level of evidence C; grade of recommendation D)

12. Recommendations for future research

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

REFERENCES

1. Herschorn S, Bosch JL, Bruschini H, Hanus T, Low A, Schick E. Surgical treatment of urinary incontinence in men. In: Abrams P, Cardozo L, Khoury S, Wein A, eds. *Second International Consultation on Incontinence*. Plymouth, U.K.: Health Publications Ltd.; 2002:785-821.
2. Mebust W, Rioso R, Schroeder F, Villers A, eds. *Correlations between pathology, clinical symptoms and the course of the disease*. Paris: SCI; 1991. Cockett A, ed. Proceeding of the International Consultation on benign prostatic hyperplasia (BPH).
3. Blaivas JG, Zayed AA, Labib KB. The bulbocavernosus reflex in urology: a prospective study of 299 patients. *J Urol*. Aug 1981;126(2):197-199.
4. Griffiths DJ, McCracken PN, Harrison GM, Gormley EA. Relationship of fluid intake to voluntary micturition and urinary incontinence in geriatric patients. *Neurourol Urodyn*. 1993;12(1):1-7.
5. Wyman JF, Choi SC, Harkins SW, Wilson MS, Fantl JA. The urinary diary in evaluation of incontinent women: a test-retest analysis. *Obstet Gynecol*. Jun 1988;71(6 Pt 1):812-817.
6. Schick E, Jolivet-Tremblay M, Dupont C, Bertrand PE, Tessier J. Frequency-volume chart: the minimum number of days required to obtain reliable results. *Neurourol Urodyn*. 2003;22(2):92-96.
7. Mouritsen L, Berild G, Hertz J. Comparison of different methods for quantification of urinary leakage in incontinent women. *Neurourol Urodyn*. 1989;8:579-587.
8. Starer P, Libow LS. The measurement of residual urine in the evaluation of incontinent nursing home residents. *Arch Gerontol Geriatr.* Mar 1988;7(1):75-81.
9. Diokno AC, Brown MB, Brock BM, Herzog AR, Normolle DP. Clinical and cystometric characteristics of continent and incontinent noninstitutionalized elderly. *J Urol*. Sep 1988;140(3):567-571.
10. Fantl JA, Newman D, Colling J, al. e. *Urinary incontinence in adults: acute and chronic management. Clinical Practice Guideline, No 2,*. Rockport,MD: U.S. Department of Health and Human Services. Public Health Service, Agency for Health Care Policy and Research; March, 1996 1996. AHCPR Publication No 96-0682.
11. Foote J, Yun S, Leach GE. Postprostatectomy incontinence. Pathophysiology, evaluation, and management. *Urol Clin North Am*. May 1991;18(2):229-241.
12. Petrou SP, Williams HJ, Young PR. Radiographic imaging of the artificial urinary sphincter pressure regulating balloon. *J Urol*. May 2001;165(5):1773-1775.
13. Leach GE, Yip CM. Urologic and urodynamic evaluation of the elderly population. *Clin Geriatr Med*. Nov 1986;2(4):731-755.
14. Goode PS, Locher JL, Bryant RL, Roth DL, Burgio KL. Measurement of postvoid residual urine with portable transabdominal bladder ultrasound scanner and urethral catheterization. *Int Urogynecol J Pelvic Floor Dysfunct*. 2000;11(5):296-300.
15. Richter S, Hag'ag R, Shalev M, Nissenkorn I. [Measuring residual urine by portable ultrasound scanner]. *Harefuah*. Aug 1999;137(3-4):93-95, 176, 175.
16. Strasser H, Frauscher F, Helweg G, Colleselli K, Reissigl A, Bartsch G. Transurethral ultrasound: evaluation of anatomy and function of the rhabdosphincter of the male urethra. *J Urol*. Jan 1998;159(1):100-104; discussion 104-105.
17. McGuire EJ, Fitzpatrick CC, Wan J, et al. Clinical assessment of urethral sphincter function. *J Urol*. Nov 1993;150(5 Pt 1):1452-1454.

18. Schick E. Objective assessment of resistance of female urethra to stress. A scale to establish degree of urethral incompetence. *Urology.* Nov 1985;26(5):518-526.

19. Peschers UM, Jundt K, Dimpfl T. Differences between cough and Valsalva leak-point pressure in stress incontinent women. *Neurourol Urodyn*. 2000;19(6):677-681.

20. Bump RC, Elser DM, Theofrastous JP, McClish DK. Valsalva leak point pressures in women with genuine stress incontinence: reproducibility, effect of catheter caliber, and correlations with other measures of urethral resistance. Continence Program for Women Research Group. *Am J Obstet Gynecol*. Aug 1995;173(2):551-557.

21. Decter RM, Harpster L. Pitfalls in determination of leak point pressure. *J Urol*. Aug 1992;148(2 Pt 2):588-591.

22. Flood HD, Alevizatos C, Liu JL. Sex differences in the determination of abdominal leak point pressure in patients with intrinsic sphincter deficiency. *J Urol*. Nov 1996;156(5):1737-1740.

23. Faerber GJ, Vashi AR. Variations in Valsalva leak point pressure with increasing vesical volume. *J Urol*. Jun 1998;159(6):1909-1911.

24. Haab F, Dmochowski R, Zimmern P, Leach GE. [The variability of the leakage pressure threshold due to exertion "the Valsalva Leak Point Pressure" as a function of the filling volume of the bladder]. *Prog Urol*. Jun 1997;7(3):422-425.

25. Theofrastous JP, Cundiff GW, Harris RL, Bump RC. The effect of vesical volume on Valsalva leak-point pressures in women with genuine stress urinary incontinence. *Obstet Gynecol*. May 1996;87(5 Pt 1):711-714.

26. Petrou SP, Kollmorgen TA. Valsalva leak point pressure and bladder volume. *Neurourol Urodyn*. 1998;17(1):3-7.

27. Swift SE, Utrie JW. The need for standardization of the valsalva leak-point pressure. *Int Urogynecol J Pelvic Floor Dysfunct*. 1996;7(4):227-230.

28. McCormack M, Pike J, Kiruluta G. Leak point of incontinence: a measure of the interaction between outlet resistance and bladder capacity. *J Urol*. Jul 1993;150(1):162-164.

29. Leach GE. Incontinence after artificial urinary sphincter placement: the role of perfusion sphincterometry. *J Urol*. Sep 1987;138(3):529-532.

30. Wang Y, Hadley HR. Management of persistent or recurrent urinary incontinence after placement of artificial urinary sphincter. *J Urol*. Oct 1991;146(4):1005-1006.

31. Comiter CV, Sullivan MP, Yalla SV. Retrograde leak point pressure for evaluating postradical prostatectomy incontinence. *Urology.* Feb 1997;49(2):231-236.

32. Choe JM, Battino BS, Bell TE. Retrograde perfusion sphincterometry with a flexible cystoscope: method of troubleshooting the AMS 800. *Urology.* Aug 1 2000;56(2):317-319.

33. Beck R, Fowler C. Clinical neurophysiology in the investigation of genitourinary tract dysfunction. In: Rushton DN, ed. *Handbook of Neurourology*. New York: Marcel Dekker; 1994:151-180.

34. Brown MC, Sutherst JR, Murray A, Richmond DH. Potential use of ultrasound in place of X-ray fluoroscopy in urodynamics. *Br J Urol*. Feb 1985;57(1):88-90.

35. Bidair M, Tiechman JM, Brodak PP, Juma S. Transrectal ultrasound urodynamics. *Urology.* Dec 1993;42(6):640-644; discussion 644-645.

36. Manieri C, Carter SS, Romano G, Trucchi A, Valenti M, Tubaro A. The diagnosis of bladder outlet obstruction in men by ultrasound measurement of bladder wall thickness. *J Urol.* Mar 1998;159(3):761-765.

37. Ozawa H, Chancellor MB, Ding YY, Nasu Y, Yokoyama T, Kumon H. Noninvasive urodynamic evaluation of bladder outlet obstruction using Doppler ultrasonography. *Urology.* Sep 1 2000;56(3):408-412.

38. Abrams P. Detrusor instability and bladder outlet obstruction. *Neurourol Urodyn*. 1985;4:317-328.

39. Hu JC, Elkin EP, Pasta DJ, et al. Predicting quality of life after radical prostatectomy: results from CaPSURE. *J Urol*. Feb 2004;171(2 Pt 1):703-707; discussion 707-708.

40. Kielb S, Dunn RL, Rashid MG, et al. Assessment of early continence recovery after radical prostatectomy: patient reported symptoms and impairment. *J Urol*. Sep 2001;166(3):958-961.

41. Sebesta M, Cespedes RD, Luhman E, Optenberg S, Thompson IM. Questionnaire-based outcomes of urinary incontinence and satisfaction rates after radical prostatectomy in a national study population. *Urology.* Dec 2002;60(6):1055-1058.

42. Lepor H, Kaci L. The impact of open radical retropubic prostatectomy on continence and lower urinary tract symptoms: a prospective assessment using validated self-administered outcome instruments. *J Urol.* Mar 2004;171(3):1216-1219.

43. Olsson LE, Salomon L, Nadu A, et al. Prospective patient-reported continence after laparoscopic radical prostatectomy. *Urology.* Oct 2001;58(4):570-572.

44. Madalinska JB, Essink-Bot ML, de Koning HJ, Kirkels WJ, van der Maas PJ, Schroder FH. Health-related quality-of-life effects of radical prostatectomy and primary radiotherapy for screen-detected or clinically diagnosed localized prostate cancer. *J Clin Oncol*. Mar 15 2001;19(6):1619-1628.

45. Deliveliotis C, Protogerou V, Alargof E, Varkarakis J. Radical prostatectomy: bladder neck preservation and puboprostatic ligament sparing—effects on continence and positive margins. *Urology.* Nov 2002;60(5):855-858.

46. Harris MJ. Radical perineal prostatectomy: cost efficient, outcome effective, minimally invasive prostate cancer management. *Eur Urol*. Sep 2003;44(3):303-308; discussion 308.

47. Maffezzini M, Seveso M, Taverna G, Giusti G, Benetti A, Graziotti P. Evaluation of complications and results in a contemporary series of 300 consecutive radical retropubic prostatectomies with the anatomic approach at a single institution. *Urology.* May 2003;61(5):982-986.

48. Hofmann T, Gaensheimer S, Buchner A, Rohloff R, Schilling A. An unrandomized prospective comparison of urinary continence, bowel symptoms and the need for further procedures in patients with and with no adjuvant radiation after radical prostatectomy. *BJU Int*. Sep 2003;92(4):360-364.

49. Ruiz-Deya G, Davis R, Srivastav SK, A MW, Thomas R. Outpatient radical prostatectomy: impact of standard perineal approach on patient outcome. *J Urol.* Aug 2001;166(2):581-586.

50. Augustin H, Pummer K, Daghofer F, Habermann H, Primus G, Hubmer G. Patient self-reporting questionnaire on urological morbidity and bother after radical retropubic prostatectomy. *Eur Urol.* Aug 2002;42(2):112-117.

51. Rassweiler J, Seemann O, Schulze M, Teber D, Hatzinger M, Frede T. Laparoscopic versus open radical prostatectomy: a comparative study at a single institution. *J Urol*. May 2003;169(5):1689-1693.

52. Cooperberg MR, Master VA, Carroll PR. Health related quality of life significance of single pad urinary incontinence following radical prostatectomy. *J Urol.* Aug 2003;170(2 Pt 1):512-515.

53. Stanford JL, Feng Z, Hamilton AS, et al. Urinary and sexual function after radical prostatectomy for clinically localized prostate cancer: the Prostate Cancer Outcomes Study. *Jama*. Jan 19 2000;283(3):354-360.

54. Horie S, Tobisu KI, Fujimoto H, Doi N, Kakizoe T. Urinary incontinence after non-nerve-sparing radical prostatectomy with neoadjuvant androgen deprivation. *Urology.* Mar 1999; 53(3):561-567.

55. Catalona WJ, Carvalhal GF, Mager DE, Smith DS. Potency, continence and complication rates in 1,870 consecutive radical retropubic prostatectomies. *J Urol*. Aug 1999;162(2):433-438.

56. Eastham JA, Kattan MW, Rogers E, et al. Risk factors for urinary incontinence after radical prostatectomy. *J Urol*. Nov 1996;156(5):1707-1713.

57. Zincke H, Oesterling JE, Blute ML, Bergstralh EJ, Myers RP, Barrett DM. Long-term (15 years) results after radical prostatectomy for clinically localized (stage T2c or lower) prostate cancer. *J Urol*. Nov 1994;152(5 Pt 2):1850-1857.

58. Leandri P, Rossignol G, Gautier JR, Ramon J. Radical retropubic prostatectomy: morbidity and quality of life. Experience with 620 consecutive cases. *J Urol*. Mar 1992;147(3 Pt 2):883-887.

59. Steiner MS, Morton RA, Walsh PC. Impact of anatomical radical prostatectomy on urinary continence. *J Urol*. Mar 1991;145(3):512-514; discussion 514-515.

60. Young MD, Weizer AZ, Silverstein AD, et al. Urinary continence and quality of life in the first year after radical perineal prostatectomy. *J Urol*. Dec 2003;170(6 Pt 1):2374-2378.

61. Lepor H, Kaci L, Xue X. Continence following radical retropubic prostatectomy using self-reporting instruments. *J Urol*. Mar 2004;171(3):1212-1215.

62. Jonler M, Madsen FA, Rhodes PR, Sall M, Messing EM, Bruskewitz RC. A prospective study of quantification of urinary incontinence and quality of life in patients undergoing radical retropubic prostatectomy. *Urology*. Sep 1996;48(3):433-440.

63. Lowe BA. Comparison of bladder neck preservation to bladder neck resection in maintaining postrostatectomy urinary continence. *Urology*. Dec 1996;48(6):889-893.

64. Poon M, Ruckle H, Bamshad BR, Tsai C, Webster R, Lui P. Radical retropubic prostatectomy: bladder neck preservation versus reconstruction. *J Urol*. Jan 2000;163(1):194-198.

65. Srougi M, Nesrallah LJ, Kauffmann JR, Nesrallah A, Leite KR. Urinary continence and pathological outcome after bladder neck preservation during radical retropubic prostatectomy: a randomized prospective trial. *J Urol*. Mar 2001;165(3):815-818.

66. Wei JT, Dunn RL, Marcovich R, Montie JE, Sanda MG. Prospective assessment of patient reported urinary continence after radical prostatectomy. *J Urol*. Sep 2000;164(3 Pt 1):744-748.

67. Ahlering TE, Woo D, Eichel L, Lee DI, Edwards R, Skarecky DW. Robot-assisted versus open radical prostatectomy: a comparison of one surgeon's outcomes. *Urology*. May 2004;63(5):819-822.

68. Anastasiadis AG, Salomon L, Katz R, Hoznek A, Chopin D, Abbou CC. Radical retropubic versus laparoscopic prostatectomy: a prospective comparison of functional outcome. *Urology*. Aug 2003;62(2):292-297.

69. Gray M, Petroni GR, Theodorescu D. Urinary function after radical prostatectomy: a comparison of the retropubic and perineal approaches. *Urology*. May 1999;53(5):881-890; discussion 890-881.

70. Hollenbeck BK, Lipp ER, Hayward RA, Montie JE, Schottenfeld D, Wei JT. Concurrent assessment of obstructive/irritative urinary symptoms and incontinence after radical prostatectomy. *Urology*. Mar 2002;59(3):389-393.

71. Groutz A, Blaivas JG, Chaikin DC, Weiss JP, Verhaaren M. The pathophysiology of post-radical prostatectomy incontinence: a clinical and video urodynamic study. *J Urol*. Jun 2000;163(6):1767-1770.

72. Ficazzola MA, Nitti VW. The etiology of post-radical prostatectomy incontinence and correlation of symptoms with urodynamic findings. *J Urol*. Oct 1998;160(4):1317-1320.

73. Giannantoni A, Mearini E, Di Stasi SM, et al. Assessment of bladder and urethral sphincter function before and after radical retropubic prostatectomy. *J Urol*. Apr 2004;171(4):1563-1566.

74. Van Kampen M, De Weerdt W, Van Poppel H, et al. Prediction of urinary continence following radical prostatectomy. *Urol Int*. 1998;60(2):80-84.

75. Hammerer P, Huland H. Urodynamic evaluation of changes in urinary control after radical retropubic prostatectomy. *J Urol*. Jan 1997;157(1):233-236.

76. Pfister C, Cappele O, Dunet F, Bugel H, Grise P. Assessment of the intrinsic urethral sphincter component function in postprostatectomy urinary incontinence. *Neurourol Urodyn*. 2002;21(3):194-197.

77. Bader P, Hugonnet CL, Burkhard FC, Studer UE. Inefficient urethral milking secondary to urethral dysfunction as an additional risk factor for incontinence after radical prostatectomy. *J Urol*. Dec 2001;166(6):2247-2252.

78. John H, Sullivan MP, Bangerter U, Hauri D, Yalla SV. Effect of radical prostatectomy on sensory threshold and pressure transmission. *J Urol*. Jun 2000;163(6):1761-1766.

79. Comiter CV, Sullivan MP, Yalla SV. Correlation among maximal urethral closure pressure, retrograde leak point pressure, and abdominal leak point pressure in men with postprostatectomy stress incontinence. *Urology*. Jul 2003;62(1):75-78.

80. Van Kampen M, De Weerdt W, Van Poppel H, De Ridder D, Feys H, Baert L. Effect of pelvic-floor re-education on duration and degree of incontinence after radical prostatectomy: a randomised controlled trial. *Lancet*. Jan 8 2000;355(9198):98-102.

81. Parekh AR, Feng MI, Kirages D, Bremner H, Kaswick J, Aboseif S. The role of pelvic floor exercises on post-prostatectomy incontinence. *J Urol*. Jul 2003;170(1):130-133.

82. Franke JJ, Gilbert WB, Grier J, Koch MO, Shyr Y, Smith JA, Jr. Early post-prostatectomy pelvic floor biofeedback. *J Urol*. Jan 2000;163(1):191-193.

83. Wille S, Sobottka A, Heidenreich A, Hofmann R. Pelvic floor exercises, electrical stimulation and biofeedback after radical prostatectomy: results of a prospective randomized trial. *J Urol*. Aug 2003;170(2 Pt 1):490-493.

84. Moore KN, Griffiths D, Hughton A. Urinary incontinence after radical prostatectomy: a randomized controlled trial comparing pelvic muscle exercises with or without electrical stimulation. *BJU Int*. Jan 1999;83(1):57-65.

85. Burgio KL, Stutzman RE, Engel BT. Behavioral training for post-prostatectomy urinary incontinence. *J Urol*. Feb 1989;141(2):303-306.

86. Meaglia JP, Joseph AC, Chang M, Schmidt JD. Post-prostatectomy urinary incontinence: response to behavioral training. *J Urol*. Sep 1990;144(3):674-676.

87. Hunter KF, Moore KN, Cody DJ, Glazener CM. Conservative management for postprostatectomy urinary incontinence. *Cochrane Database Syst Rev*. 2004(2):CD001843.

88. McGuire EJ, Appell RA. Transurethral collagen injection for urinary incontinence. *Urology*. Apr 1994;43(4):413-415.

89. Aboseif SR, O'Connell HE, Usui A, McGuire EJ. Collagen injection for intrinsic sphincteric deficiency in men. *J Urol*. Jan 1996;155(1):10-13.

90. Cummings JM, Boullier JA, Parra RO. Transurethral collagen injections in the therapy of post-radical prostatectomy stress incontinence. *J Urol*. Mar 1996;155(3):1011-1013.

91. Sanchez-Ortiz RF, Broderick GA, Chaikin DC, et al. Collagen injection therapy for post-radical retropubic prostatectomy incontinence: role of Valsalva leak point pressure. *J Urol*. Dec 1997;158(6):2132-2136.

92. Smith DN, Appell RA, Rackley RR, Winters JC. Collagen injection therapy for post-prostatectomy incontinence. *J Urol*. Aug 1998;160(2):364-367.

93. Klutke JJ, Subir C, Andriole G, Klutke CG. Long-term results after antegrade collagen injection for stress urinary incontinence

following radical retropubic prostatectomy. *Urology*. May 1999;53(5):974-977.

94. Tiguert R, Gheiler EL, Gudziak MR. Collagen injection in the management of post-radical prostatectomy intrinsic sphincteric deficiency. *Neurourol Urodyn*. 1999;18(6):653-658.
95. Cespedes RD, Leng WW, McGuire EJ. Collagen injection therapy for postprostatectomy incontinence. *Urology*. Oct 1999;54(4):597-602.
96. Gomes CM, Broderick GA, Sanchez-Ortiz RF, Preate D, Jr., Rovner ES, Wein AJ. Artificial urinary sphincter for post-prostatectomy incontinence: impact of prior collagen injection on cost and clinical outcome. *J Urol*. Jan 2000;163(1):87-90.
97. Bugel H, Pfister C, Sibert L, Cappele O, Khalaf A, Grise P. [Intraurethral Macroplastic injections in the treatment of urinary incontinence after prostatic surgery]. *Prog Urol*. Dec 1999;9(6):1068-1076.
98. Kaufman JJ. A new operation for male incontinence. *Surg Gynecol Obstet*. Aug 1970;131(2):295-299.
99. Kaufman JJ. Treatment of post-prostatectomy urinary incontinence using a silicone gel prosthesis. *Br J Urol*. Dec 1973;45(6):646-653.
100. Kaufman JJ. Surgical treatment of post-prostatectomy incontinence: use of the penile crura to compress the bulbous urethra. *J Urol*. Feb 1972;107(2):293-297.
101. Schaeffer AJ, Clemens JQ, Ferrari M, Stamey TA. The male bulbourethral sling procedure for post-radical prostatectomy incontinence. *J Urol*. May 1998;159(5):1510-1515.
102. Clemens JQ, Bushman W, Schaeffer AJ. Questionnaire based results of the bulbourethral sling procedure. *J Urol*. Dec 1999;162(6):1972-1976.
103. Clemens JQ, Bushman W, Schaeffer AJ. Urodynamic analysis of the bulbourethral sling procedure. *J Urol*. Dec 1999;162(6):1977-1981; discussion 1981-1972.
104. John H. Bulbourethral composite suspension:: a new operative technique for post-prostatectomy incontinence. *J Urol*. May 2004;171(5):1866-1870; discussion 1869-1870.
105. Migliari R, Pistolesi D, De Angelis M. Polypropilene sling of the bulbar urethra for post-radical prostatectomy incontinence. *Eur Urol*. Feb 2003;43(2):152-157.
106. Madjar S, Jacoby K, Giberti C, et al. Bone anchored sling for the treatment of post-prostatectomy incontinence. *J Urol*. Jan 2001;165(1):72-76.
107. Comiter CV. The male sling for stress urinary incontinence: a prospective study. *J Urol*. Feb 2002;167(2 Pt 1):597-601.
108. Ullrich NF, Comiter CV. The male sling for stress urinary incontinence: 24-month followup with questionnaire based assessment. *J Urol*. Jul 2004;172(1):207-209.
109. Ullrich NF, Comiter CV. The male sling for stress urinary incontinence: urodynamic and subjective assessment. *J Urol*. Jul 2004;172(1):204-206.
110. Onur R, Rajpurkar A, Singla A. New perineal bone-anchored male sling: lessons learned. *Urology*. Jul 2004;64(1):58-61.
111. Rajpurkar A, Onur R, Singla A. Patient satisfaction and clinical efficacy of the new perineal bone-anchored male sling. *Eur Urol*. 2004.
112. Leach GE, Trockman B, Wong A, Hamilton J, Haab F, Zimmern PE. Post-prostatectomy incontinence: urodynamic findings and treatment outcomes. *J Urol*. Apr 1996;155(4):1256-1259.
113. Davidson PJ, van den Ouden D, Schroeder FH. Radical prostatectomy: prospective assessment of mortality and morbidity. *Eur Urol*. 1996;29(2):168-173.
114. Perez LM, Webster GD. Successful outcome of artificial urinary sphincters in men with post-prostatectomy urinary incontinence despite adverse implantation features. *J Urol*. Oct 1992;148(4):1166-1170.
115. Gomha MA, Boone TB. Artificial urinary sphincter for post-prostatectomy incontinence in men who had prior radiotherapy: a risk and outcome analysis. *J Urol*. Feb 2002;167(2 Pt 1):591-596.
116. Montague DK. The artificial urinary sphincter (AS 800): experience in 166 consecutive patients. *J Urol*. Feb 1992;147(2):380-382.
117. Martins FE, Boyd SD. Artificial urinary sphincter in patients following major pelvic surgery and/or radiotherapy: are they less favorable candidates? *J Urol*. Apr 1995;153(4):1188-1193.
118. Fleshner N, Herschorn S. The artificial urinary sphincter for post-radical prostatectomy incontinence: impact on urinary symptoms and quality of life. *J Urol*. Apr 1996;155(4):1260-1264.
119. Mottet N, Boyer C, Chartier-Kastler E, Ben Naoum K, Richard F, Costa P. Artificial urinary sphincter AMS 800 for urinary incontinence after radical prostatectomy: the French experience. *Urol Int*. 1998;60 Suppl 2:25-29; discussion 35.
120. Madjar S, Gousse AE, Lambert MM, Fishman IJ. Artificial urinary sphincter implantation for radical prostatectomy urinary incontinence: which factors influence patient satisfaction? *BJU Int*. 2000;86 (suppl. 3):121.
121. Klijn AJ, Hop WC, Mickisch G, Schroder FH, Bosch JL. The artificial urinary sphincter in men incontinent after radical prostatectomy: 5 year actuarial adequate function rates. *Br J Urol*. Oct 1998;82(4):530-533.
122. Haab F, Trockman BA, Zimmern PE, Leach GE. Quality of life and continence assessment of the artificial urinary sphincter in men with minimum 3.5 years of followup. *J Urol*. Aug 1997;158(2):435-439.
123. Goldwasser B, Furlow WL, Barrett DM. The model AS 800 artificial urinary sphincter: Mayo Clinic experience. *J Urol*. Apr 1987;137(4):668-671.
124. Litwiller SE, Kim KB, Fone PD, White RW, Stone AR. Post-prostatectomy incontinence and the artificial urinary sphincter: a long-term study of patient satisfaction and criteria for success. *J Urol*. Dec 1996;156(6):1975-1980.
125. Kuznetsov DD, Kim HL, Patel RV, Steinberg GD, Bales GT. Comparison of artificial urinary sphincter and collagen for the treatment of postprostatectomy incontinence. *Urology*. Oct 1 2000;56(4):600-603.
126. Elliott DS, Barrett DM. Mayo Clinic long-term analysis of the functional durability of the AMS 800 artificial urinary sphincter: a review of 323 cases. *J Urol*. Apr 1998;159(4):1206-1208.
127. Clemens JQ, Schuster TG, Konnak JW, McGuire EJ, Faerber GJ. Revision rate after artificial urinary sphincter implantation for incontinence after radical prostatectomy: actuarial analysis. *J Urol*. Oct 2001;166(4):1372-1375.
128. Gousse AE, Madjar S, Lambert MM, Fishman IJ. Artificial urinary sphincter for post-radical prostatectomy urinary incontinence: long-term subjective results. *J Urol*. Nov 2001;166(5):1755-1758.
129. Fulford SC, Sutton C, Bales G, Hickling M, Stephenson TP. The fate of the 'modern' artificial urinary sphincter with a follow-up of more than 10 years. *Br J Urol*. May 1997;79(5):713-716.
130. Brito CG, Mulcahy JJ, Mitchell ME, Adams MC. Use of a double cuff AMS800 urinary sphincter for severe stress incontinence. *J Urol*. Feb 1993;149(2):283-285.
131. DiMarco DS, Elliott DS. Tandem cuff artificial urinary sphincter as a salvage procedure following failed primary sphincter placement for the treatment of post-prostatectomy incontinence. *J Urol*. Oct 2003;170(4 Pt 1):1252-1254.

132. Guralnick ML, Miller E, Toh KL, Webster GD. Transcorporal artificial urinary sphincter cuff placement in cases requiring revision for erosion and urethral atrophy. *J Urol*. May 2002;167(5):2075-2078; discussion 2079.

133. Kowalczyk JJ, Spicer DL, Mulcahy JJ. Erosion rate of the double cuff AMS800 artificial urinary sphincter: long-term followup. *J Urol*. Oct 1996;156(4):1300-1301.

134. O'Connor RC, Gerber GS, Avila D, Chen AA, Bales GT. Comparison of outcomes after single or DOUBLE-CUFF artificial urinary sphincter insertion. *Urology*. Oct 2003;62(4):723-726.

135. Manunta A, Guille F, Patard JJ, Lobel B. Artificial sphincter insertion after radiotherapy: is it worthwhile? *BJU Int*. Mar 2000;85(4):490-492.

136. McConnell JD, Barry MJ, Bruskewitz RC, et al. *Benign prostatic hyperplasia: diagnosis and treatment. Clinical practice guidelines, No. 8*. Rockville, MD: Agency for Health Care Policy and Research, Public health service, US department of Health and Human Services; 1994. AHPCR Publication No.94-0582.

137. Herschorn S, Boccon-Gibod L, Bosch JL, et al. Surgical treatment of urinary incontinence in men. In: Abrams P, Khoury S, Wein A, eds. *First International Consultation on Urinary Incontinence*. Plymouth, U.K.: Health Publications Ltd.; 1999:691-729.

138. Scott FB. The artificial urinary sphincter: experience in adults. *Urol Clin North Am*. 1989;16:105.

139. Schreiter F. Operative Therapie der Harninkontinenz des Mannes. *Urologe*. 1991;[A] 30:223.

140. Frangenheim P. Zur operativen Behandlung der Inkontinenz der männlichen Harnröhre. *Verh. Dtsch. Ges. Chir.* 1914;43:149.

141. Godbole P, Mackinnon AE. Expanded PTFE bladder neck slings for incontinence in children: the long-term outcome. *BJU Int*. Jan 2004;93(1):139-141.

142. Thuroff JW, Hohenfellner M, Schultz-Lampel D. Die Harninkontinenz des Mannes. Faszienzügelplastik zur Therapie der Streßinkontinenz. *Akt. Urol*. 1992;23:149.

143. Cespedes RD, Jacoby K. Male slings for postprostatectomy incontinence. *Tech Urol*. Jun 2001;7(2):176-183.

144. Sousa-Escandon A, Rodriguez Gomez JI, Uribarri Gonzalez C, Marques-Queimadelos A. Externally readjustable sling for treatment of male stress urinary incontinence: points of technique and preliminary results. *J Endourol*. Feb 2004;18(1):113-118.

145. Drach GW, Griebling TL. Geriatric urology. *J Am Geriatr Soc*. Jul 2003;51(7 Suppl):S355-358.

146. Peyromaure M, Ravery V, Boccon-Gibod L. The management of stress urinary incontinence after radical prostatectomy. *BJU Int*. Jul 2002;90(2):155-161.

147. Tse V, Stone AR. Incontinence after prostatectomy: the artificial urinary sphincter. *BJU Int*. Dec 2003;92(9):886-889.

148. Walsh IK, Williams SG, Mahendra V, Nambirajan T, Stone AR. Artificial urinary sphincter implantation in the irradiated patient: safety, efficacy and satisfaction. *BJU Int*. Mar 2002;89(4):364-368.

149. Petrou SP, Elliott DS, Barrett DM. Artificial urethral sphincter for incontinence. *Urology*. Sep 1 2000;56(3):353-359.

150. Iselin CE. Periurethral collagen injections for incontinence following radical prostatectomy: does the patient benefit? *Curr Opin Urol*. May 1999;9(3):209-212.

151. Resnick NM, Elbadawi A, Yalla SV. Age and the lower urinary tract: What is normal? *Neurourol Urodyn*. 1995;14:577-579.

152. Lawton CA, Won M, Pilepich MV, et al. Long-term treatment sequelae following external beam irradiation for adenocarcinoma of the prostate: analysis of RTOG studies 7506 and 7706. *Int J Radiat Oncol Biol Phys*. Sep 1991;21(4):935-939.

153. Perez CA, Lee HK, Georgiou A, Lockett MA. Technical factors affecting morbidity in definitive irradiation for localized carcinoma of the prostate. *Int J Radiat Oncol Biol Phys*. Mar 1 1994;28(4):811-819.

154. Shipley WU, Zietman AL, Hanks GE, et al. Treatment related sequelae following external beam radiation for prostate cancer: a review with an update in patients with stages T1 and T2 tumor. *J Urol*. Nov 1994;152(5 Pt 2):1799-1805.

155. Weil MD, Crawford ED, Cornish P, et al. Minimal toxicity with 3-FAT radiotherapy of prostate cancer. *Semin Urol Oncol*. May 2000;18(2):127-132.

156. Hanlon AL, Watkins Bruner D, Peter R, Hanks GE. Quality of life study in prostate cancer patients treated with three-dimensional conformal radiation therapy: comparing late bowel and bladder quality of life symptoms to that of the normal population. *Int J Radiat Oncol Biol Phys*. Jan 1 2001;49(1):51-59.

157. Sandhu AS, Zelefsky MJ, Lee HJ, Lombardi D, Fuks Z, Leibel SA. Long-term urinary toxicity after 3-dimensional conformal radiotherapy for prostate cancer in patients with prior history of transurethral resection. *Int J Radiat Oncol Biol Phys*. Oct 1 2000;48(3):643-647.

158. Scalliet PG, Remouchamps V, Curran D, et al. Retrospective analysis of results of p(65)+Be neutron therapy for treatment of prostate adenocarcinoma at the cyclotron of Louvain-la-Leuve. Part II: Side effects and their influence on quality of life measured with QLQ-C30 of EORTC. *Int J Radiat Oncol Biol Phys*. Apr 1 2004;58(5):1549-1561.

159. Fransson P, Bergstrom P, Lofroth PO, Widmark A. Prospective evaluation of urinary and intestinal side effects after BeamCath stereotactic dose-escalated radiotherapy of prostate cancer. *Radiother Oncol*. Jun 2002;63(3):239-248.

160. Jonler M, Ritter MA, Brinkmann R, Messing EM, Rhodes PR, Bruskewitz RC. Sequelae of definitive radiation therapy for prostate cancer localized to the pelvis. *Urology*. Dec 1994;44(6):876-882.

161. Green N, Treible D, Wallack H. Prostate cancer: post-irradiation incontinence. *J Urol*. Aug 1990;144(2 Pt 1):307-309.

162. Lee WR, Schultheiss TE, Hanlon AL, Hanks GE. Urinary incontinence following external-beam radiotherapy for clinically localized prostate cancer. *Urology*. Jul 1996;48(1):95-99.

163. Petrovich Z, Lieskovsky G, Langholz B, et al. Comparison of outcomes of radical prostatectomy with and without adjuvant pelvic irradiation in patients with pathologic stage C (T3N0) adenocarcinoma of the prostate. *Am J Clin Oncol*. Aug 1999;22(4):323-331.

164. Petrovich Z, Lieskovsky G, Langholz B, Jozsef G, Streeter OE, Jr., Skinner DG. Postoperative radiotherapy in 423 patients with pT3N0 prostate cancer. *Int J Radiat Oncol Biol Phys*. Jul 1 2002;53(3):600-609.

165. Ornstein DK, Oh J, Herschman JD, Andriole GL. Evaluation and management of the man who has failed primary curative therapy for prostate cancer. *Urol Clin North Am*. Nov 1998;25(4):591-601.

166. Rogers E, Ohori M, Kassabian VS, Wheeler TM, Scardino PT. Salvage radical prostatectomy: outcome measured by serum prostate specific antigen levels. *J Urol*. Jan 1995;153(1):104-110.

167. Wang Y, Hadley HR. Experiences with the artificial urinary sphincter in the irradiated patient. *J Urol*. Mar 1992;147(3):612-613.

168. Gundian JC, Barrett DM, Parulkar BG. Mayo Clinic experience with the AS800 artificial urinary sphincter for urinary incontinence after transurethral resection of prostate or open prostatectomy. *Urology*. Apr 1993;41(4):318-321.

169. Venn SN, Greenwell TJ, Mundy AR. The long-term outcome of

artificial urinary sphincters. *J Urol*. Sep 2000;164(3 Pt 1):702-706; discussion 706-707.

170. Faerber GJ, Richardson TD. Long-term results of transurethral collagen injection in men with intrinsic sphincter deficiency. *J Endourol*. Aug 1997;11(4):273-277.
171. Bevan-Thomas R, Wesley OL, Cespedes RD, al. e. Long-term follow-up of periurethral collagen injections for male intrinsic deficiency. *J Urol*. 1999;161:257 (Abstr.).
172. Griebling TL, Kreder KJ, Jr., Williams RD. Transurethral collagen injection for treatment of postprostatectomy urinary incontinence in men. *Urology*. Jun 1997;49(6):907-912.
173. Elsergany R, Ghoniem GM. Collagen injection for intrinsic sphincteric deficiency in men: a reasonable option in selected patients. *J Urol*. May 1998;159(5):1504-1506.
174. Martins FE, Bennett CJ, Dunn M, Filho D, Keller T, Lieskovsky G. Adverse prognostic features of collagen injection therapy for urinary incontinence following radical retropubic prostatectomy. *J Urol*. Nov 1997;158(5):1745-1749.
175. Beyer C, Priestly JB. Biochemical disease-free survival following 1-125 prostate implantation. *Int J Radiat Oncol Biol Phys*. 1995;32:254 (abstr.).
176. Blasko JC, Ragde H, Grimm PD. Transperineal ultrasound-guided implantation of the prostate: morbidity and complications. *Scand J Urol Nephrol Suppl*. 1991;137:113-118.
177. Stock RG, Stone NN, Dewyngaert JK. PSA findings and biopsy results following interactive ultrasound guided transperineal brachtherapy for early stage prostate cancer. Paper presented at: Proceedings of the American Radium Society 78th Annual Meeting, 1995; Paris, France.
178. Wallner K, Roy J, Zelefsky M, Fuks Z, Harrison L. Fluoroscopic visualization of the prostatic urethra to guide transperineal prostate implantation. *Int J Radiat Oncol Biol Phys*. Jul 1 1994;29(4):863-867.
179. Kaye KW, Olson DJ, Payne JT. Detailed preliminary analysis of 125iodine implantation for localized prostate cancer using percutaneous approach. *J Urol*. Mar 1995;153(3 Pt 2):1020-1025.
180. Blasko JC, Ragde H, Luse RW, Sylvester JE, Cavanagh W, Grimm PD. Should brachytherapy be considered a therapeutic option in localized prostate cancer? *Urol Clin North Am*. Nov 1996;23(4):633-650.
181. Hu K, Wallner K. Urinary incontinence in patients who have a TURP/TUIP following prostate brachytherapy. *Int J Radiat Oncol Biol Phys*. Mar 1 1998;40(4):783-786.
182. Benoit RM, Naslund MJ, Cohen JK. Complications after prostate brachytherapy in the Medicare population. *Urology*. Jan 2000;55(1):91-96.
183. Merrick GS, Butler WM, Lief JH, Dorsey AT. Temporal resolution of urinary morbidity following prostate brachytherapy. *Int J Radiat Oncol Biol Phys*. Apr 1 2000;47(1):121-128.
184. Crook J, Lukka H, Klotz L, Bestic N, Johnston M. Systematic overview of the evidence for brachytherapy in clinically localized prostate cancer. *Cmaj*. Apr 3 2001;164(7):975-981.
185. Talcott JA, Clark JA, Stark PC, Mitchell SP. Long-term treatment related complications of brachytherapy for early prostate cancer: a survey of patients previously treated. *J Urol*. Aug 2001;166(2):494-499.
186. Grills IS, Martinez AA, Hollander M, et al. High dose rate brachytherapy as prostate cancer monotherapy reduces toxicity compared to low dose rate palladium seeds. *J Urol*. Mar 2004;171(3):1098-1104.
187. Shinohara K, Connolly JA, Presti JC, Jr., Carroll PR. Cryosurgical treatment of localized prostate cancer (stages T1 to T4): preliminary results. *J Urol*. Jul 1996;156(1):115-120; discussion 120-111.
188. Bahn DK, Lee F, Solomon MH, Gontina H, Klionsky DL, Lee FT, Jr. Prostate cancer: US-guided percutaneous cryoablation. Work in progress. *Radiology*. Feb 1995;194(2):551-556.
189. Cox RL, Crawford ED. Complications of cryosurgical ablation of the prostate to treat localized adenocarcinoma of the prostate. *Urology*. Jun 1995;45(6):932-935.
190. Wieder J, Schmidt JD, Casola G, vanSonnenberg E, Stainken BF, Parsons CL. Transrectal ultrasound-guided transperineal cryoablation in the treatment of prostate carcinoma: preliminary results. *J Urol*. Aug 1995;154(2 Pt 1):435-441.
191. Cohen JK, Miller RJ, Rooker GM, Shuman BA. Cryosurgical ablation of the prostate: two-year prostate-specific antigen and biopsy results. *Urology*. Mar 1996;47(3):395-401.
192. Coogan CL, McKiel CF. Percutaneous cryoablation of the prostate: preliminary results after 95 procedures. *J Urol*. Nov 1995;154(5):1813-1817.
193. Sosa ER, Martin T, Lynn K. Cryosurgical treatment of prostate cancer: a multicenter review of compilations. *J Urol*. 1996;155:361 (Abstr.).
194. Long JP, Fallick ML, LaRock DR, Rand W. Preliminary outcomes following cryosurgical ablation of the prostate in patients with clinically localized prostate carcinoma. *J Urol*. Feb 1998;159(2):477-484.
195. Pisters LL, von Eschenbach AC, Scott SM, et al. The efficacy and complications of salvage cryotherapy of the prostate. *J Urol*. Mar 1997;157(3):921-925.
196. Derakhshani P, Neubauer S, Braun M, Zumbe J, Heidenreich A, Engelmann U. Cryoablation of localized prostate cancer. Experience in 48 cases, PSA and biopsy results. *Eur Urol*. Sep 1998;34(3):181-187.
197. Long JP, Bahn D, Lee F, Shinohara K, Chinn DO, Macaluso JN, Jr. Five-year retrospective, multi-institutional pooled analysis of cancer-related outcomes after cryosurgical ablation of the prostate. *Urology*. Mar 2001;57(3):518-523.
198. de la Taille A, Hayek O, Benson MC, et al. Salvage cryotherapy for recurrent prostate cancer after radiation therapy: the Columbia experience. *Urology*. Jan 2000;55(1):79-84.
199. Izawa JI, Ajam K, McGuire E, et al. Major surgery to manage definitively severe complications of salvage cryotherapy for prostate cancer. *J Urol*. Dec 2000;164(6):1978-1981.
200. Alcini E, Racioppi M, D'Addessi A, Menchinelli P, Grassetti F, Alcini A. Bladder replacement by detubularized ileal loop: 10 years of experience using a personal technique. *Br J Urol*. May 1996;77(5):688-693.
201. Cancrini A, De Carli P, Pompeo V, et al. Lower urinary tract reconstruction following cystectomy: experience and results in 96 patients using the orthotopic ileal bladder substitution of Studer et al. *Eur Urol*. 1996;29(2):204-209.
202. Elmajian DA, Stein JP, Skinner DG. Orthotopic urinary diversion: the Kock ileal neobladder. *World J Urol*. 1996;14(1):40-46.
203. Studer UE, Danuser H, Hochreiter W, Springer JP, Turner WH, Zingg EJ. Summary of 10 years' experience with an ileal low-pressure bladder substitute combined with an afferent tubular isoperistaltic segment. *World J Urol*. 1996;14(1):29-39.
204. Benson MC, Seaman EK, Olsson CA. The ileal ureter neobladder is associated with a high success and a low complication rate. *J Urol*. May 1996;155(5):1585-1588.
205. Abol-Enein H, Ghoneim MA. Further clinical experience with the ileal W-neobladder and a serous-lined extramural tunnel for orthotopic substitution. *Br J Urol*. Nov 1995;76(5):558-564.
206. Rogers E, Scardino PT. A simple ileal substitute bladder after radical cystectomy: experience with a modification of the Studer pouch. *J Urol*. May 1995;153(5):1432-1438.

207. Hautmann RE, Miller K, Steiner U, Wenderoth U. The ileal neobladder: 6 years of experience with more than 200 patients. *J Urol.* Jul 1993;150(1):40-45.

208. Hautmann RE, de Petriconi R, Gottfried HW, Kleinschmidt K, Mattes R, Paiss T. The ileal neobladder: complications and functional results in 363 patients after 11 years of followup. *J Urol.* Feb 1999;161(2):422-427; discussion 427-428.

209. Steven K, Poulsen AL. The orthotopic Kock ileal neobladder: functional results, urodynamic features, complications and survival in 166 men. *J Urol.* Aug 2000;164(2):288-295.

210. Abol-Enein H, Ghoneim MA. Functional results of orthotopic ileal neobladder with serous-lined extramural ureteral reimplantation: experience with 450 patients. *J Urol.* May 2001;165(5):1427-1432.

211. Carrion R, Arap S, Corcione G, et al. A multi-institutional study of orthotopic neobladders: functional results in men and women. *BJU Int.* Apr 2004;93(6):803-806.

212. O'Connor RC, Kuznetsov DD, Patel RV, Galocy RM, Steinberg GD, Bales GT. Artificial urinary sphincter placement in men after cystectomy with orthotopic ileal neobladder: continence, complications, and quality of life. *Urology.* Apr 2002; 59(4):542-545.

213. Tchetgen MB, Sanda MG, Montie JE, Faerber GJ, English S. Collagen injection for the treatment of incontinence after cystectomy and orthotopic neobladder reconstruction in women. *J Urol.* 2001;163:212 (Abstr.).

214. Herschorn S, Thijssen A, Radomski SB. The value of immediate or early catheterization of the traumatized posterior urethra. *J Urol.* Nov 1992;148(5):1428-1431.

215. Kotkin L, Koch MO. Impotence and incontinence after immediate realignment of posterior urethral trauma: result of injury or management? *J Urol.* May 1996;155(5):1600-1603.

216. Iselin CE, Webster GD. The significance of the open bladder neck associated with pelvic fracture urethral distraction defects. *J Urol.* Aug 1999;162(2):347-351.

217. Jayanthi VR, Churchill BM, McLorie GA, Khoury AE. Concomitant bladder neck closure and Mitrofanoff diversion for the management of intractable urinary incontinence. *J Urol.* Aug 1995;154(2 Pt 2):886-888.

218. Meulen T, Zambon JV, Janknegt RA. Treatment of anastomotic strictures and urinary incontinence after radical prostatectomy with urolume wallstent and AMS 800 artificial sphincter. *J Endourol.* Sep 1999;13(7):517-520.

219. Elliott DS, Boone TB. Combined stent and artificial urinary sphincter for management of severe recurrent bladder neck contracture and stress incontinence after prostatectomy: a long-term evaluation. *J Urol.* Feb 2001;165(2):413-415.

220. Woodhouse CR. The fate of the abnormal bladder in adolescence. *J Urol.* Dec 2001;166(6):2396-2400.

221. Mouriquand PD, Bubanj T, Feyaerts A, et al. Long-term results of bladder neck reconstruction for incontinence in children with classical bladder exstrophy or incontinent epispadias. *BJU Int.* Dec 2003;92(9):997-1001; discussion 1002.

222. Woodhouse CR, Redgrave NG. Late failure of the reconstructed exstrophy bladder. *Br J Urol.* Apr 1996;77(4):590-592.

223. Yerkes EB, Adams MC, Rink RC, Pope JI, Brock JW, 3rd. How well do patients with exstrophy actually void? *J Urol.* Sep 2000;164(3 Pt 2):1044-1047.

224. Gearhart JP. The exstrophy-epispadias complex in the new millennium—science, practice and policy. *J Urol.* Oct 1999;162(4):1421-1423.

225. Chan DY, Jeffs RD, Gearhart JP. Determinants of continence in the bladder exstrophy population: predictors of success? *Urology.* Apr 2001;57(4):774-777.

226. Dodson JL, Surer I, Baker LA, Jeffs RD, Gearhart JP. The newborn exstrophy bladder inadequate for primary closure: evaluation, management and outcome. *J Urol.* May 2001;165(5):1656-1659.

227. Gearhart JP. Complete repair of bladder exstrophy in the newborn: complications and management. *J Urol.* Jun 2001;165(6 Pt 2):2431-2433.

228. Ferrer FA, Tadros YE, Gearhart J. Modified Young-Dees-Leadbetter bladder neck reconstruction: new concepts about old ideas. *Urology.* Nov 2001;58(5):791-796.

229. Mesrobian HG, Kelalis PP, Kramer SA. Long-term followup of 103 patients with bladder exstrophy. *J Urol.* Apr 1988;139(4):719-722.

230. Connor JP, Hensle TW, Lattimer JK, Burbige KA. Long-term followup of 207 patients with bladder exstrophy: an evolution in treatment. *J Urol.* Sep 1989;142(3):793-795; discussion 795-796.

231. Grady RW, Mitchell ME. Complete primary repair of exstrophy. *J Urol.* Oct 1999;162(4):1415-1420.

232. El-Sherbiny MT, Hafez AT, Ghoneim MA. Complete repair of exstrophy: further experience with neonates and children after failed initial closure. *J Urol.* Oct 2002;168(4 Pt 2):1692-1694; discussion 1694.

233. Hohenfellner R, Stein R. Primary urinary diversion in patients with bladder exstrophy. *Urology.* Dec 1996;48(6):828-830.

234. Stein R, Fisch M, Black P, Hohenfellner R. Strategies for reconstruction after unsuccessful or unsatisfactory primary treatment of patients with bladder exstrophy or incontinent epispadias. *J Urol.* Jun 1999;161(6):1934-1941.

235. Hafez AT, Elsherbiny MT, Dawaba MS, Abol-Enein H, Ghoneim MA. Long-term outcome analysis of low pressure rectal reservoirs in 33 children with bladder exstrophy. *J Urol.* Jun 2001;165(6 Pt 2):2414-2417.

236. Canning DA. Bladder exstrophy: the case for primary bladder reconstruction. *Urology.* Dec 1996;48(6):831-834.

237. Capolicchio G, McLorie GA, Farhat W, Merguerian PA, Bagli DJ, Khoury AE. A population based analysis of continence outcomes and bladder exstrophy. *J Urol.* Jun 2001;165(6 Pt 2):2418-2421.

238. Hollowell JG, Hill PD, Duffy PG, Ransley PG. Evaluation and treatment of incontinence after bladder neck reconstruction in exstrophy and epispadias. *Br J Urol.* Jun 1993;71(6):743-749.

239. Diamond DA, Bauer SB, Dinlenc C, et al. Normal urodynamics in patients with bladder exstrophy: are they achievable? *J Urol.* Sep 1999;162(3 Pt 1):841-844; discussion 844-845.

240. Dave S, Grover VP, Agarwala S, Mitra DK, Bhatnagar V. Cystometric evaluation of reconstructed classical bladder exstrophy. *BJU Int.* Sep 2001;88(4):403-408.

241. Baker LA, Jeffs RD, Gearhart JP. Urethral obstruction after primary exstrophy closure: what is the fate of the genitourinary tract? *J Urol.* Feb 1999;161(2):618-621.

242. Bolduc S, Capolicchio G, Upadhyay J, Bagli DJ, Khoury AE, McLorie GA. The fate of the upper urinary tract in exstrophy. *J Urol.* Dec 2002;168(6):2579-2582; discussion 2582.

243. Austin PF, Rink RC, Lockhart JL. The gastrointestinal composite urinary reservoir in patients with myelomeningocele and exstrophy: long-term metabolic followup. *J Urol.* Sep 1999;162(3 Pt 2):1126-1128.

244. Ebert A, Schott G, Hirschfelder H, Rosch WH. Management of failed bladder exstrophy closure in adolescence and adulthood. *BJU Int.* Nov 2000;86(7):901-904.

245. Gershbaum MD, Stock JA, Hanna MK. Gracilis muscle sling for select incontinent "bladder exstrophy cripples". *J Urol.* Jun 2001;165(6 Pt 2):2422-2424.

246. Caione P, Capozza N. Endoscopic treatment of urinary incontinence in pediatric patients: 2-year experience with dextranomer/hyaluronic acid copolymer. *J Urol*. Oct 2002;168(4 Pt 2):1868-1871.

247. Nguyen HT, Baskin LS. The outcome of bladder neck closure in children with severe urinary incontinence. *J Urol*. Mar 2003;169(3):1114-1116; discussion 1116.

248. Pathak HR, Mahajan R, Ali NI, Kaul S, Andankar MG. Bladder preservation in adult classic exstrophy: early results of four patients. *Urology*. May 2001;57(5):906-910.

249. Silver RI, Gros DA, Jeffs RD, Gearhart JP. Urolithiasis in the exstrophy-epispadias complex. *J Urol*. Sep 1997;158(3 Pt 2):1322-1326.

250. Gros DA, Dodson JL, Lopatin UA, Gearhart JP, Silver RI, Docimo SG. Decreased linear growth associated with intestinal bladder augmentation in children with bladder exstrophy. *J Urol*. Sep 2000;164(3 Pt 2):917-920.

251. El-Ghoneimi A, Muller C, Guys JM, Coquet M, Monfort G. Functional outcome and specific complications of gastrocystoplasty for failed bladder exstrophy closure. *J Urol*. Sep 1998;160(3 Pt 2):1186-1189.

252. Mingin GC, Nguyen HT, Mathias RS, Shepherd JA, Glidden D, Baskin LS. Growth and metabolic consequences of bladder augmentation in children with myelomeningocele and bladder exstrophy. *Pediatrics*. Dec 2002;110(6):1193-1198.

253. Frimberger D, Lakshmanan Y, Gearhart JP. Continent urinary diversions in the exstrophy complex: why do they fail? *J Urol*. Oct 2003;170(4 Pt 1):1338-1342.

254. Smeulders N, Woodhouse CR. Neoplasia in adult exstrophy patients. *BJU Int*. May 2001;87(7):623-628.

255. Abrams P, Cardozo L, Fall M, et al. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. *Neurourol Urodyn*. 2002;21(2):167-178.

256. Ahlberg J, Edlund C, Wikkelso C, Rosengren L, Fall M. Neurological signs are common in patients with urodynamically verified "idiopathic" bladder overactivity. *Neurourol Urodyn*. 2002;21(1):65-70.

257. Turner-Warwick R. Observations upon techniques for reconstruction of the urethral meatus, the hypospadiac glans deformity and the penile urethra. *Urol Clin North Am*. Oct 1979;6(3):643-655.

258. Abrams P. Bladder instability: concept, clinical associations and treatment. *Scand J Urol Nephrol Suppl*. 1984;87:7-12.

259. Malone-Lee JG. New data on urodynamics in the symptomatic elderly. *Neurourol Urodyn*. 1990;9:409.

260. Chai TC, Gray ML, Steers WD. The incidence of a positive ice water test in bladder outlet obstructed patients: evidence for bladder neural plasticity. *J Urol*. Jul 1998;160(1):34-38.

261. Cruz F, Guimaraes M, Silva C, Rio ME, Coimbra A, Reis M. Desensitization of bladder sensory fibers by intravesical capsaicin has long lasting clinical and urodynamic effects in patients with hyperactive or hypersensitive bladder dysfunction. *J Urol*. Feb 1997;157(2):585-589.

262. Kuo HC. Effectiveness of intravesical resiniferatoxin for anticholinergic treatment refractory detrusor overactivity due to nonspinal cord lesions. *J Urol*. Sep 2003;170(3):835-839.

263. Palma PCR, Thiel M, Riccetto CLZ, Dambros M, Miyaoka R, Rodriguez Netto Jr N. Resiniferatoxin for detrusor instability refractory to anticholinergics. *Int Brazilian J Urol*. 2004;30:53-58.

264. Rios M, Mattos J, D., Panhoca R, al. e. Intravesical resiniferatoxin for the treatment of idiopathic detrusor overactivity in women: a randomized double-blind placebo controlled study. *Neurourol Urodyn*. 2004;23(5-6):Abstr.

265. Silva C, Ribeiro MJ, Cruz F. The effect of intravesical resiniferatoxin in patients with idiopathic detrusor instability suggests that involuntary detrusor contractions are triggered by C-fiber input. *J Urol*. Aug 2002;168(2):575-579.

266. Harper M, Popat RB, Dasgupta R, Fowler CJ, Dasgupta P. A minimally invasive technique for outpatient local anaesthetic administration of intradetrusor botulinum toxin in intractable detrusor overactivity. *BJU Int*. Aug 2003;92(3):325-326.

267. Loch A, Loch T, Osterhage J, al. e. Botulinum-A toxin detrusor injection in the treatment of non-neurogenic and neurologic cases of urge incontinence. *Eur Urol Suppl*. February, 2003 2003;2(1):172.

268. Radziszewski P, Borkowski A. Botulinum toxin type A intravesical injections for intractable bladder overactivity. *Eur Urol Suppl*. 2002;1(1):174.

269. Rapp DE, Lucioni A, Katz EE, O'Connor RC, Gerber GS, Bales GT. Use of botulinum-A toxin for the treatment of refractory overactive bladder symptoms: an initial experience. *Urology*. Jun 2004;63(6):1071-1075.

270. Kuo HC. Urodynamic evidence of effectiveness of botulinum A toxin injection in treatment of detrusor overactivity refractory to anticholinergic agents. *Urology*. May 2004;63(5):868-872.

271. Chancellor MB, O'Leary M, Erickson J, al. e. Successful use of bladder botulinum toxin injection to treat refractory overactive bladder. *J Urol*. 2003;169 (suppl.):351 (Abstr. DP350).

272. Wyndaele JJ, Van Dromme SA. Muscular weakness as side effect of botulinum toxin injection for neurogenic detrusor overactivity. *Spinal Cord*. Nov 2002;40(11):599-600.

273. Pistolesi D, Selli C, Rossi B, Stampacchia G. Botulinum toxin type B for type A resistant bladder spasticity. *J Urol*. Feb 2004;171(2 Pt 1):802-803.

274. Reitz A, Schurch B. Botulinum toxin type B injection for management of type A resistant neurogenic detrusor overactivity. *J Urol*. Feb 2004;171(2 Pt 1):804; discussion 804-805.

275. Denys P, Even-Schneider A, Thiry Escudie I, Ben Smail D, Ayoub N, Chartier-Kastler E. [Efficacy of botulinum toxin A for the treatment of detrusor hyperreflexia]. *Ann Readapt Med Phys*. Jul 2003;46(6):326-328.

276. Schulte-Baukloh H, Michael T, Sturzebecher B, Knispel HH. Botulinum-a toxin detrusor injection as a novel approach in the treatment of bladder spasticity in children with neurogenic bladder. *Eur Urol*. Jul 2003;44(1):139-143.

277. Riccabona M, Koen M, Schindler M, et al. Botulinum-A toxin injection into the detrusor: a safe alternative in the treatment of children with myelomeningocele with detrusor hyperreflexia. *J Urol*. Feb 2004;171(2 Pt 1):845-848; discussion 848.

278. Giannantoni A, Di Stasi SM, Stephen RL, Bini V, Costantini E, Porena M. Intravesical resiniferatoxin versus botulinum-A toxin injections for neurogenic detrusor overactivity: a prospective randomized study. *J Urol*. Jul 2004;172(1):240-243.

279. Godec C, Cass AS, Ayala GF. Electrical stimulation for incontinence. Technique, selection, and results. *Urology*. Apr 1976;7(4):388-397.

280. Tanagho E. Concepts of neuromodulation. *Neurourol Urodyn*. 1993;12:487-488.

281. Trsinar B, Kraij B. Maximal electrical stimulation in children with unstable bladder and nocturnal enuresis and/or daytime incontinence: a controlled study. *Neurourol Urodyn*. 1996;15(2):133-142.

282. Primus G, Kramer G. Maximal external electrical stimulation for treatment of neurogenic or non-neurogenic urgency and/or urge incontinence. *Neurourol Urodyn*. 1996;15(3):187-194.

283. Fall M. Does electrostimulation cure urinary incontinence? *J Urol*. Apr 1984;131(4):664-667.

284. McGuire EJ, Zhang SC, Horwinski ER, Lytton B. Treatment of motor and sensory detrusor instability by electrical stimulation. *J Urol*. Jan 1983;129(1):78-79.

285. Siegel SW, Richardson DA, Miller KL, et al. Pelvic floor electrical stimulation for the treatment of urge and mixed urinary incontinence in women. *Urology*. Dec 1997;50(6):934-940.

286. Merrill DC. The treatment of detrusor incontinence by electrical stimulation. *J Urol*. Oct 1979;122(4):515-517.

287. Nakamura M, Sakurai T, Tsujimoto Y, Tada Y. Bladder inhibition by electrical stimulation of the perianal skin. *Urol Int*. 1986;41(1):62-63.

288. Nakamura M, Sakurai T, Sugao H, Sonoda T. Maximum electrical stimulation for urge incontinence. *Urol Int*. 1987;42(4):285-287.

289. Dijkema HE, Weil EH, Mijs PT, Janknegt RA. Neuromodulation of sacral nerves for incontinence and voiding dysfunctions. Clinical results and complications. *Eur Urol*. 1993;24(1):72-76.

290. Schmidt RA. Treatment of unstable bladder. *Urology*. Jan 1991;37(1):28-32.

291. Bosch JL, Groen J. Sacral (S3) segmental nerve stimulation as a treatment for urge incontinence in patients with detrusor instability: results of chronic electrical stimulation using an implantable neural prosthesis. *J Urol*. Aug 1995;154(2 Pt 1):504-507.

292. Bosch JL, Groen J. Disappointing results of neuromodulation in men with urge incontinence due to detrusor instability. *Neurourol Urodyn*. 1997;16:347-349.

293. Shaker HS, Hassouna M. Sacral nerve root neuromodulation: an effective treatment for refractory urge incontinence. *J Urol*. May 1998;159(5):1516-1519.

294. Hassouna MM, Siegel SW, Nyeholt AA, et al. Sacral neuromodulation in the treatment of urgency-frequency symptoms: a multicenter study on efficacy and safety. *J Urol*. Jun 2000;163(6):1849-1854.

295. Edlund C, Hellstrom M, Peeker R, Fall M. First Scandinavian experience of electrical sacral nerve stimulation in the treatment of the overactive bladder. *Scand J Urol Nephrol*. Dec 2000;34(6):366-376.

296. Schmidt RA, Jonas U, Oleson KA, et al. Sacral nerve stimulation for treatment of refractory urinary urge incontinence. Sacral Nerve Stimulation Study Group. *J Urol*. Aug 1999;162(2):352-357.

297. Weil EH, Ruiz-Cerda JL, Eerdmans PH, Janknegt RA, Bemelmans BL, van Kerrebroeck PE. Sacral root neuromodulation in the treatment of refractory urinary urge incontinence: a prospective randomized clinical trial. *Eur Urol*. Feb 2000;37(2):161-171.

298. Bosch JL, Groen J. Sacral nerve neuromodulation in the treatment of patients with refractory motor urge incontinence: long-term results of a prospective longitudinal study. *J Urol*. Apr 2000;163(4):1219-1222.

299. Siegel SW, Catanzaro F, Dijkema HE, et al. Long-term results of a multicenter study on sacral nerve stimulation for treatment of urinary urge incontinence, urgency-frequency, and retention. *Urology*. Dec 4 2000;56(6 Suppl 1):87-91.

300. Grunewald V, Hofner K, Thon WF, Kuczyk MA, Jonas U. Sacral electrical neuromodulation as an alternative treatment option for lower urinary tract dysfunction. *Restor Neurol Neurosci*. 1999;14(2-3):189-193.

301. Aboseif S, Tamaddon K, Chalfin S, Freedman S, Kaptein J. Sacral neuromodulation as an effective treatment for refractory pelvic floor dysfunction. *Urology*. Jul 2002;60(1):52-56.

302. Hedlund H, Schultz A, Talseth T, Tonseth K, van der Hagen A. Sacral neuromodulation in Norway: clinical experience of the first three years. *Scand J Urol Nephrol Suppl*. 2002(210):87-95.

303. Roupret M, Chartier-Kastler E, Almeras C, Ayoub N, Haertig A, Richard F. Sacral neuromodulation for refractory detrusor overactivity in women with an artificial urinary sphincter. *J Urol*. Jul 2004;172(1):236-239.

304. Abrams P, Blaivas JG, Fowler CJ, et al. The role of neuromodulation in the management of urinary urge incontinence. *BJU Int*. Mar 2003;91(4):355-359.

305. Diokno AC, Leu PB, Konstandt DB. A simplified method of implanting a neuromodulator device. *J Urol*. Apr 2003;169(4):1466-1469.

306. Swami KS, Feneley RC, Hammonds JC, Abrams P. Detrusor myectomy for detrusor overactivity: a minimum 1-year follow-up. *Br J Urol*. Jan 1998;81(1):68-72.

307. Leng WW, Blalock HJ, Fredriksson WH, English SF, McGuire EJ. Enterocystoplasty or detrusor myectomy? Comparison of indications and outcomes for bladder augmentation. *J Urol*. Mar 1999;161(3):758-763.

308. Hasan ST, Marshall C, Robson WA, Neal DE. Clinical outcome and quality of life following enterocystoplasty for idiopathic detrusor instability and neurogenic bladder dysfunction. *Br J Urol*. Nov 1995;76(5):551-557.

309. McInerney PD, DeSouza N, Thomas PJ, Mundy AR. The role of urodynamic studies in the evaluation of patients with augmentation cystoplasties. *Br J Urol*. Oct 1995;76(4):475-478.

310. Bramble FJ. The treatment of adult enuresis and urge incontinence by enterocystoplasty. *Br J Urol*. Dec 1982;54(6):693-696.

311. Sethia KK, Webb RJ, Neal DE. Urodynamic study of ileocystoplasty in the treatment of idiopathic detrusor instability. *Br J Urol*. Mar 1991;67(3):286-290.

312. Mundy AR, Stephenson TP. "Clam" ileocystoplasty for the treatment of refractory urge incontinence. *Br J Urol*. Dec 1985;57(6):641-646.

313. Edlund C, Peeker R, Fall M. Clam ileocystoplasty: successful treatment of severe bladder overactivity. *Scand J Urol Nephrol*. Jun 2001;35(3):190-195.

314. Shokeir AA, Ibrahim AM, Hamid MY, Shalaby MA, Hussein HE, Badr M. Urinary bilharziasis in upper Egypt. I. A clinicopathological study. *East Afr Med J*. Apr 1972;49(4):298-311.

315. Smith RB, van Cangh P, Skinner DG, Kaufman JJ, Goodwin WE. Augmentation enterocystoplasty: a critical review. *J Urol*. Jul 1977;118(1 Pt 1):35-39.

316. Kerr WK, Gale GL, Peterson KS. Reconstructive surgery for genitourinary tuberculosis. *J Urol*. Mar 1969;101(3):254-266.

317. Zinman L, Libertino JA. Technique of augmentation cecocystoplasty. *Surg Clin North Am*. Jun 1980;60(3):703-710.

318. Dounis A, Abel BJ, Gow JG. Cecocystoplasty for bladder augmentation. *J Urol*. Feb 1980;123(2):164-167.

319. Lunghi F, Nicita G, Selli C, Rizzo M. Clinical aspects of augmentation enterocystoplasties. *Eur Urol*. 1984;10(3):159-163.

320. Shawket TN, Muhsen J. Treatment of bilharzial-contracted bladder by ileocystoplasty or colocystoplasty. *J Urol*. Feb 1967;97(2):285-287.

321. Whitmore WF, 3rd, Gittes RF. Reconstruction of the urinary tract by cecal and ileocecal cystoplasty: review of a 15-year experience. *J Urol*. Mar 1983;129(3):494-498.

322. Chan SL, Ankenman GJ, Wright JE, McLoughlin MG. Cecocystoplasty in the surgical management of the small contracted bladder. *J Urol*. Sep 1980;124(3):338-340.

323. Shirley SW, Mirelman S. Experiences with colocystoplasties, cecocystoplasties and ileocystoplasties in urologic surgery: 40 patients. *J Urol*. Aug 1978;120(2):165-168.

324. Goodwin WE, Turner RD, Winter CC. Results of ileocystoplasty. *J Urol*. Dec 1958;80(6):461-466.

325. Winter CC, Goodwin WE. Results sigmoidocystoplasty. *J Urol*. Dec 1958;80(6):467-472.

326. Fall M, Nilsson S. Volume augmentation cystoplasty and persistent urgency. *Scand J Urol Nephrol*. 1982;16(2):125-128.

327. Goldwasser B, Webster GD. Augmentation and substitution enterocystoplasty. *J Urol*. Feb 1986;135(2):215-224.

328. Weinberg AC, Boyd SD, Lieskovsky G, Ahlering TE, Skinner DG. The hemi-Kock augmentation ileocystoplasty: a low pressure anti-refluxing system. *J Urol*. Dec 1988;140(6):1380-1384.

329. Novak R. [Surgical treatment of contracted tuberculous bladder]. *Plucne Bolesti Tuberk*. Apr-Jun 1969;21(2):109-114.

330. Sayegh ES, Dimmette RM. The fibrotic contracted urinary bladder associated with schistosomiasis and chronic ulceration: a clinicopathological study including treatment. *J Urol*. Apr 1956;75(4):671-679.

331. Beduk Y, Anafarta K, Baltaci S, Adsan O, Iskit N. Urinary tract reconstruction in a patient with urethral stricture, contracted bladder and erectile impotence. *Int Urol Nephrol*. 1994;26(2):173-178.

332. Kuo HC. Clinical outcome and quality of life after enterocystoplasty for contracted bladders. *Urol Int*. 1997;58(3):160-165.

333. Kawamura S, Kumasaka K, Noro K, Aoki H, Kubo T, Abe T. [A case of replacement ileocystoplasty for contracted bladder]. *Hinyokika Kiyo*. Sep 1991;37(9):1049-1052.

334. Hradec EA. Bladder substitution: indications and results in 114 operations. *J Urol*. Oct 1965;94(4):406-417.

335. Lima SV, Araujo LA, Montoro M, Maciel A, Vilar FO. The use of demucosalized bowel to augment small contracted bladders. *Br J Urol*. Sep 1998;82(3):436-439.

336. el Otmany A, Hamada H, al Bouzidi A, et al. [Squamous cell carcinoma in an augmentation of the ilial bladder for tuberculosis]. *Prog Urol*. Jun 1999;9(3):534-536.

337. Yamada Y, Takenaka A, Gotoh K, Yamanaka N. Augmentation ileocystoplasty and ileal ureter replacement for distal ureteral cancer in a patient with a contracted bladder. *Int J Urol*. Sep 1999;6(9):475-478.

338. Miyano G, Yamataka A, Okada Y, et al. Sigmoidocolocystoplasty for augmentation of iatrogenic small capacity bladder caused by direct injury to the bladder during inguinal hernia repair: long-term follow-up. *Pediatr Surg Int*. Jan 2004;20(1):61-64.

339. Tash JA, Eid JF. Urethrocutaneous fistula due to a retained ring of condom. *Urology*. Sep 1 2000;56(3):508.

340. Porter AT, Littrup P, Grignon D, al. e. Radiotherapy and Cryotherapy for Prostate Cancer. In: Walsh PC, Retik AB, Vaughan Jr ED, Wein AJ, eds. *Campbell's Urology*. 7th ed. Philadelphia: W.B. Saunders Co.; 1998:2605-2606.

341. Thomas R, Davis R, Ahuja S. Toward out-patient radical prostatectomy: a cost effective cost management of patients with localized prostate cancer. *BJU Int*. 1997;80(2):261.

342. Fahal AH, Sharfi AR, Sheik HE, el Hassan AM, Mahgoub ES. Internal fistula formation: an unusual complication of mycetoma. *Trans R Soc Trop Med Hyg*. Sep-Oct 1996;90(5):550-552.

343. Chiou RK, Anderson JC, Tran T, Patterson RH, Wobig R, Taylor RJ. Evaluation of urethral strictures and associated abnormalities using high-resolution and color Doppler ultrasound. *Urology*. Jan 1996;47(1):102-107.

344. Blandy JP, Singh M. Fistulae involving the adult male urethra. *Br J Urol*. Dec 1972;44(6):632-643.

345. Culp OS, Calhoon HW. A Variety of Rectourethral Fistulas: Experiences with 20 Cases. *J Urol*. May 1964;91:560-571.

346. Endo M, Hayashi A, Ishihara M, et al. Analysis of 1,992 patients with anorectal malformations over the past two decades in Japan. Steering Committee of Japanese Study Group of Anorectal Anomalies. *J Pediatr Surg*. Mar 1999;34(3):435-441.

347. Rintala RJ, Lindahl HG. Posterior sagittal anorectoplasty is superior to sacroperineal-sacroabdominoperineal pull-through: a long-term follow-up study in boys with high anorectal anomalies. *J Pediatr Surg*. Feb 1999;34(2):334-337.

348. Badalament RA, Bahn DK, Kim H, Kumar A, Bahn JM, Lee F. Patient-reported complications after cryoablation therapy for prostate cancer. *Urology*. Aug 1999;54(2):295-300.

349. Benchekroun A, Lachkar A, Soumana A, et al. [Urethrorectal fistula. Report of 11 cases]. *Ann Urol (Paris)*. 1999;33(2):93-96.

350. Smith AM, Veenema RJ. Management of rectal injury and rectourethral fistulas following radical retropubic prostatectomy. *J Urol*. Nov 1972;108(5):778-779.

351. Tiptaft RC, Motson RW, Costello AJ, Paris AM, Blandy JP. Fistulae involving rectum and urethra: the place of Parks's operations. *Br J Urol*. Dec 1983;55(6):711-715.

352. Noldus J, Graefen M, Huland H. An old technique for a new approach for repair of rectourinary fistulas. *J Urol*. 1997;157 (Suppl.):1547.

353. Eastham JA, Scardino PT. Radical prostatectomy. In: Walsh PC, Retik AB, Vaughan Jr ED, Wein AJ, eds. *Campbell's Urology*. 7th ed. Philadelphia: W.B. Saunders Co.; 1997:2547-2564.

354. Nyam DC, Pemberton JH. Management of iatrogenic rectourethral fistula. *Dis Colon Rectum*. Aug 1999;42(8):994-997; discussion 997-999.

355. Zippe CD. Cryosurgery of the prostate: techniques and pitfalls. *Urol Clin North Am*. Feb 1996;23(1):147-163.

356. Montorsi F, Guazzoni G, Bergamaschi F, al. e. Transrectal prostatic hyperthermia and advanced prostatic cancer: Clinical results of one year follow up. *Acta Urol Ital*. 1992;6 (Suppl. ^6):471-474.

357. Kleinberg L, Wallner K, Roy J, et al. Treatment-related symptoms during the first year following transperineal 125I prostate implantation. *Int J Radiat Oncol Biol Phys*. Mar 1 1994;28(4):985-990.

358. Fengler SA, Abcarian H. The York Mason approach to repair of iatrogenic rectourinary fistulae. *Am J Surg*. Mar 1997;173(3):213-217.

359. Chang KM, Lee RC, Chiu AW, Wang JH, Chiang H. Malakoplakia of the prostate forming a fistulous tract to rectum: a case report. *Zhonghua Yi Xue Za Zhi (Taipei)*. Dec 1996;58(6):439-443.

360. Felipetto R, Vigano L, Cecchi M, Florentini L, Minervini R. Use of fibrin sealant in the treatment of prostatic cutaneous fistula in a case of Pseudomonas prostatitis. *Int Urol Nephrol*. 1995;27(5):563-565.

361. al-Ali M, Kashmoula D, Saoud IJ. Experience with 30 posttraumatic rectourethral fistulas: presentation of posterior transsphincteric anterior rectal wall advancement. *J Urol*. Aug 1997;158(2):421-424.

362. Gibbons RP. Radical perineal prostatectomy. In: Walsh PC, Retik AB, Vaughan Jr ED, Wein AJ, eds. *Campbell's Urology*. 7th ed. Philadelphia: W.B. Saunders Co.; 1997:2589-2603.

363. Turner-Warwick R. The use of the omental pedicle graft in urinary tract reconstruction. *J Urol*. Sep 1976;116(3):341-347.

364. Ryan JA, Jr., Beebe HG, Gibbons RP. Gracilis muscle flap for closure of rectourethral fistula. *J Urol*. Jul 1979;122(1):124-125.

365. Venable DD. Modification of the anterior perineal transanorectal approach for complicated prostatic urethrorectal fistula repair. *J Urol*. Aug 1989;142(2 Pt 1):381-384.

366. Stephenson RA, Middleton RG. Repair of rectourinary fistulas using a posterior sagittal transanal transrectal (modified York-Mason) approach: an update. *J Urol*. Jun 1996;155(6):1989-1991.

367. Culkin DJ, Ramsey CE. Urethrorectal fistula: transanal, transsphincteric approach with locally based pedicle interposition flaps. *J Urol*. Jun 2003;169(6):2181-2183.

368. Young HH. Repair of rectourethral fistula. In: Young HH, Davis DM, eds. *Young's Practice of Urology*. Vol 2. Philadelphia: W.B. Saunders Co.; 1926:582.

369. Lewis LG. Repair of rectourethral fistulas. *J Urol*. 1947;57:1173-1181.

370. Goodwin WE, Turner RD, Winter CC. Rectourinary fistula: principles of management and a technique of surgical closure. *J Urol*. Oct 1958;80(4):246-254.

371. Youssef AH, Fath-Alla M, El-Kassaby AW. Perineal subcutaneous dartos pedicled flap as a new technique for repairing urethrorectal fistula. *J Urol*. May 1999;161(5):1498-1500.

372. Ng L, Sorcini A, Mourtzinos A, al. e. Management of the complex rectourinary fistula with buccal mucosal patch graft and muscle flap support. *J Urol*. 2004;17 Suppl. 4:62.

373. Kilpatrick FR, Thompson HR. Post-operative rectoprostatic fistula and closure by Kraske's approach. *Br J Urol*. Dec 1962;34:470-474.

374. Kilpatrick FR, Mason AY. Post-operative recto-prostatic fistula. *Br J Urol*. Dec 1969;41(6):649-654.

375. Fournier R, Traxer O, Lande P, Tuech JJ, Vergos M. [Posterior trans-anal-sphincter approach in the management of urethro-prostate-rectal fistula]. *J Urol (Paris)*. 1996;102(2):75-78.

376. Bukowski TP, Chakrabarty A, Powell IJ, Frontera R, Perlmutter AD, Montie JE. Acquired rectourethral fistula: methods of repair. *J Urol*. Mar 1995;153(3 Pt 1):730-733.

377. Vose SN. A technique for repair of recto-urethral fistula. *J Urol*. 1949;61:790-794.

378. Parks AG, Motson RW. Peranal repair of rectoprostatic fistula. *Br J Surg*. Dec 1983;70(12):725-726.

379. Gecelter L. Transanorectal approach to the posterior urethra and bladder neck. *J Urol*. Jun 1973;109(6):1011-1016.

380. Zinman L. The challenge of the complex rectourethral fistula: algorithm of management. *AUA News*. 2003(Jan/Feb):47-48.

381. Wilbert DM, Buess G, Bichler KH. Combined endoscopic closure of rectourethral fistula. *J Urol*. Jan 1996;155(1):256-258.

382. Bardari F, D'Urso L, Muto G. Conservative treatment of iatrogenic urinary fistulas: the value of cyanoacrylic glue. *Urology*. Dec 2001;58(6):1046-1048.

383. Kraske P. Zur Extirpation hochsitzender Mastdarmkrebse. *Verh. Dtsch. Ges. Chir.* 1885;14:464-474.

384. Hata F, Yasoshima T, Kitagawa S, et al. Transanal repair of rectourethral fistula after a radical retropubic prostatectomy: report of a case. *Surg Today*. 2002;32(2):170-173.

385. Venkatesh KS, Ramanujam P. Fibrin glue application in the treatment of recurrent anorectal fistulas. *Dis Colon Rectum*. Sep 1999;42(9):1136-1139.

386. Madjar S, Raz S, Gousse AE. Fixed and dynamic urethral compression for the treatment of post-prostatectomy urinary incontinence: is history repeating itself? *J Urol*. Aug 2001;166(2):411-415.

387. Scott FB, Bradley WE, Timm GW. Treatment of urinary incontinence by implantable prosthetic sphincter. *Urology*. Mar 1973;1(3):252-259.

388. Montague DK, Angermeier KW, Paolone DR. Long-term continence and patient satisfaction after artificial sphincter implantation for urinary incontinence after prostatectomy. *J Urol*. Aug 2001;166(2):547-549.

389. Gomha MA, Boone TB. Voiding patterns in patients with post-prostatectomy incontinence: urodynamic and demographic analysis. *J Urol*. May 2003;169(5):1766-1769.

390. ter Meulen PH, Zambon V, Kessels AG, van Kerrebroeck PE. Quality of life, functional outcome and durability of the AMS 800 artificial urinary sphincter in patients with intrinsic sphincter deficiency. *Urol Int*. 2003;71(1):55-60.

391. Gonzalez R, Nguyen DH, Koleilat N, Sidi AA. Compatibility of enterocystoplasty and the artificial urinary sphincter. *J Urol*. Aug 1989;142(2 Pt 2):502-504; discussion 520-501.

392. Abdel-Azim MS, Abdel-Hakim AM. Gastrocystoplasty in patients with an areflexic low compliant bladder. *Eur Urol*. Aug 2003;44(2):260-265.

393. Grein U, Meyer WW. Local recurrent cancer after radical prostatectomy and incontinence. Is the artificial urinary sphincter a useful therapeutic option? *Urol Int*. 2001;66(1):9-12.

394. Wilson SK, Delk JR, 2nd, Henry GD, Siegel AL. New surgical technique for sphincter urinary control system using upper transverse scrotal incision. *J Urol*. Jan 2003;169(1):261-264.

395. Stone AR, Nguyen M, Tse V. Letter, re: New surgical technique for sphincterurinary control system using upper transverse scrotal incision. *J Urol*. 2003;170:550-551.

396. Murray KH, Nurse DE, Mundy AR. Detrusor behaviour following implantation of the Brantley Scott artificial urinary sphincter for neuropathic incontinence. *Br J Urol*. Feb 1988;61(2):122-128.

397. Light JK, Pietro T. Alteration in detrusor behavior and the effect on renal function following insertion of the artificial urinary sphincter. *J Urol*. Sep 1986;136(3):632-635.

398. Bauer SB, Reda EF, Colodny AH, Retik AB. Detrusor instability: a delayed complication in association with the artificial sphincter. *J Urol*. Jun 1986;135(6):1212-1215.

399. Roth DR, Vyas PR, Kroovand RL, Perlmutter AD. Urinary tract deterioration associated with the artificial urinary sphincter. *J Urol*. Mar 1986;135(3):528-530.

400. Bitsch M, Nerstrom H, Nordling J, Hald T. Upper urinary tract deterioration after implantation of artificial urinary sphincter. *Scand J Urol Nephrol*. 1990;24(1):31-34.

401. Churchill BM, Gilmour RF, Khoury AE, McLorie GA. Biological response of bladders rendered continent by insertion of artificial sphincter. *J Urol*. Oct 1987;138(4 Pt 2):1116-1119.

402. Scott FB, Fishman IJ, Shabsigh R. The impact of the artificial urinary sphincter in the neurogenic bladder on the upper urinary tracts. *J Urol*. Sep 1986;136(3):636-642.

403. Warwick DJ, Abrams P. The perineal artificial sphincter for acquired incontinence—a cut and dried solution? *Br J Urol*. Nov 1990;66(5):495-499.

404. O'Flynn KJ, Thomas DG. Artificial urinary sphincter insertion in congenital neuropathic bladder. *Br J Urol*. Feb 1991; 67 (2):155-157.

405. Aprikian A, Berardinucci G, Pike J, Kiruluta G. Experience with the AS-800 artificial urinary sphincter in myelodysplastic children. *Can J Surg*. Aug 1992;35(4):396-400.

406. Simeoni J, Guys JM, Mollard P, et al. Artificial urinary sphincter implantation for neurogenic bladder: a multi-institutional study in 107 children. *Br J Urol*. Aug 1996;78(2):287-293.

407. Ghoniem GM, Lapeyrolerie J, Sood OP, Thomas R. Tulane experience with management of urinary incontinence after placement of an artificial urinary sphincter. *World J Urol*. 1994;12(6):333-336.

408. Montague DK, Angermeier KW. Postprostatectomy urinary incontinence: the case for artificial urinary sphincter implantation. *Urology*. Jan 2000;55(1):2-4.

409. Bosch JL. The contemporary role of the artificial urinary sphincter. *Curr Opin Urol*. May 2000;10(3):219-223.

410. Light JK, Reynolds JC. Impact of the new cuff design on reliability of the AS800 artificial urinary sphincter. *J Urol*. Mar 1992;147(3):609-611.

411. Leibovich BC, Barrett DM. Use of the artificial urinary sphincter in men and women. *World J Urol*. 1997;15(5):316-319.

412. Fishman IJ, Shabsigh R, Scott FB. Experience with the artificial urinary sphincter model AS800 in 148 patients. *J Urol*. Feb 1989;141(2):307-310.

413. Marks JL, Light JK. Management of urinary incontinence after prostatectomy with the artificial urinary sphincter. *J Urol*. Aug 1989;142(2 Pt 1):302-304.

414. Elliott DS, Barrett DM, Gohma M, Boone TB. Does nocturnal deactivation of the artificial urinary sphincter lessen the risk of urethral atrophy? *Urology*. Jun 2001;57(6):1051-1054.

415. Smith DN, Fralick R, Appell RA. Incontinence after placement of a sphincter. *Urology*. Dec 1997;50(6):974.

416. Nurse DE, Mundy AR. One hundred artificial sphincters. *Br J Urol*. Apr 1988;61(4):318-325.

417. Webster GD, Sihelnik SA. Troubleshooting the malfunctioning Scott artificial urinary sphincter. *J Urol*. Feb 1984;131(2):269-272.

418. Decter RM, Roth DR, Fishman IJ, Shabsigh R, Scott FB, Gonzales ET, Jr. Use of the AS800 device in exstrophy and epispadias. *J Urol*. Nov 1988;140(5 Pt 2):1202-1203.

419. Motley RC, Barrett DM. Artificial urinary sphincter cuff erosion. Experience with reimplantation in 38 patients. *Urology*. Mar 1990;35(3):215-218.

420. Frank I, Elliott DS, Barrett DM. Success of de novo reimplantation of the artificial genitourinary sphincter. *J Urol*. Jun 2000;163(6):1702-1703.

421. Martins FE, Boyd SD. Post-operative risk factors associated with artificial urinary sphincter infection-erosion. *Br J Urol*. Mar 1995;75(3):354-358.

422. Lai HH, Smith CP, Teh BS, Butler EB, Boone TB. Pelvic radiotherapy does not increase the complication rates of artificial urinary sphincter implantation. *Int J Radiat Oncol Biol Phys*. Oct 1 2003;57(2 Suppl):S273.

423. Bartoletti R, Gacci M, Travaglini F, Sarti E, Selli C. Intravesical migration of AMS 800 artificial urinary sphincter and stone formation in a patient who underwent radical prostatectomy. *Urol Int*. 2000;64(3):167-168.

424. Laungani RG, Angermeier KW, Montague DK. Giant urethral diverticulum in an adult male: a complication of the artificial urinary sphincter. *J Urol*. Oct 2003;170(4 Pt 1):1307-1308.

425. Spiess PE, Capolicchio JP, Kiruluta G, Salle JP, Berardinucci G, Corcos J. Is an artificial sphincter the best choice for incontinent boys with Spina Bifida? Review of our long term experience with the AS-800 artificial sphincter. *Can J Urol*. Apr 2002;9(2):1486-1491.

426. Dalkin BL, Wessells H, Cui H. A national survey of urinary and health related quality of life outcomes in men with an artificial urinary sphincter for post-radical prostatectomy incontinence. *J Urol*. Jan 2003;169(1):237-239.

427. Herschorn S, Boccon-Gibod L, Bosch JL, al. e. Surgical treatment of urinary incontinence in men. In: Abrams P, Khoury S, Wein A, eds. *First International Consultation on Urinary Incontinence*. Plymouth, UK: Health Publication Ltd; 1999:691-729.

428. Kreder KJ, Webster GD. Evaluation and management of incontinence after implantation of the artificial urinary sphincter. *Urol Clin North Am*. May 1991;18(2):375-381.

429. Wahl GR. Urinary incontinence after radical prostatectomy. *Semin Urol Oncol*. 2000;18:66-70.

430. Taylor GA, Lebowitz RL. Artificial urinary sphincters in children: radiographic evaluation. *Radiology*. Apr 1985;155(1):91-97.

431. Lorentzen T, Dorph S, Hald T. Artificial urinary sphincters. Radiographic evaluation. *Acta Radiol*. Jan-Feb 1987;28(1):63-66.

432. Furness PD, 3rd, Franzoni DF, Decter RM. Bladder augmentation: does it predispose to prosthetic infection of simultaneously placed artificial genitourinary sphincters or in situ ventriculoperitoneal shunts? *BJU Int*. Jul 1999;84(1):25-29.

433. Barrett DM, Licht MR. Implantation of the artificial genitourinary sphincter in men and women. In: Walsh PC, Retik AB, Vaughan Jr ED, Wein AJ, eds. *Campbell's Urology*. 7th ed. Philadelphia: W.B. Saunders Co.; 1998:1121-1134.

434. Kabalin JN. Addition of a second urethral cuff to enhance performance of the artificial urinary sphincter. *J Urol*. Oct 1996;156(4):1302-1304.

435. Bryan DE, Mulcahy JJ, Simmons GR. Salvage procedure for infected noneroded artificial urinary sphincters. *J Urol*. Dec 2002;168(6):2464-2466.

436. Bell BB, Mulcahy JJ. Management of cuff erosion of the double cuff artificial urinary sphincter. *J Urol*. Jan 2000;163(1):85-86.

437. Hajivassiliou CA. A review of the complications and results of implantation of the AMS artificial urinary sphincter. *Eur Urol*. Jan 1999;35(1):36-44.

438. Hubner W, Trigo Rocha F, Gilling P, Sadi M, Schlarp O. International Multi-Center study assessing the safety and efficacy of the adjustable continence therapy (ProACT) for the treatment of post radical prostatectomy incontinence: preliminary results. *J Urol*. 2003;169:122 (Abstr. 473).

439. Schlarp O, Hubner W. Treatment of Postprostatectomy Incontinence - 3 Years Experience Using a New Minimal Invasive Technique. Paper presented at: XVIII Congress of the European Association of Urology (EAU), 2003; Madrid, Spain.

440. Gilling P, Hubner W, Trigo Rocha F, Sadi M, Schlarp O. International Multi-Center study evaluating the adjustable continence therapy (ProACT) for male post prostatectomy stress urinary incontinence. *J Urol*. 2004;171:132 (Abstr. 494).