



Surgical Management of Urinary Stress Incontinence

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Abstract

Urinary incontinence (UI) is defined by the International Continence Society as an "involuntary loss of urine which is objectively a demonstrable, social, and hygienic problem. Stress incontinence which constitutes nearly the half of all urinary incontinence cases, mainly depends on surgical treatment. There is not an optimal surgical procedure for treatment stress urinary incontinence. Treatment alternatives should be individualised for each patient. Assessment of patients presenting with urinary incontinence should include a focused medical history and examination and incontinence type should be determined. Preoperative, the type of incontinence should be determined and the optimal treatment should be planned. Several surgical techniques have been developed and long term outcomes published in recent years. Midurethral slings have become the most commonly performed procedures for urinary stress incontinence since they are safe, effective and have good long term outcomes. But it should be kept in mind that there is no single operation successful for the urinary stress incontinence.

Keywords: Stress incontinence, tot, tvf

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Introduction

Urinary incontinence (UI) is defined by the International Continence Society as an “involuntary loss of urine which is objectively a demonstrable, social, and hygienic problem”[1]. Stress urinary incontinence (SUI) is one of the three main types of urinary incontinence. SUI is the complaint of involuntary leakage on effort or exertion or on sneezing or coughing. During effort or coughing, the intra-abdominal pressure is increased, and the urethral sphincter is unable to maintain a pressure higher than bladder. Thus, urine leakage occurs during everyday activities such as lifting, laughing, jumping, running, sneezing, or coughing [2,3]. Stress urinary incontinence (SUI) is a major health problem that affects millions of women throughout the World and the prevalence of UI in women is estimated to range from 13% to 46% [4,5]. Approximately 210,000 women operated with this cause each year in the United States [6].

Pathophysiology

The symptoms of stress incontinence are associated with urethral hypermobility and intrinsic sphincter deficiency. While the former is caused by a weakness in the pelvic floor musculature, pelvic fascia and pubourethral ligaments, the latter is caused by pudendal nerve damage and damage to the intrinsic and extrinsic urethral sphincter.

More recently the ‘integral theory’ has been defined by Petros and Ulmsten [7]. This theory that the distal and midurethra are most important for the continence mechanism[8], and maximal urethral closure pressure is regulated at the midurethral point [9].

Patient assessment

Blavius and Olsen defined a classification of stress urinary incontinence based on fluoroscopic images [10]. There are 3 types of incontinence defined by them; Type 1: urethral hypermobility, Type 2: mix type, Type 3: intrinsic sphincter deficiency. Summary of the different types of SUI in Table 1.

Table 1. Summary of the different types of SUI

	Findings on videourodynamics	Abdominal leak-point pressures
Type 1	The urethra and vesical neck are closed at rest, located at or above superior border of pubic symphysis	>120 cmH ₂ O
Type 2	The vesical neck is closed at rest, located above the margin of symphysis pubis	>90 cmH ₂ O
Type 3	The vesical neck and urethra are open even in the absence of strain.	<60 cmH ₂ O

Assessment of patients presenting with urinary incontinence should include a focused medical, surgical history and examination. The history should include characterization of incontinence, severity of symptoms, frequency and impact on lifestyle. Questionnaires can be used to determinate subjective measurement of the severity of symptoms. Objective measurements can be obtained from pad test, stress test, Q-tip test or urodynamic test datas. The role of Urodynamics Study (UDS) testing before surgery is unclear. Most urogynecologists and urologists recommend that UDS is essential before surgery in SUI with or without other symptoms. Most, however, recognize the need for further research for addressing this question [11]. Careful office evaluation of these women should include detailed history taking, pelvic examination including a cough test, uroflowmetry and a postvoid residual scan. However, women with pre-existing voiding dysfunction and failed incontinence surgery will still need objective measurement of urodynamics [9].

Surgical interventions

Urethral support is integral to continence. Thus, surgical procedures that recreate this support often diminish or cure incontinence. Over years, More than 200 procedures have been developed for the surgical correction of SUI with variable subjective and objective cure rates [12]. Surgical approaches for SUI should be individualized to the patient and dependent on the type of SUI and surgeons should inform patients of the risk and success rate associated with a particular procedure, and patients should play an active role in deciding treatment. For urethral hypermobility, surgery should reinforce support for the sphincter unit. Approaches that have been utilized to treat this form of SUI include bladder neck suspension, pubovaginal slings and midurethral sling surgeries. When SUI develops from intrinsic sphincter deficiency (ISD), the purpose of surgery is to restore urethral coaptation. Procedures that have been

applied to regain sphincter function include pubovaginal slings, periurethral bulking agents and or artificial urinary sphincter. A retropubic midurethral sling seems to be an effective primary surgical treatment for urethral hypermobility, as well as ISD. Treatment alternatives and procedure effectiveness of SUI summarized in Table 2.

Table 2. Treatment alternatives for SUI

PROCEDURE	Type 1	Type 2	Type 3
MMK	+++	++	++
Burch	++++	+++	++
Pubovaginal sling	+++	+++	+++
Retropubic midurethral tape	++++	++	++
Transobturator midurethral tape	++++	++	+
Colpography anterior/Kelly plication	+	-	-
Bulking agents	++	+	++

Surgical Procedures of SUI

A-Retropubic urethropexy

Retropubic approaches include Burch retropubic urethropexy and the Marshall-Marchetti-Krantz (MMK) procedure [13,14]. These are colposuspension procedures, which involve suspension and anchorage of the pubocervical fascia to the musculoskeletal framework of the pelvis and stabilize the urethra so that the urethrovesical junction (UVJ) and proximal urethra are replaced intra-abdominally. This anatomic placement allows normal pressure transmission during periods of increased intra-abdominal pressure restoring continence in a previously incontinent, hypermobile UVJ.

1. Marshall Marchetti Krantz Cystourethropexy

This procedure was described in 1949. The periosteum of the symphysis pubis is used to suspend the urethrovesical junction (UVJ) and the bladder neck [13]. It is an effective surgical treatment of SUI, with a 5-year continence rate of approximately 86 percent and 15-year continence rate of approximately 75 percent [15]. Complications commonly associated with these procedures can include de novo detrusor overactivity, urinary retention, and in the

case of the MMK, osteitis pubis (%2.5). Because of these complications Burch colposuspension is developed and MMK is rarely performed.

2. Burch Colposuspension

The Burch procedure was described in 1961, by John Burch [14]. There are many modifications of this technique. Mostly performed is Tanagho modification that uses the strength of the iliopectineal ligament (Cooper ligament) to lift the anterior vaginal wall and the periurethral and perivesicular fibromuscular tissue [16]. It has a 5-year continence rate of 82 percent and 12-year continence rate of 69 percent [17]. Although its durability has been proven, the open repair is less commonly performed due to the advent of less invasive procedures. However, a role for this procedure remains when concomitant open surgery is planned in conjunction with surgical correction of stress urinary incontinence. Laparoscopic burch operation described firstly in 1991, decreasing morbidity, while still providing a satisfactory outcome [18].

B-Sling Procedures

1. Pubovaginal Sling (PVS)

The first urethral sling procedure was defined by Von Giordano in 1907 [19]. However, even after several technical improvements and application of many different materials, the pubovaginal sling (PVS) was rarely used until repopularized by McGuire and Lytton in 1978 [20]. It has traditionally been used for intrinsic sphincteric deficiency related SUI. In addition, this procedure may also be indicated for patients with prior failed antiincontinence operations. With this surgery, a strip of either rectus fascia or fascia lata is placed under the bladder neck and through the retropubic space and ends are secured at the level of the rectus abdominis fascia [21,22]. There are many modifications and some muscles (gracilis and pyramidalis), fascia (rectus sheath or fascia lata) and syntethic materials used for this operation. The most important complication of this procedure is osteomyelitis or osteitis pubis and is seen at 1.3 % of operations [23]. Continence rates of this procedure are 94% for primary operations and 86% for operations utilized after prior failed antiincontinence operations[24].

2. Mid Urethral Sling(MUS)

a) Retropubic approach

Tension-free vaginal tape

TVT(Tension-free vaginal tape) was first pioneered by Ulmstein in 1996 using a polypropylene mesh [25]. A synthetic sling is inserted through an anterior vaginal incision at the midurethra through a retropubic approach and brought out suprapubically through a skin incision. On increasing abdominal pressure, the tape tightens around the urethra maintaining continence. The procedure is minimally invasive, with a shorter operative duration and can be undertaken electively as a day case. Besides, its effectivity and having high cure rates for ten years, so the TVT procedure is widely acknowledged as the current gold standard surgical treatment for SUI [26]. TVT procedures have subjective cure rates that are comparable to retropubic colposuspension with lesser perioperative complications, less postoperative voiding dysfunction, shorter operative time and hospital stay, but quite more bladder perforations. A important complication related to tape procedures involves infection and erosion, which can be associated with the type of the tape and its pore size [27] NICE guidelines recommends only type 1 macroporous polypropylene mesh for this procedure [28]. A study by Bai et al. showed that TVT was more effective in treating SUI from ISD and non-ISD patients than other procedures. The treatment success rates of the two groups (ISD vs non-ISD) at 1 month follow up (87.0 vs 100%; $p = 0.0053$) showed a significant difference, but no significant differences were found at 3, 6 and 12 months [29].

Transobturator tape

The transobturator approach to midurethral sling placement was introduced by Delorme, at 2001; with the intent to reduce the risks of vascular and lower urinary tract injury that can be associated with traversing the retropubic space [30]. Using the transobturator tape (TOT) procedure approach, a mesh is directed bilaterally through the obturator foramen and underneath the midurethra. Bilateral skin punctures are made in the genitofemoral fold at the level of the clitoris. Two methods have evolved based on the direction of approach. The inside-out technique and outside-in technique applicable for perform TOT. A comparison of both approaches yielded no significant difference in efficacy or morbidity [31]. An other

study research the effectiveness between inside-out and outside-in TOT approaches. There was no significant difference in patient-reported success rate at 3-year follow up [32]. The meta-analysis of RCT and prospective cohort studies reported good cure rates of the stress component, and lower cure rates of urge incontinence over time after Mid urethral sling procedures in mixed uriner incontinance [33].

A multicenter randomized study of 597 women compared the retropubic and transobturator techniques for treatment of SUI. There was no significant differences in objective and subjective success rates at 12 months were found between the retropubic (80.8 and 62.2 %) and the transobturator (77.7 and 55.8 %) routes of surgery [34]. TVT and TOT procedures, morbidities such as though bladder perforation, pelvic hematomas and voiding difficulties were less common in the TOT group, whereas postoperative groin pain and mesh exposure were higher in the TVT group. In a recent RCT of TVT versus TOT, although there was no significant difference between the cure rates, a palpable tape and erosion of mesh was noted more frequently in the TOT [35]. Palpable tape present could lead to long-term complications, such as erosions that might require treatment, because of that any economic savings by the TOT might be premature when considering long-term outcomes. A comparison of both procedures over the long reported that efficacy is maintained and complication rates remain low in patients who applied TVT. The evidence to date suggests that TVT gives better outcomes for ISD and severe SUI. The long-term TVT outcome studies have showed that the procedure remains effective (77% success rates), even after 10 years [36,37]. Comparison of TOT and TVT effectiveness summarized in Table 3.

Table 3. TOT and TVT effectiveness

Type of stress incontinance	Type of retropubic approach
mixed urinary incontinance	TOT
intrinsic sphincter deficiency	TVT
immobil bladder neck	TOT

3. Minimal Invazive Sling

More recently, single-incision mini slings have been developed as a more minimally invasive approach to managing SUI in the outpatient setting. With this technique, an 8-cm-long strip of polypropylene synthetic mesh is placed across and beneath the midurethra through a small

vaginal incision. Mesh is not threaded through the retropubic space and avoids the potential for vascular injury [12]. There is no incision on the skin. While there is an increasing evidence base to support their use, at present, there is a insufficiency of long-term efficacy data. A systematic review and meta-analysis has compared single-incision tapes with midurethral tapes in nine randomized controlled trials in 758 women [38]. Overall, the single-incision tapes were associated with significantly lower patient-reported and objective cure, although, there was no difference in QoL improvement. Therefore, while the single-incision mini tapes may offer a minimally invasive alternative to standard midurethral tapes, current evidence would suggest that efficacy may be inferior and more long-term studies are required.

4. Periurethral Injections

Injection of bulking agents is a minimally invasive procedure for women intrinsic sphincter deficiency. Agents such as autologous fat, collagen, or carbon beads are injected through a needle placed transurethrally or periurethrally[39]. Cure or improvement rates range from 40 to 60 percent, and this rate decreases by the time [40]. This procedure is suitable for women whose symptoms do not respond to noninvasive treatments and who cannot undergo surgery. Repeated injections required to maintain effectiveness [41]. Adverse effects include urinary retention, urgency, dysuria, and urinary tract infections.

Conclusion

There is not an optimal surgical procedure for treatment stress urinary incontinence. Assessment of patients presenting with urinary incontinence should include a focused medical history and examination and incontinence type should be determined. Treatment alternatives should be individualised for each patient. Midurethral slings are safe, easy performed and long term results good so MUS widely used surgical method is expected to be used frequently in the future.

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