Surgical management of stress urinary incontinence

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Abstract

Women are seeking treatment for stress urinary incontinence more readily due to increasing awareness of minimally invasive surgical solutions and greater expectations of pelvic floor health with advancing age. Surgery for stress urinary incontinence should only be undertaken in women following a comprehensive assessment and when conservative treatments have failed. The current evidence favours a retropubic mid-urethral tape procedure using the bottom-up approach, or colposuspension. At present there is not enough long term data on the transobturator tape technique, however, short-term data show equal efficacy as the retropubic tape. Pubovaginal slings using autologous rectus sheath fascia have the highest success rate, but also have significantly higher incidence of operative morbidity and voiding problems. Urethral bulking agents are a safe alternative, especially in those women where more invasive surgery is not desired. It is important to counsel that they have a lower success rate and repeat injections are often needed.

Keywords incontinence procedure; stress urinary incontinence

Introduction

Urinary incontinence has been found to affect up to 25% of women of all age groups with nearly 7% having significant incontinence. Among these, stress urinary incontinence accounts for 50% of incontinence. It is more common in younger women with the highest prevalence of 25.3% found in women aged 35–44 years. It has a significant impact on the overall quality of life. The International Continence Society defines stress urinary incontinence (SUI) as any involuntary leakage of urine on exertion or effort, or on sneezing or coughing. Obesity and parity are significant risk factors for SUI.

Many women suffer in silence in the belief that it is a condition of old age for which nothing can be done. Another reason for this was that traditional surgery was associated with longer recovery and higher morbidity. However, with the availability of newer minimally invasive techniques, there has been an increasing interest amongst gynaecologists to offer these options. As women are becoming more aware of the improvements in the treatment choices for urinary incontinence there is a rise in the number of women seeking treatment for SUI. Hence gynaecologists need to be aware of all currently available options for treating SUI to be able to offer and counsel women appropriately.

Preoperative considerations

The NICE guideline CG40 “Urinary Incontinence: The Management of Urinary Incontinence in Women” recommends that a history is taken to categorize urinary incontinence into stress, urge or mixed incontinence. It is also important to elicit any symptoms of voiding difficulty, which may get worse after surgery. A history of other symptoms of pelvic floor dysfunction should be documented including coital incontinence, prolapse bowel problems or sexual dysfunction (Table 1). A general examination should include the woman’s BMI, blood pressure, urinalysis, abdominal and pelvic examinaation including assessment of pelvic floor muscle tone. A neurological examination may be required if the history suggests possible neuropathology. Although it is not essential for the woman to have completed childbearing, it is an important factor to consider because any future pregnancies or deliveries may affect the success rate. A bladder diary should form an integral part of preoperative assessment as it can give valuable information on fluid intake (type and amount) and frequency and volume of voids. Preoperative urodynamics is not essential as per the NICE guidance if the woman has symptoms of pure stress incontinence; however, two professional bodies, i.e. British Society of Uroynaeology (BSUG) and British Association of Urological Surgeons (BAUS), recommend urodynamics for all women prior to surgery for SUI.

Conservative management in terms of one to one supervised pelvic floor exercises by a trained pelvic floor physiotherapist should be offered prior to surgery. Other conservative measures in terms of lifestyle modifications such as fluid management, weight loss and smoking cessation should also be emphasized. It is also essential to take into consideration patients’ expectations and counsel about realistic outcomes and risks.

Surgery for stress urinary incontinence

There are more than 200 procedures for stress urinary incontinence described in literature. NICE recommends three types of procedures for SUI: retropubic mid-urethral tape procedures, colposuspension and autologous fascial sling. These procedures are discussed below, with commonly performed variants. Kelly plication, Marshall—Marchetti—Krantz (MMK) and needle suspensions are no longer recommended. Artificial sphincters are discussed as a last resort procedure in few select cases following failed previous surgery.

Mid-urethral tapes

There are more than 35 different types of tapes available on the market for the treatment of SUI. They vary in their composition and approach used for insertion. They are based on the integral theory of female urinary incontinence as proposed by Petros and Ulmsten. These can be further divided into the following type depending on the approach to insertion and the exit points of the trocars.
Assessment of women with urinary incontinence

**History**
- Age
- Parity
- Severity of incontinence, pad usage
- Overactive bladder symptoms
- Voiding
- Fluid intake — type and amount
- Prolapse
- Bowel symptoms, constipation and faecal incontinence
- Sexual function, coital incontinence
- Previous surgery
- Medical health including current medications
- Neurological symptoms
- Future childbearing wishes
- Social history and lifestyle
- Preferences for treatment

**Examination**
- BMI
- blood pressure
- Urinalysis
- Cardiovascular, respiratory status
- Abdominal masses, scars
- Vulval skin — excoriation, oedema, atrophy and lichen sclerosis
- Prolapse
- Pelvic floor muscle function
- Pelvic masses
- Neurological — tone, power and anal reflex

**Investigations**
- Bladder diary
- Postvoid residual
- Urodynamics if failed conservative treatment

**Table 1**

**Retropubic tapes**

**Bottom-up approach:** This was the original tension free vaginal tape (Gynecare, TVT) procedure described by Ulmsten in 1996. More than 100,000 TVT procedures have been performed worldwide. The tape is a synthetic, polypropylene, monofilamentous mesh with a pore size of 75—150 μm (type 1 mesh) and measures 40 cm long by 11 mm wide. There are many other similar tapes on the market such as Advantage (Boston Scientific) and Align (Bard Urological).

The procedure begins with the injection of prilocaine and adrenaline diluted with saline in the retropubic space for hydrodissection. A small suburethral incision in the vagina and two small suprapubic incisions, 2 cm on each side of the midline are made. After sharp dissection in the vagina and placing the catheter guard to deflect the bladder away, the TVT trocars attached to the tape are passed from the vaginal incisions up to the suprapubic incision on each side (Figure 1). After a cystoscopy to rule out bladder perforation, the plastic sheath covering the tape is removed and the tape is adjusted without excessive tension. The tape is then trimmed and the vaginal and skin incisions are closed with absorbable sutures.

**Figure 1** Anatomical diagram demonstrating the placement of a retropubic mid-urethral tape.

The TVT has now replaced the Burch colposuspension as the operation of choice for a primary procedure for SUI. This is largely due to the fact that it is a minimally invasive procedure with low intra- and post-operative morbidity, quicker recovery and equivalent long-term success rates. The main complication is bladder injury, however, in most cases it has no long-term effects if recognized at the time and the trocar repositioned. The reported incidence of bladder injury in the Finnish and Austrian register is 3.8% and 2.7% of cases. The Finnish register reports voiding difficulties in 7.6% and urinary tract infection in 4.1%. The other side effect is de novo urge symptoms which are reported to range from 5.9% to 25%. Bowel injury rates are reported as 0.04%. This is a rare but potentially fatal complication of retropubic tapes.

**Top-down approach** was developed after the vaginal approach with the idea of giving more control over the passage of the needles. The SPARC Sling system (American Medical Systems) consists of two disposable needles with dilator—connector tips to create the sling tract and also help to attach the ends of the plastic sheath enclosing the mesh. The mesh is a 4–0 loosely knitted polypropylene with an absorbable tensioning suture within. The vaginal and skin incisions are made as in the TVT and hydrodissection with local anaesthetic may be used. Dissection laterally at the level of mid-urethra is performed as in the bottom-up approach. The needle is passed through the suprapubic incision up to the rectus muscle. It is then rotated through 90° to keep it close to the dorsal surface of the pubic bone. When the needle reaches the endopelvic fascia a finger is inserted in the vaginal incision to guide the needle through the dissected area on either side of the miduretha. The sling is then attached to the needle tips and pulled through the suprapubic incisions. Cystoscopy is performed and tension adjusted. The plastic sheath is removed and the vaginal and skin incisions are closed.

The complications and success rate are similar to the TVT procedure. Acute urinary retention requiring loosening of the tape is more common after the SPARC procedures.

**Transobturator approach** was described by DeLorme in 2001 with the idea of decreasing the risk associated with the passage of
trocars in the retropubic space, especially the risk of bladder or bowel injury. This was an outside-in procedure (TOT). Subsequently an inside-out procedure (Gynecare TVT-O) was introduced by de Leval.

Outside-in: The patient is placed in lithotomy position with hyper flexion of the hip to 120° which is different from the 70° used in the retropubic procedures. A vaginal incision is made at the level of midurethra and dissection is done laterally towards the ischiopubic ramus. A small skin incision is made on either side 1.5 cm lateral to the ischiopubic ramus. Using specially designed needles the obturator membrane is perforated and then the needle is turned medially. It is then guided with a finger in the vaginal incision to exit in the vagina. The tape is then loaded onto the needle and pulled through the skin incision. Tension is adjusted so that a dissecting scissors can lie flat easily between the tape and urethra. The incisions are closed with absorbable sutures. Cystoscopy was originally not described as necessary after this procedure, however, with case reports of bladder injury following this procedure, it is good practice to perform a cystoscopy.

Inside-out: The TVT-O procedure uses plastic tubes containing the tape, helical passers and an introducer (Figure 2). The vaginal incision and dissection are the same as in the outside-in approach. The obturator membrane is punctured with scissors and the introducer is passed at a 45° angle until it perforates the membrane. Groin incisions are made at a point 2 cm above the urethra and 2 cm lateral to the inner thigh folds. The tubing attached to the helical passer is placed within the introducer and rotated to exit through the groin incisions. The tubing is then pulled from the passer as the passer is brought back out through the vaginal incision and the tape is pulled through.

There is a lower incidence of bladder and bowel injury with the transobturator approach, however, the incidence of vaginal perforations or erosions and groin pain are reported to be higher than the retropubic approach.

Outcome evidence

TVT is the most extensively evaluated procedure. The longest reported follow-up to date is by Nilsson et al. which showed a subjective and objective cure rate of 77% and 90% at 11.5 years after TVT. In a multicentre randomized trial comparing TVT with colposuspension, results at 5 years follow-up show equal efficacy of TVT to colposuspension for cure of stress urinary incontinence (81% for TVT and 90% for colposuspension, P = 0.21). It has also shown to be effective in the treatment of recurrent incontinence and mixed incontinence.

SPARC: A randomized controlled trial (RCT) of TVT and SPARC in 301 operations showed similar objective cure rates at 6 weeks (97.3% vs 97.4%) but a higher subjective cure rate with TVT (87.1% vs 76.5%). A retrospective study comparing TVT and SPARC in 122 women showed higher objective (95% vs 70%) and subjective (86% vs 60%) cure rates with the TVT procedure.

Colposuspension

The most commonly performed colposuspension is the Tanagho modification of a Burch colposuspension published in 1976. He recommended tying the suspension sutures from the endopelvic fascia on either side of the urethra and bladder neck to the iliopubic ligaments, without excessive elevation and compression of the urethra against the posterior surface of the symphysis pubis. This according to him would reduce the voiding dysfunction and irritative voiding symptoms associated with the Burch colposuspension. This method has now been considered the gold standard for a long time. Vancaillie and Schuessler described a laparoscopic method of colposuspension in 1991.

In open colposuspension, the retropubic space is entered through a low transverse abdominal incision and blunt dissection. Two non-absorbable sutures are placed on each side in the endopelvic fascia on either side of the urethra and bladder neck and these sutures are attached to the ipsilateral iliopubic ligament. The sutures are tied without causing hyper elevation of the urethra.
In the laparoscopic approach, four ports are used (one umbilical, one suprapubic and two lateral). Either a trans-peritoneal or extraperitoneal approach can be used to enter the space of Retzius. Two non-absorbable sutures are placed in either side as in open procedure. Complications of colposuspension include haemorrhage and bladder trauma. Cystoscopy is recommended at the end of the procedure to rule out bladder trauma and confirm ureteric patency. The other potential complications include voiding difficulties, de novo urgency, chronic pain, dyspareunia, osteitis pubis and prolapse especially of the posterior compartment.

Outcome evidence
Colposuspension has the longest follow-up data of all operations for stress urinary incontinence. The overall long-term success rates are reported as 68.9–88.0%. Carey et al. and Kitchener et al. published RCTs in 2006 comparing open and laparoscopic colposuspension. Both showed no significant difference in the objective and subjective cure rate between open and laparoscopic procedures at 24 months. The laparoscopic procedure requires the surgeon to have advanced laparoscopic suturing skills. Hence the NICE guidelines state that laparoscopic colposuspension should be undertaken only by an experienced laparoscopic surgeon working in a multidisciplinary team with expertise in the assessment and treatment of urinary incontinence. Urinary retention rate of up to 21% has been reported and the risk of de novo urinary urgency has been reported as 5–30%. However, with the recent 11 years follow-up data for the TVT showing similar success rates, some authors are questioning whether TVT should replace colposuspension as the gold standard. Certainly the suburethral synthetic sling is now the most commonly performed primary procedure for stress urinary incontinence.

Pubovaginal slings
These were described nearly 100 years ago and they are usually reserved for women with recurrent stress urinary incontinence. With greater understanding of the mechanism of urinary continence following DeLancey’s hammock theory and Petros and Ulmsten’s ‘integral theory’ there has been resurgence in interest in the pubovaginal sling. The procedure is performed usually with autologous material such as rectus sheath or fascia lata. A lower abdominal transverse incision is made and a strip of rectus sheath of adequate length and width is harvested. Sutures are attached to each end of the strip of rectus sheath. The vagina is incised at the level of the bladder neck and the retropubic space is dissected bilaterally. A retropubic needle is inserted suprapubically and directed towards the vaginal incision, sutures attached to the sling are pulled up and the end of the sling is brought up to the rectus sheath. The sutures are tied to the lower edge of the rectus sheath after adjusting the tension on the sling. Cystoscopy is performed at the end.

Outcome evidence
A multicentre RCT comparing the pubovaginal sling using autologous rectus fascia and the Burch colposuspension by Albo et al. showed that at 24 months the success rate was higher with the autologous fascial sling (66% vs 49%, \( P < 0.001 \)). However, the incidence of urinary tract infections, voiding difficulty and postoperative urge incontinence was higher with the autologous fascial slings. It has been suggested that the autologous fascial sling should be considered the gold standard as most of these are done for recurrent incontinence and even then they have a high success rate. However, the downside is the greater operative morbidity and longer recovery and also higher incidence of voiding difficulty.

Urethral bulking agents
Urethral bulking agents are used to create artificial cushions in the urethral submucosa, improving urethral coaptation and hence preventing urinary leakage. They can be injected transurethrally or paraurethrally with or without cystoscopic guidance. They are the least invasive amongst all procedures for treating stress urinary incontinence and can be performed as an outpatient. The ideal agent for injection should be long lasting, hypoallergenic, non-migratory and should cause the least inflammatory response. There are various agents available at present such as GAX-collagen (Contigen), ethylene vinyl alcohol copolymer (Uryx), carbon-coated zirconium beads (Durasphere), calcium hydroxyapatite (Coaptite) and vulcanized silicone (Macrolastique). The NICE guidance IPG138 states that the current evidence on safety and short-term efficacy of intramural urethral bulking procedures is adequate to support the use of these procedures provided normal arrangements are in place for clinical governance and audit. It also states that patients should be counselled that the benefits of these procedures diminish in the long term but they can be repeated.

Outcome evidence
A Cochrane review of periurethral injection therapy for urinary incontinence in women in 2007 and reprinted in 2009 concluded that there is still unsatisfactory basis for the use of urethral bulking agents as a first line treatment for stress urinary incontinence. Transurethral route results in fewer complications than paraurethral administration. The success rate is lower than synthetic slings/colposuspension and pubovaginal suburethral slings. It is inferior to open surgery at 12 months but has a better safety profile. It has a lower morbidity rate. The review recommended other surgical procedures as first line treatment for women who are fit for surgery and injectable therapy for those who have extensive co-morbidity and are not fit for surgery. Women need to be aware that more than one injection may be required to achieve improvement and the efficacy reduces with time. There have been reports of granulomatous reactions after use of Coaptite and periurethral abscess leading to urethral fistula following Zuidex. Macrolastique seems to be a durable material with no major complications.

Recurrent stress urinary incontinence
There is no consensus on the correct procedure for the management of recurrent stress urinary incontinence. However, it is recommended that these patients are evaluated in the context of a subspecialty level service incorporating multidisciplinary assessment. A thorough assessment of these patients is critical to detect any detrusor overactivity. The most commonly performed procedures for primary stress incontinence is a suburethral sling and many tertiary centres reserve colposuspension and autologous fascia pubovaginal slings for recurrent incontinence. There are reports of a repeat suburethral sling resulting in a good
success rate also. Artificial urinary sphincters are uncommonly used in women with recurrent stress incontinence.

**Artificial urinary sphincter (AUS)**
This is an implantable device which comprises of an inflatable cuff, a balloon to regulate pressure and a control pump. It was first introduced in 1972 and has been mainly used in patients with sphincter weakness due to neurogenic bladder dysfunction and in men following prostatectomy. It has also been used in a small number of women for intrinsic sphincter deficiency after previous failed surgery.

It can be placed vaginally or abdominally where the cuff surrounds the bladder neck, the balloon is placed in the pelvis and the pump is placed in the labium majus. There is a higher infection rate when placed vaginally; hence most surgeons choose the abdominal route. Main contraindication for its use is the inability to manipulate the pump. Other relative contraindications are previous radiotherapy and bladder neck or urethral injury which results in higher incidence of erosion.

**Outcome evidence**
A review by Hussain et al. showed continence rates of 73% (range 61–96%) with a complication rate of 12% (range 3–33%) for mechanical failure, 4.5–67% for early infection or erosion, 15% for late erosion and 7% for delayed recurrent incontinence. However, majority of the patients had the surgery for neurogenic bladder dysfunction or post-prostatectomy. In a review of 68 cases of women with intrinsic sphincter deficiency who had the AUS implanted, Thomas et al. reported a 37% retention rate for the original sphincter. In 47% the reason for removal of the device was infection or erosion.

**Conclusion**
With greater life expectancy and women leading a more active lifestyle, there is an increase in the number of women seeking medical intervention for urinary incontinence. Stress urinary incontinence following failed conservative therapy is the main indication for surgery. The current evidence suggests mid-urethral tape procedure using the retropubic route with a Type 1 mesh to be the procedure of choice as first-line treatment and this has now replaced colposuspension. It remains to be seen if the transobturator route of mid-urethral tape placement will show similar success rates as the retropubic route in the long term.

**Practice points**
- Surgical management of stress urinary incontinence should be offered only after conservative management has failed
- The current evidence supports the retropubic synthetic sling with a bottom-up approach as the primary procedure for stress urinary incontinence
- Long-term data on the transobturator synthetic sling is awaited
- Autologous fascial sling has the highest success rate in terms of treating stress urinary incontinence, however, with greater morbidity
- Urethral bulking agents are safe procedures in women with contraindications for surgery, but have lower success rate and need to be repeated

**Further reading**


