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Surgery Illustrated – Surgical Atlas
The artificial genitourinary sphincter

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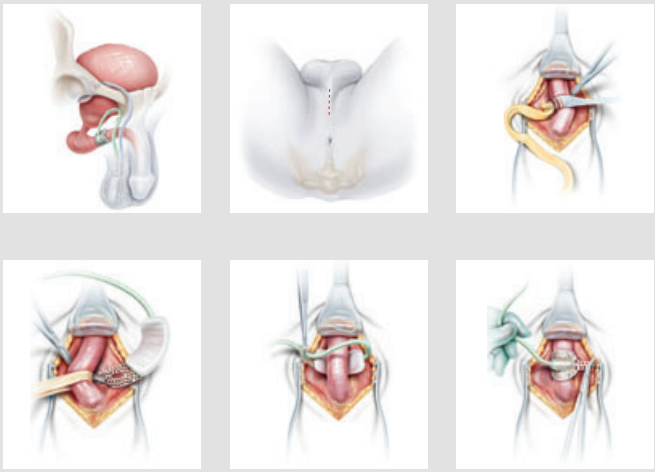

INTRODUCTION

Since its introduction by Scott in 1973, the artificial genitourinary sphincter (AUS) has proven to be an effective treatment for refractory urinary incontinence [1]. Over the years, the original AUS 721 model had many revisions to the cuff, pump and reservoir components. The most current development, the narrow back-cuff AMS 800 (American Medical Systems, Minnetonka, MN, USA), has reported continence rates of 61–96% and with low morbidity [2,3]. In this article describing the implantation of the AMS 800 AUS, our goal is to outline proper patient selection, define current surgical technique, and identify troublesome postoperative care issues.

PLANNING AND PREPARATION

The checklist for the AMS 800 is:

Before surgery

- Stable symptoms for >6 months; stress incontinence much greater than urge incontinence symptoms;
- Normal perineal/scrotal examination;
- Negative urine culture;
- Radiological or cystoscopic evidence of a patent urethra;

Surgery

- Perioperative antibiotics (ampicillin/gentamicin);
- AMS 800 components;
- Cuffs (3.5–4.5 cm bulbar, 8–14 cm bladder neck);
- Control pump;
- Balloon reservoir (51–60, 61–70, 71–80, 81–90 cmH_2O);

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- Tubing/AMS Quick Connectors/assembly tool;
- Water/contrast medium solution; 50 mL diatrizoate (Hypaque) + 60 mL water).

PATIENT SELECTION

The AMS 800 AUS is used primarily to treat symptomatic stress urinary incontinence in men, but the device can also be used to treat incontinence in women and children. All patients considering an AUS should have stable urinary symptoms for ≥6 months before implantation. Validated urinary-specific quality-of-life questionnaires, e.g. the Incontinence Impact Questionnaire 7 and Urogenital Distress Inventory 6, can be helpful in determining both the type and severity of incontinence symptoms [4].

For patients with significant urge symptoms, multichannel fluoroscopic urodynamics are performed with an occluded urethra to evaluate detrusor overactivity and bladder compliance. Patients with studies showing uninhibited detrusor contractions, abnormal compliance (<20 mL/cmH_2O), or grade >2 VUR are then treated with anticholinergics for 4 weeks and the studies repeated. AUS implantation is delayed in patients with continued abnormalities on urodynamic studies until the specific issues are addressed. Failure to treat refractory conditions might lead to lower patient satisfaction or upper urinary tract compromise.

On physical examination, patients are evaluated for sufficient manual dexterity to activate the control pump. The perineal skin is examined for cellulitis, ulcers, or fungal infections. A urine culture is obtained for all patients before surgery, and those with positive samples are treated with antibiotics before surgery. All patients should also have cystoscopy or a urethrogram taken to document a urethra patent enough to accommodate a 16 F catheter or sound.

PLANNING BEFORE SURGERY

The most common indication for AUS implantation is urinary incontinence after prostatectomy. Bulbous urethral cuffs, usually of 4.5 cm, are generally used for this condition. A bladder neck cuff, 8–14 cm, is generally indicated for treating incontinence in men with congenital or acquired anatomical urethral abnormalities. Most patients having an AUS implanted will require a 61–70 cmH_2O reservoir, independent of cuff size or location. Patients with radiation damage or previous erosions might benefit from 51–60 cmH_2O reservoirs to minimize compression on damaged urethral tissues.

PREPARATION/POSITIONING

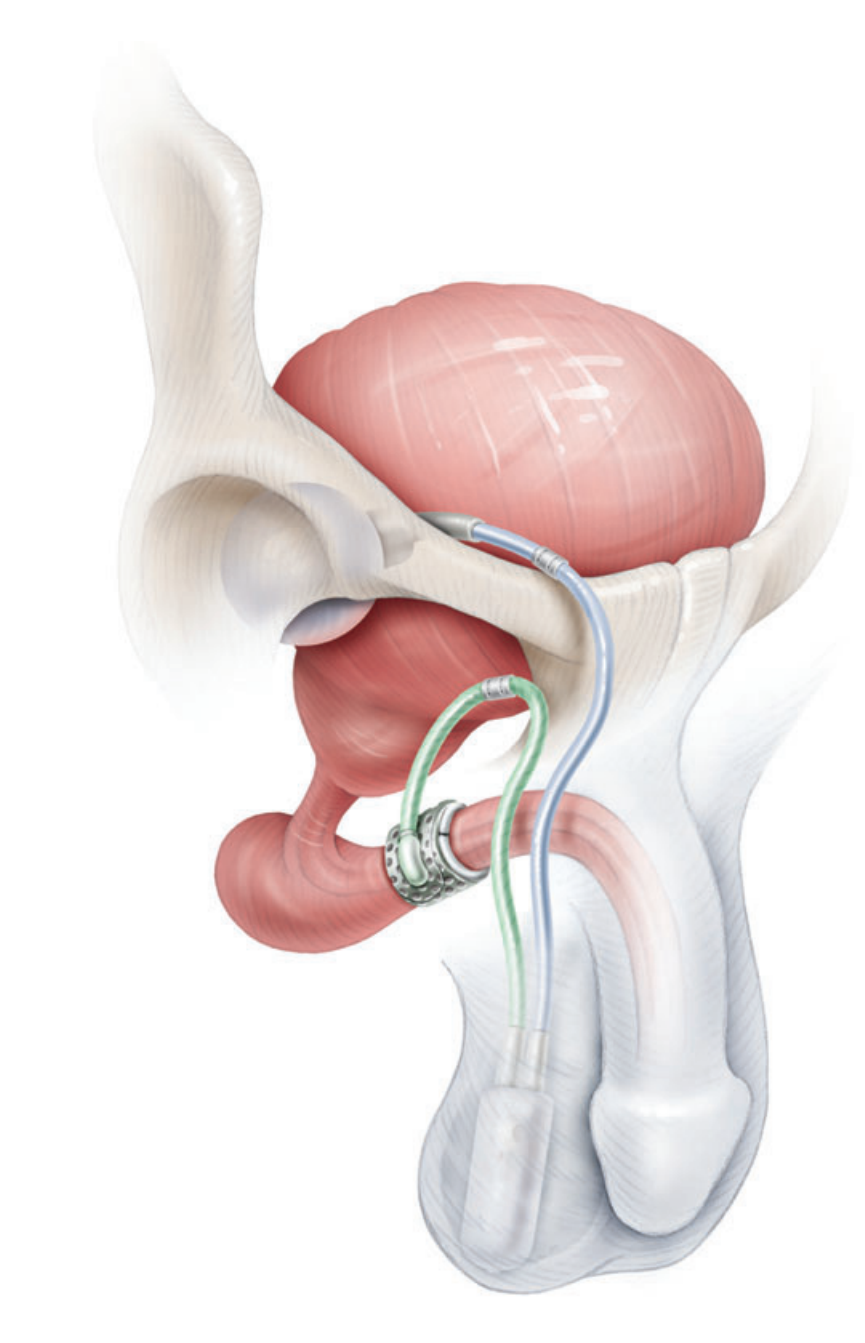
All patients receive broad-spectrum antibiotics, e.g. ampicillin and gentamicin, 1 h before surgical incision. During surgery, access to the operating room should be limited to essential personnel and through-traffic strictly restricted. The patient is placed supine for a bladder neck cuff and in the dorsal lithotomy position for a perineal cuff. Perineal and scrotal skin is shaved with clippers after the patient is under anaesthesia. A meticulous 5-min sterile preparation with iodophors is then done and the patient draped with several layers such that only the lower abdomen, penis and scrotum are exposed. A perineal cuff also requires exposure to the perineum with care made to exclude the anus from the surgical field. A 12 F urethral catheter is sterilely placed after the patient is draped. During the procedure, the AMS sphincter components should be isolated from sharp surgical instruments and needles on a back table. These components should not be handled with gloves contaminated with blood or other body fluids. When clamping the AUS tubing, rubber-shod clamps should be used to prevent unrecognized tubing injury.

OPERATIVE TECHNIQUE

BULBOUS URETHRAL CUFF IN MEN

Figures 1 and 2

The bulbous urethra can be accessed via a midline perineal incision. The apex of incision should be located at the base of the scrotum and it is extended to 1 cm below the pubic symphysis. Retraction is established with a Richardson retractor cephalad and a Gelpi retractor caudad or with a Lone-Star (Cooper Surgical, Inc., Trumbull, CT, USA) self-retaining retractor system. Sharp dissection is used to expose the bulbocavernosus muscles over the bulbous urethra.



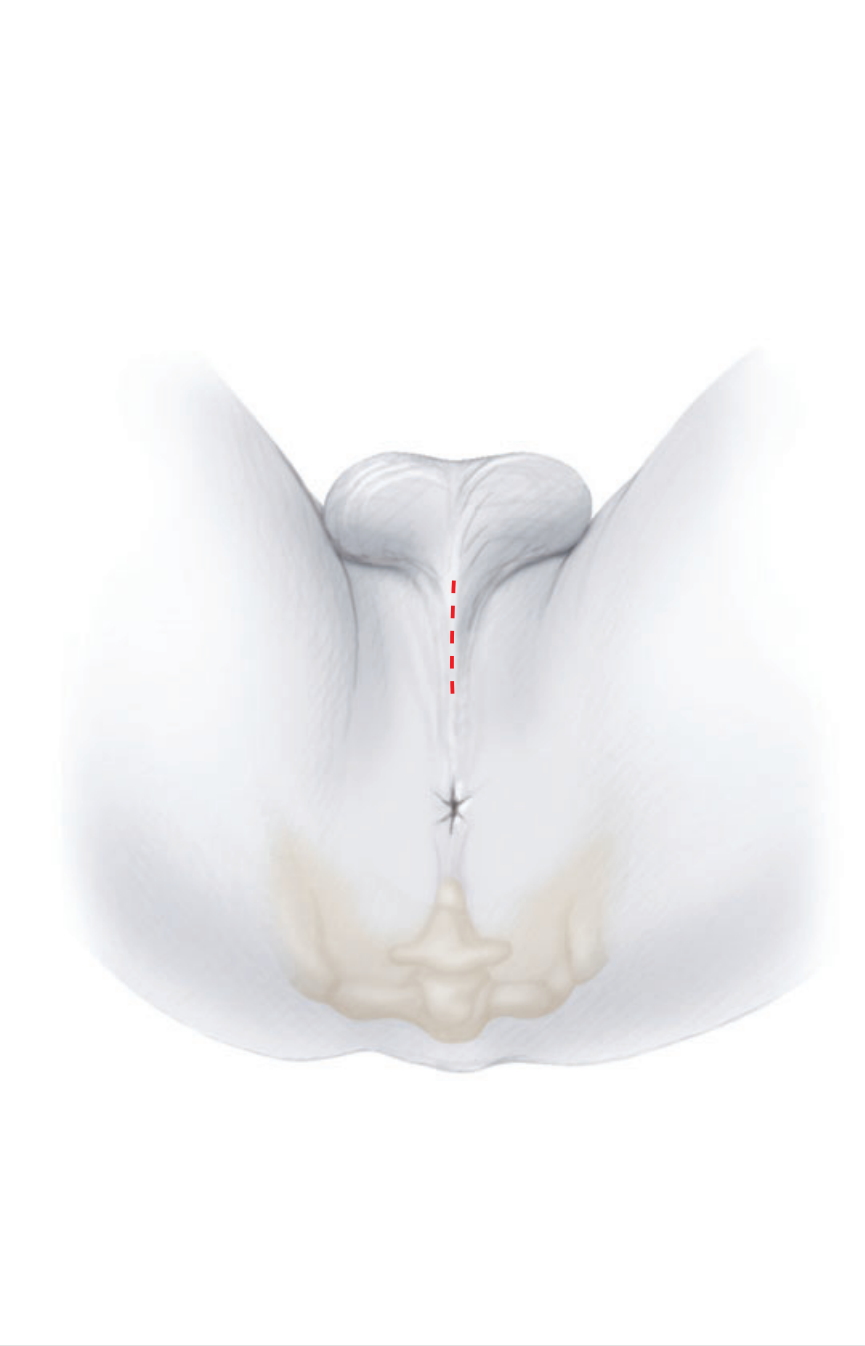


Figure 3

The bulbocavernosus muscles are divided sharply in the midline and retracted laterally. Blunt dissection is used to expose the tunica albuginea of the corpus cavernosum dorsally. A vein retractor can then be placed to gently retract the urethra medially to bluntly develop this plane between the corpus cavernosum and the dorsal urethral wall. Sharp dissection is used to dissect the dorsal urethra wall from the intracorporal septum. The urethra is at greatest risk for injury during this manoeuvre.

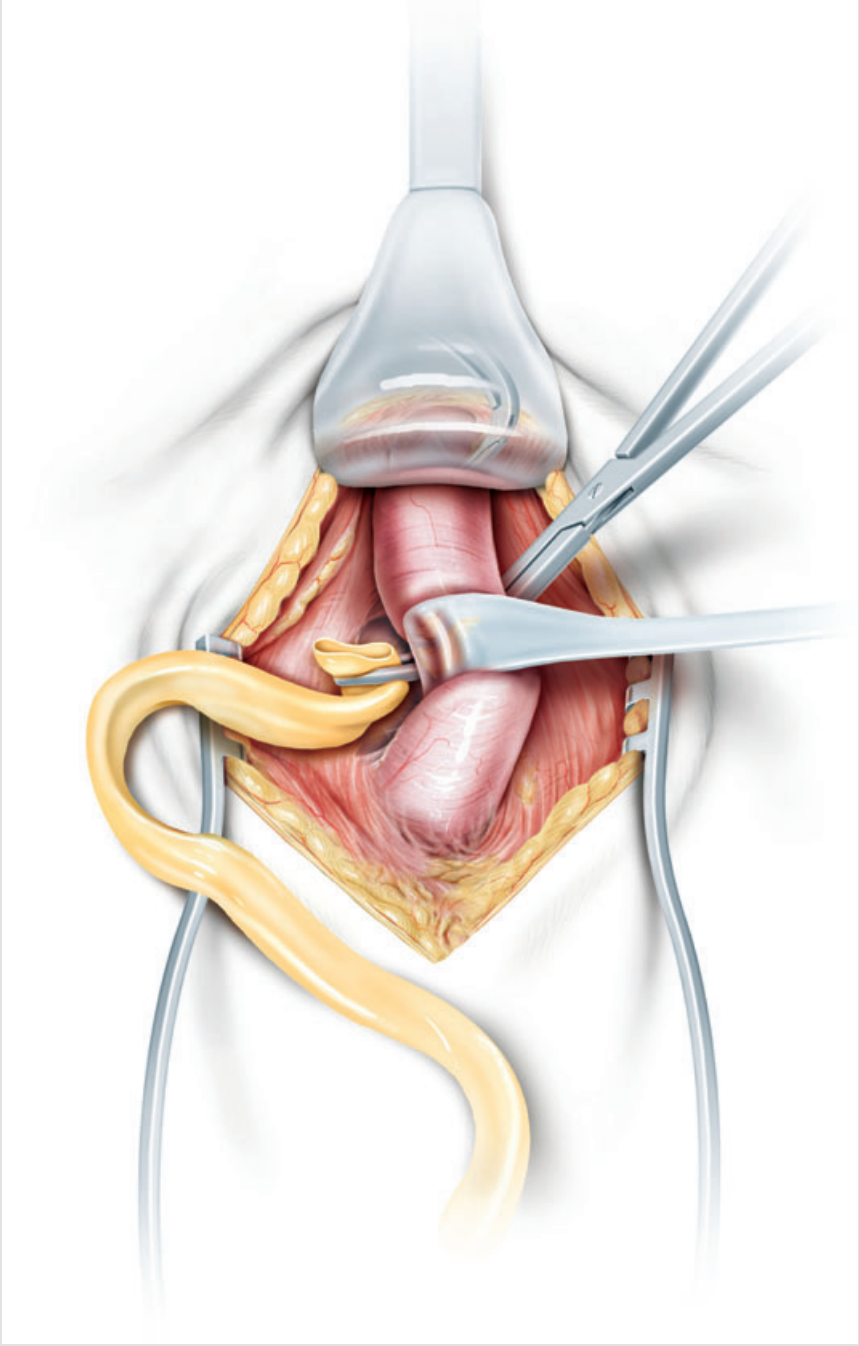
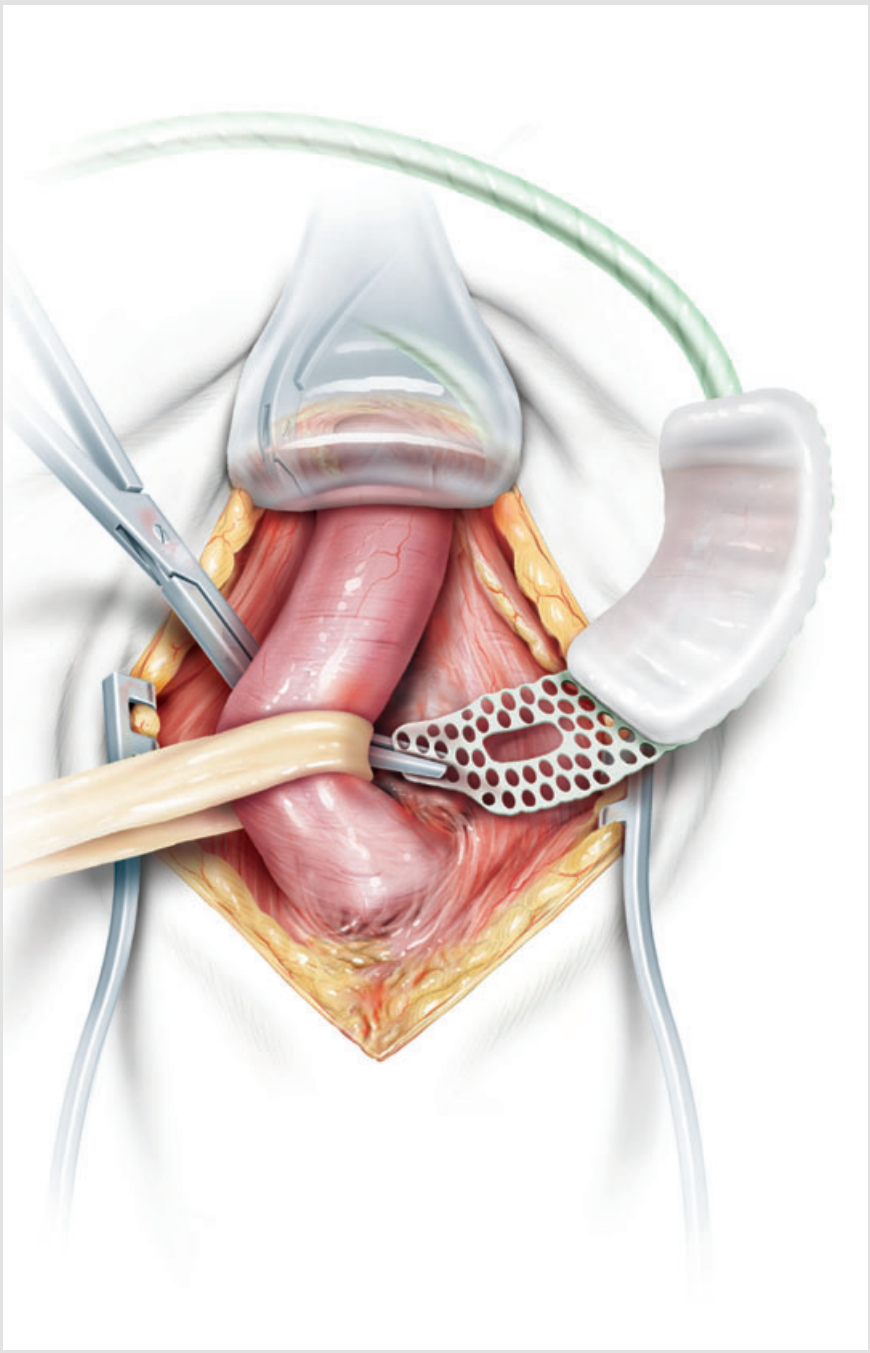


Figure 4

A right-angle can be used to gently puncture the septum if visualization does not allow safe sharp dissection. A 5 mm Penrose retractor can then be passed under the urethra and used to elevate the urethra off the septum to facilitate better exposure for sharp dissection. If the urethra is violated during the dissection, abort the procedure and leave the catheter in place for 3 weeks. The AUS can be safely implanted 3 months after the injury.

The dorsal urethral wall is usually dissected in a proximal direction off the corpus cavernosum. Success rates can be higher when the cuff is placed as proximal as possible on the exposed bulbous urethra. Once the dorsal urethral wall is dissected off the intracorporal septum for 2 cm, the urethral diameter is measured; most men will require a 4.5-cm cuff.

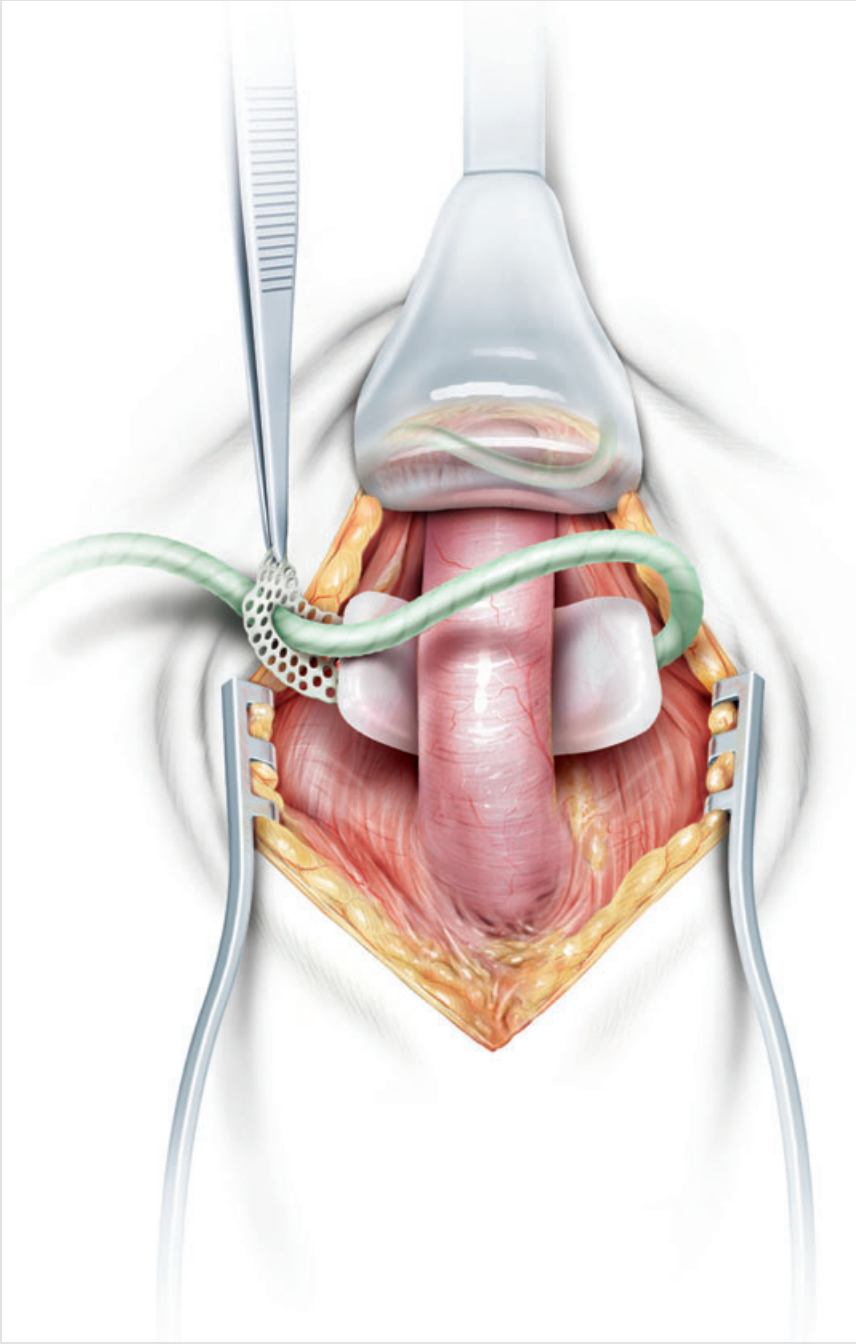
The AMS 800 AUS components are then prepared at the back table. The surgeon or surgical technician usually changes gloves to avoid contamination before handling the components. The cuff, pump and reservoir are soaked in sterile water and purged of air. The tubing of each piece is clamped with a rubber-shod clamp near the end of the tubing to prevent air from re-entering the system.



Figures 5 and 6

The urethral cuff is passed 'tab first' behind the dorsal urethra, toward the anticipated location of the control pump. The tubing is then fed through the tab and the tab is snapped closed over the ventrum of the urethra. The wound is then packed with moist sponges and covered with a sterile towel.

Attention is next turned to the lower abdomen. A 5-cm transverse incision is made in the lower quadrant on the ipsilateral side of the urethral cuff tubing. The rectus fascia is exposed and incised for a 3-cm opening. The rectus abdominis muscles are separated and a pocket is then made beneath the muscle to accommodate the reservoir. The pocket is generally made in the direction of the space of Retzius. Failure to place the reservoir beneath the muscles will result in a palpable bulge from the inflated reservoir. Intraperitoneal reservoir placement might be necessary in thin patients. Interrupted 0 polydioxanone sutures are then pre-laced in the fascia. The reservoir is delivered into the pocket below the rectus muscles and the sutures are tied down, with care not to trap the reservoir tubing between the sutures and the fascia. The reservoir is then filled with 22 mL of the iso-osmotic Hypaque/water solution and the tubing re-clamped.



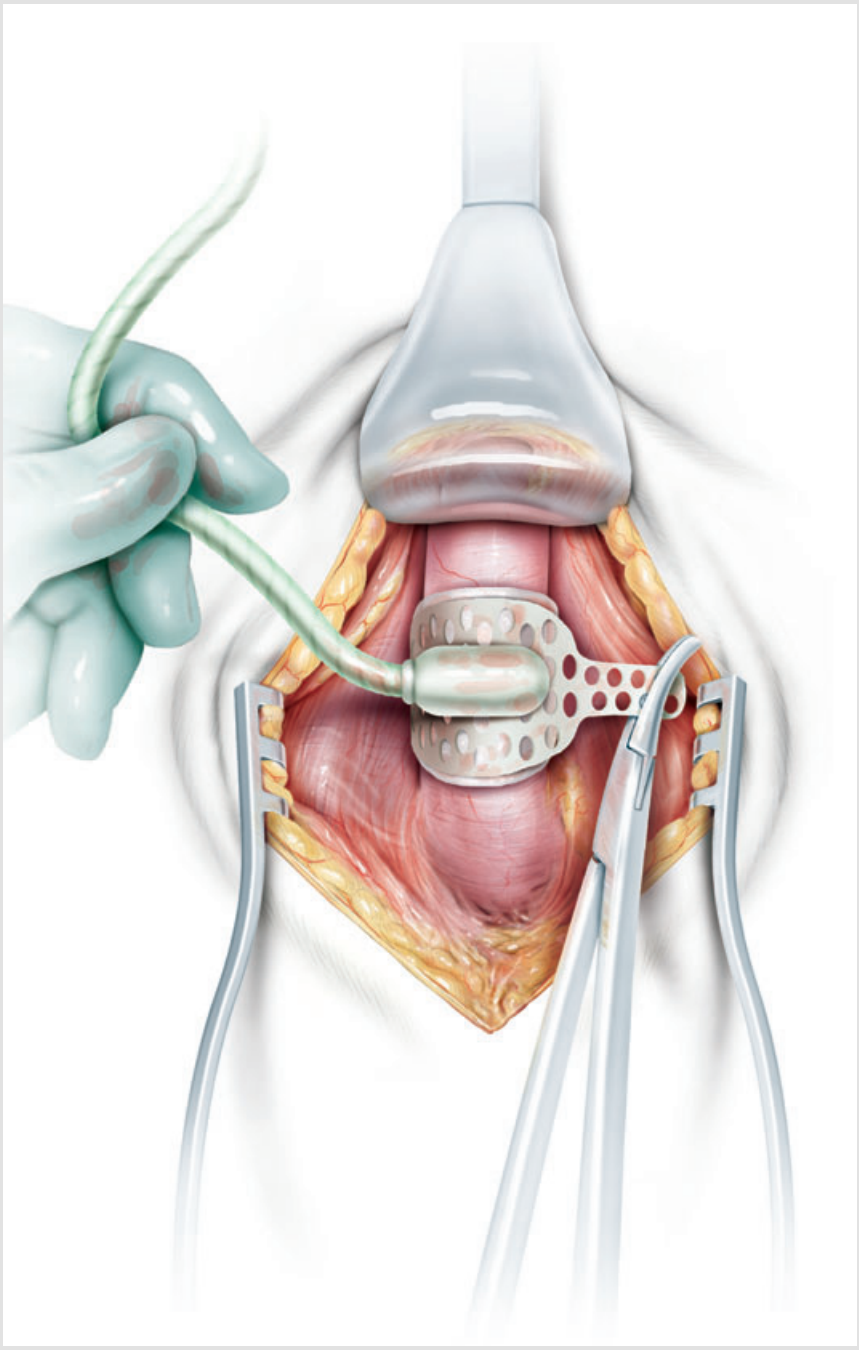


Figure 7

A subcutaneous tunnel is then created between the abdominal counter-incision and the hemiscrotum of the patient's dominant hand. Hegar dilators or a ring forceps can be used to create a subdartos scrotal pocket for the pump. The pocket should allow the pump to sit in the most dependant position in the scrotum, lateral to the testicle. The pump, positioned such that the control button is laterally orientated, is then delivered into the scrotal pocket with ring forceps. A Babcock clamp can be placed on the pump tubing in the scrotum to prevent migration after the pump is positioned.

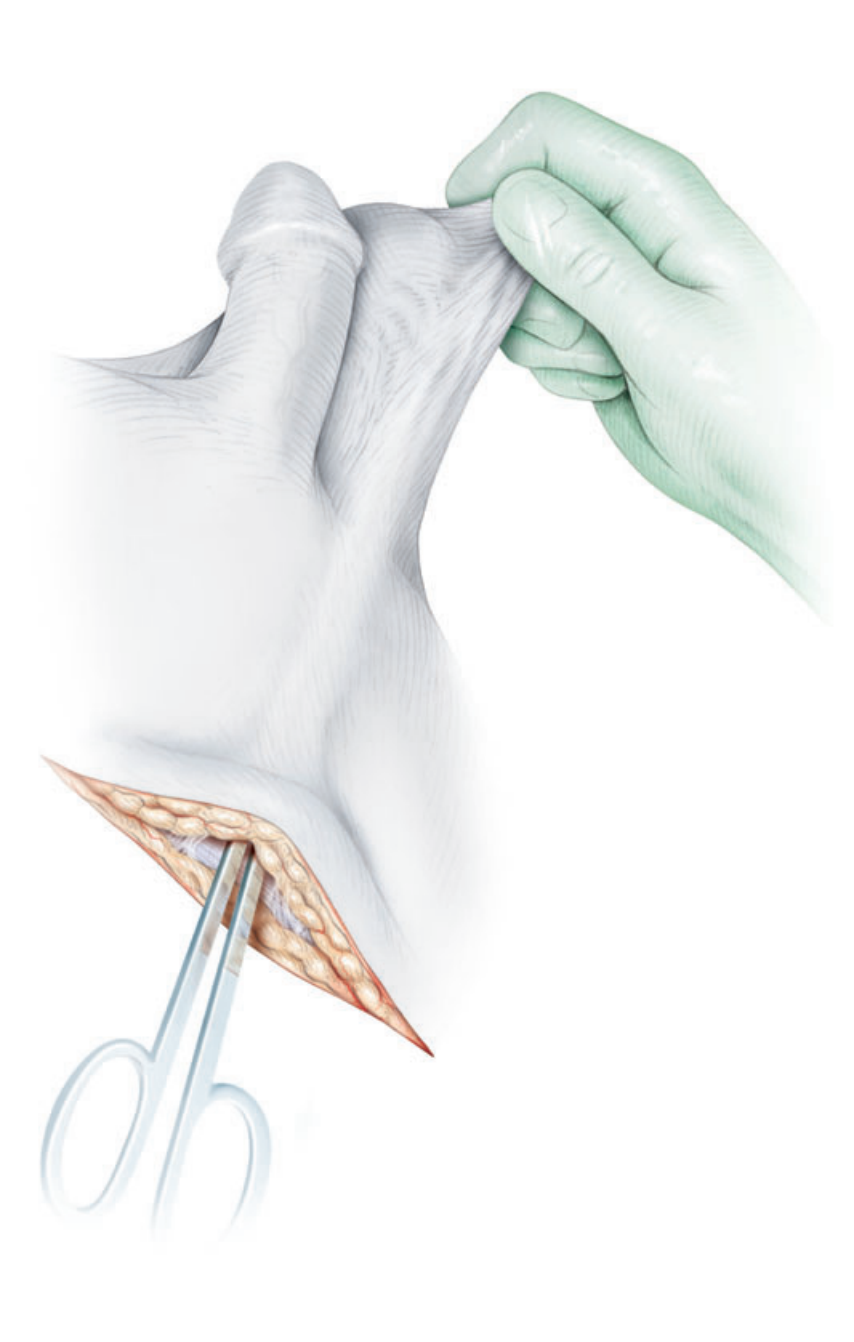
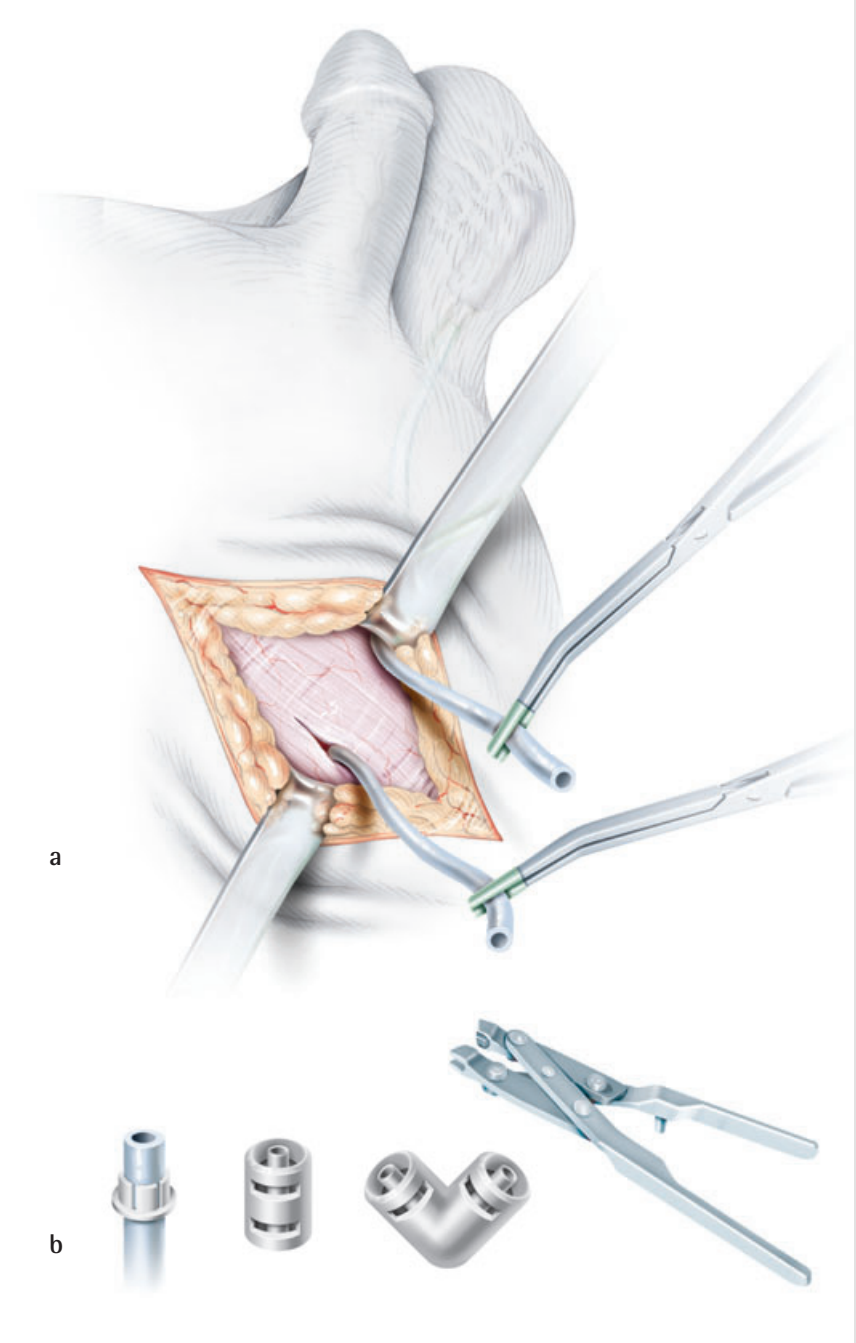


Figure 8

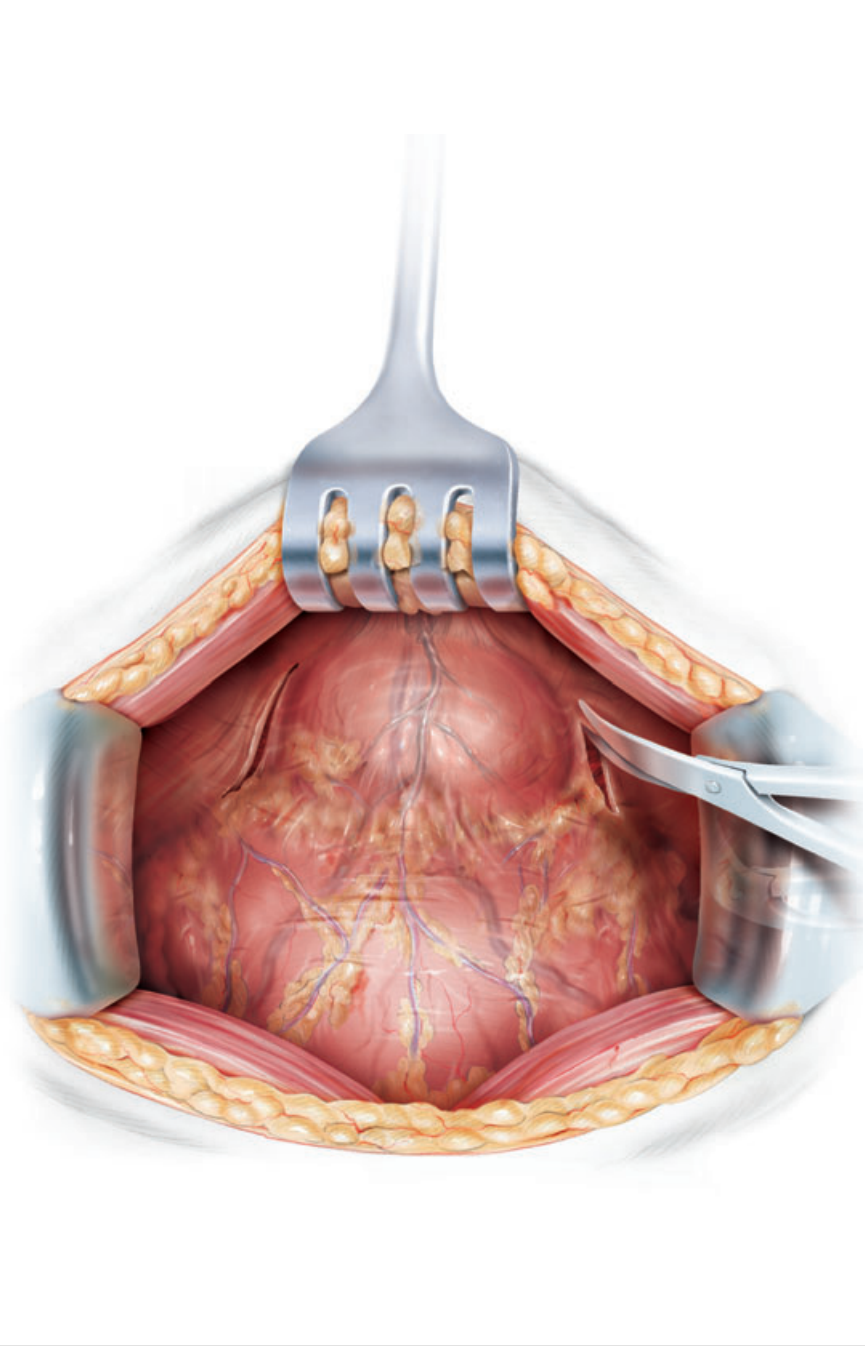
After positioning the pump, the urethral cuff tubing is delivered from the perineal incision to the abdominal counter-incision using a long Schnidt clamp or right-angle. The AMS 800 AUS has colour-coded tubing and similarly coloured tubes are connected with either 2–0 polypropylene suture or the AMS Quick Connect set. After the tubing connections are completed, all clamps are removed and the system is allowed to pressurize. The device is cycled twice to verify that all components are connected and functioning. The pump is then squeezed a final time and, after a 10–15 s delay, the sphincter system is locked open by deploying the control button on the pump. Wounds are then irrigated and closed. The 12 F urethral catheter is left overnight. No further drains are used.



BLADDER NECK CUFF PLACEMENT

Figures 9, 10 and 11

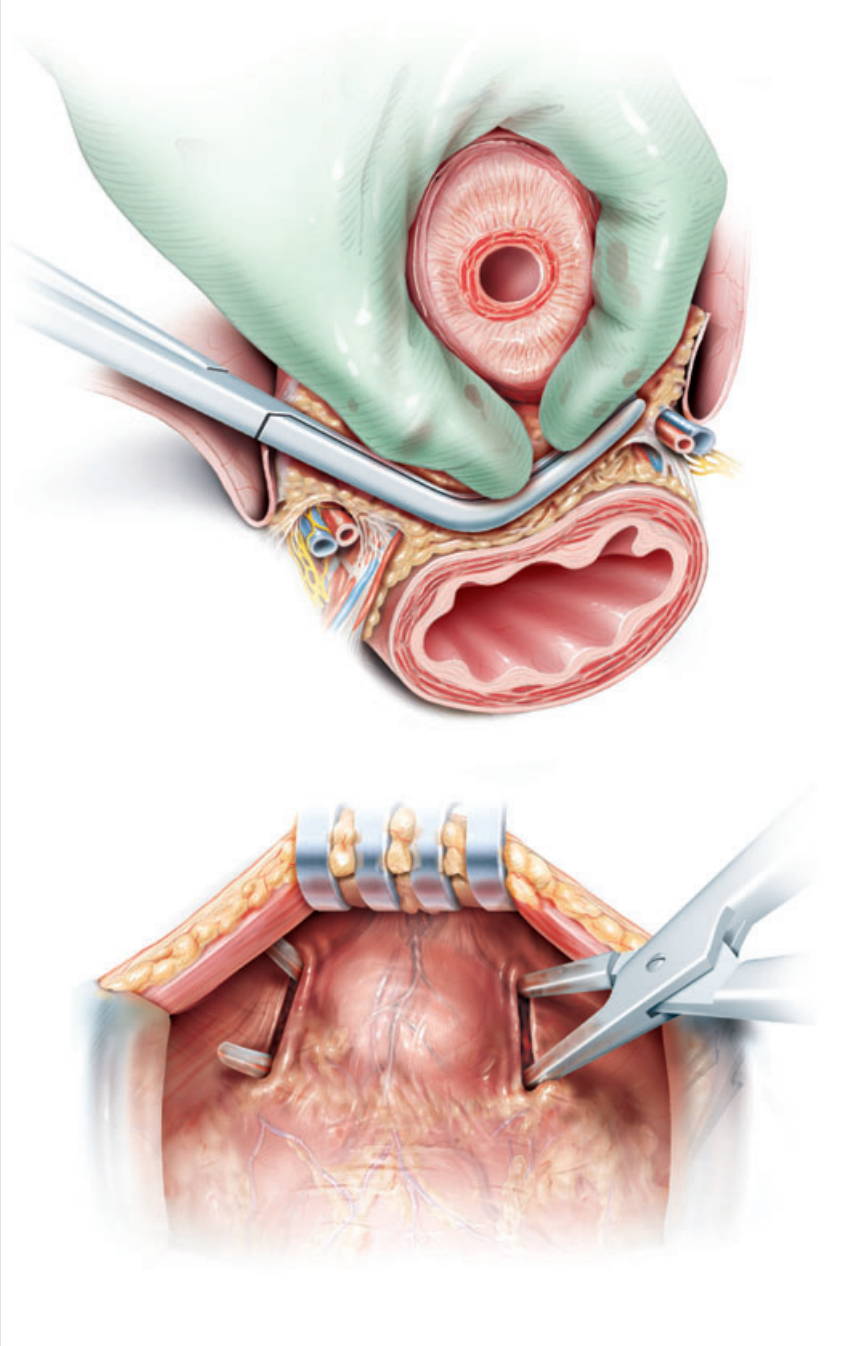
The bladder neck is approached through a midline incision on a patient placed supine. The rectus fascia is divided and the retroperitoneal space entered. In men, a plane is developed between the bladder neck and the rectum by first incising the endopelvic fascia laterally, elevating the urethra, and the carefully passing a right-angle between posterior urethral wall and the rectum. A 2-cm posterior dissection will allow adequate room for the bladder neck cuff. Rectal injury necessitates two-layer closure of the rectal wall violation and ending the case. Severe injuries (>2 cm) require omental interposition or diverting colostomy.



POSTOPERATIVE CARE

In our institution, patients are kept overnight for observation. On the first day after surgery the 12 F catheter is removed. With a properly placed, deactivated AUS, the patient should still have symptoms of stress urinary incontinence. If a patient has unexpected urinary retention or significant hesitancy after catheter removal, the 12 F catheter is carefully replaced and a voiding trial is attempted again in 24 h. Many voiding trial failures in a patient with a properly deactivated AUS necessitate a urodynamic evaluation and/or cuff replacement.

All patients are discharged with acetaminophen and codeine for pain control. After catheter removal, no further antibiotics are given; routine wound care is used. Patients are instructed to avoid perineal pressure, e.g. bike riding, horseback riding, etc., and sexual activity is restricted during the 6-week recovery. Patients are also asked to gently push the pump to the most dependant part of the scrotum on a daily basis, to prevent pump migration.



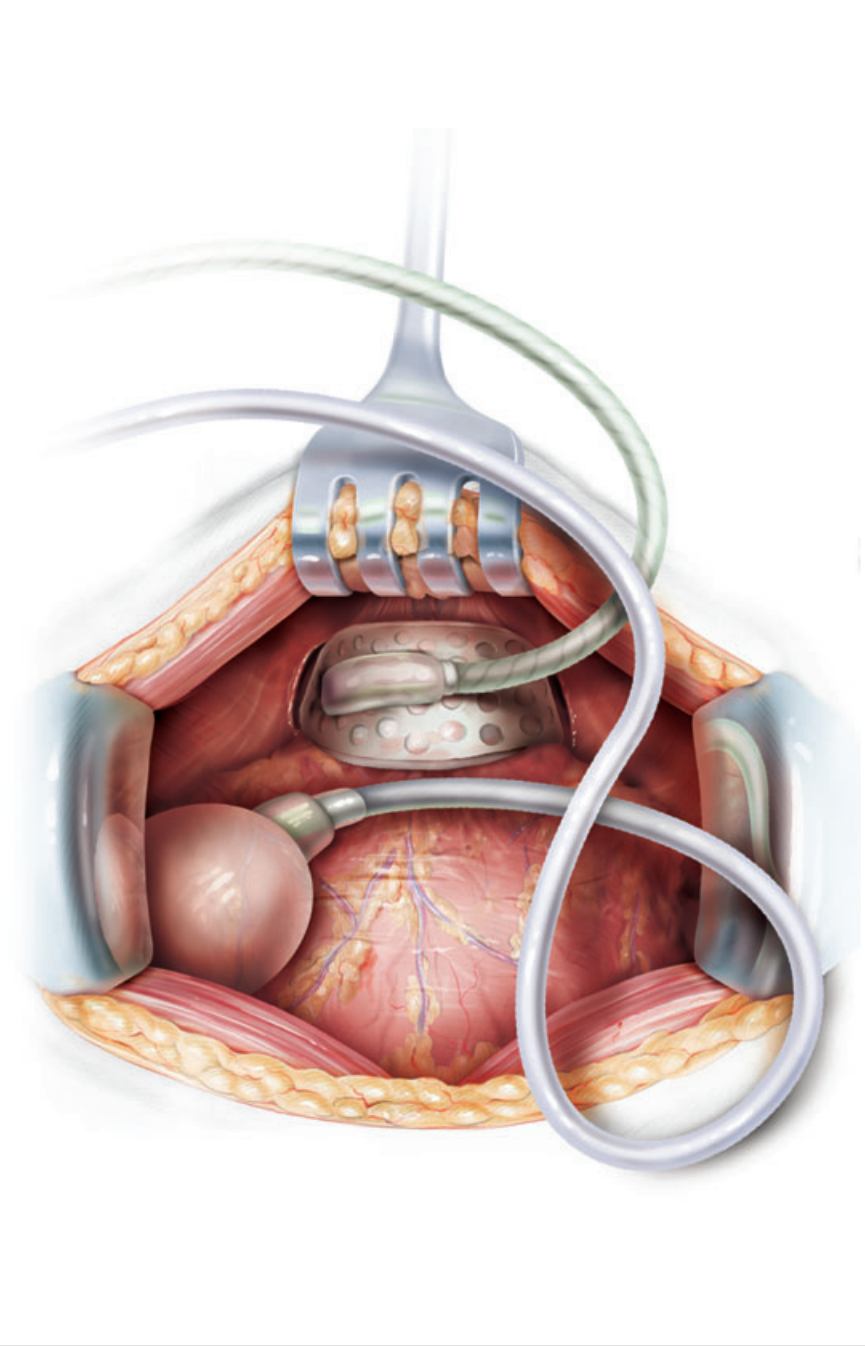
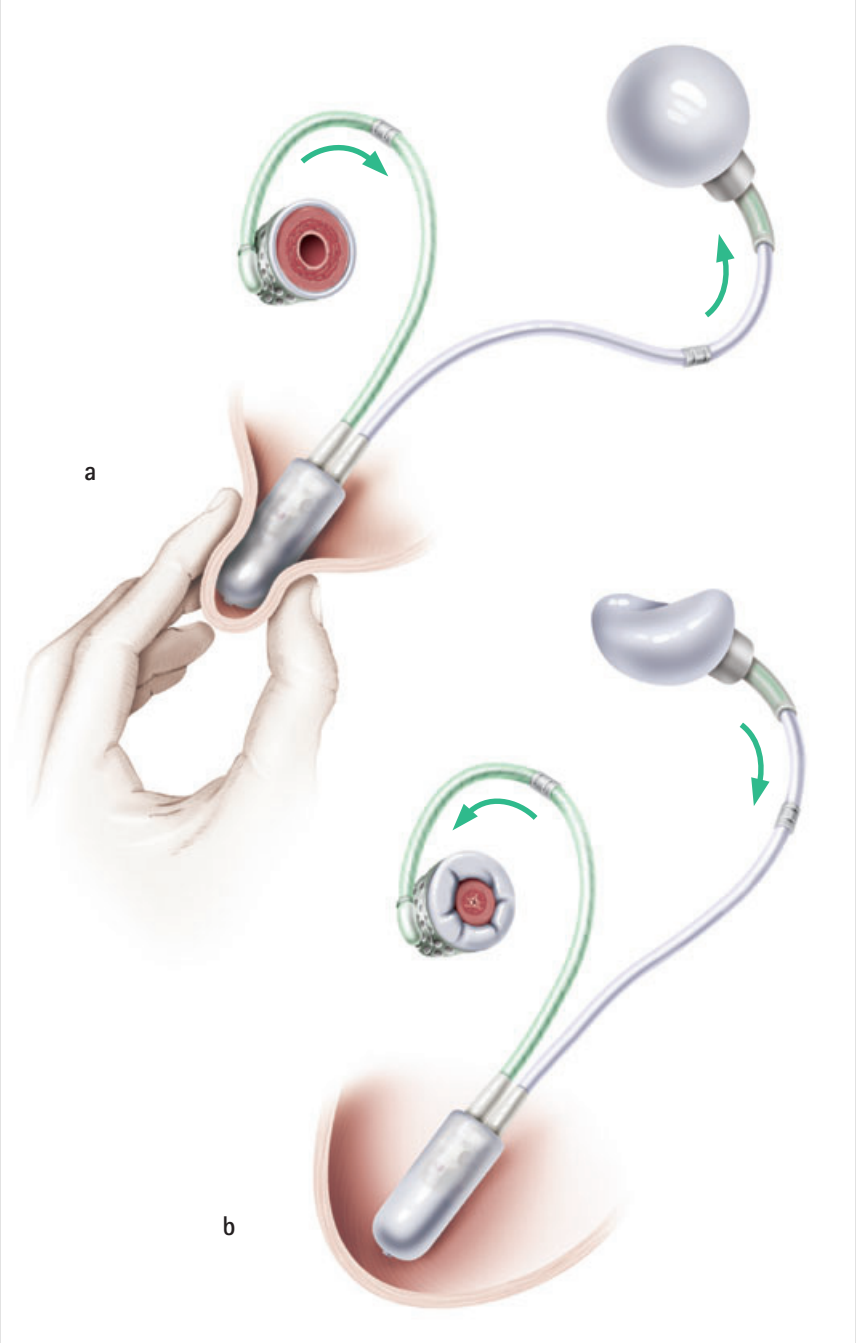


Figure 12

Patients return at 6 weeks after surgery for AUS activation. After the wounds are inspected, the patient is placed supine on the examination table. The AUS pump is isolated in the scrotum and squeezed until a gentle popping sensation confirms unlocking of the pump control pin. Fluid returning into the pump chamber further confirms successful activation.

Patients are instructed to report dysuria, haematuria, or changes in voiding patterns. Any suspected UTI requires urine culture and a cystoscopy to exclude cuff erosion. Many patients with long-standing urinary incontinence might have some urinary frequency and urgency as the bladder begins to store larger volumes of urine. Timed voiding and fluid management usually resolves these symptoms but an anticholinergic can also be used.



FROM SURGEON TO SURGEON

There are several challenges before and after surgery that a surgeon might encounter.

The irradiated patient or with previous erosion: Patients with previous radiation therapy are at greater risk of urethral cuff erosion [5]. A lower pressure reservoir (51–60 cmH_2O) can be used, or the cuff can be placed transcorporally [6] to minimize compressive trauma.

The unstable bladder neck contracture: Bladder neck contractures are challenging. Some can be managed with a programme of transurethral radial incision followed by frequent balloon dilatation until the contracture stabilizes. Refractory contractures can benefit from placing a Urolume stent before the AUS [7].

Low compliance bladder: Urodynamics can be useful to identify patients with low bladder compliance. Patients not responding to anticholinergics will require either autoaugmentation or formal enterocystoplasty. Failure to improve bladder storage pressures before increasing the bladder outlet resistance will result in severe urge incontinence or upper tract damage.

Unable to activate the pump: Occasionally, the pump control pin is locked in an open position and cannot be activated with gentle manipulation. There are several strategies to counter this problem. Pushing on the opposite side of the pump control button can occasionally force the pin into the open position and allow the pump chamber to fill. If this fails, bend the pump between the hands, using two thumbs to push the pin into the open position. A final attempt to activate the pump can be attempted under sedation or anaesthesia. Once the patient is asleep, the pump can be very vigorously squeezed without pain to the patient. Lacking success, the pump components should then be replaced.

Persistent incontinence after AUS activation: this requires a methodical evaluation. Incontinence due to urethral atrophy can be managed by reducing the size of urethral cuff, adding 5–10 mL more fluid to the reservoir, or placing a tandem cuff [8].

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