THE JOURNAL OF OBSTETRICS AND GYNECOLOGY OF INDIA

The Journal of Obstetrics and Gynecology of India (March–April 2017) 67(2):86–90
DOI 10.1007/s13224-017-0980-9

INVITED MINI REVIEW

Advances in the SUI Surgeries

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Received: 1 March 2017 / Accepted: 2 March 2017 / Published online: 17 March 2017

About the Author

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Abstract Stress urinary incontinence is a condition associated with advancing age and high parity. Millions of women all over the world have suffered, in silence, embarrassment and social isolation due to this condition. Over the years, several operative procedures have evolved for correction of urinary incontinence with many of them having poor success or high recurrence rates over long-term period. This mini review covers various surgical procedures evolved over the last couple of years and recent advances in the management of urinary incontinence.

Keywords Urinary incontinence · Urodynamics · Midurethral sling surgeries

Introduction

Stress urinary incontinence (SUI) has a significant impact on the quality of life for many women, pushing them in embarrassment, social isolation and sometimes even depression. Although the estimates of prevalence vary

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widely due to inconsistencies in the definitions of SUI and differences in populations studied [1], a large meta-analysis reported an estimated prevalence for urinary incontinence of 30% in women aged 30–60 years, with approximately half of the cases attributed to SUI [2]; Another study reported the prevalence of SUI as 5–30% in European women [3].

Definition

Stress urinary incontinence is a symptom that refers to leakage of urine during events that result in increased abdominal pressure such as sneezing, coughing, physical exercise, lifting, bending and even changing positions.

To Confirm the Diagnosis and Characterize SUI

Stress urinary incontinence may be characterized by demonstration of leakage with increasing abdominal pressure, frequency of incontinence episodes (diagnosed by history, questionnaire, bladder diary), severity (the volume of urine leakage diagnosed by history, questionnaire, bladder diary, pad test), degree of bother (diagnosed by history, bladder diary, questionnaire), sphincter function (diagnosed by examination, Valsalva leak point pressure, urethral pressure profile), degree of urethral mobility (diagnosed by estimation at the time of physical examination, cotton swab test or imaging).

Diagnostic Guidelines for the Patient

The evaluation of the patient should include the components like focused history, focused physical examination, objective demonstration of SUI and assessment of post-void residual urine volume, urinalysis and culture if indicated [4].

History should include characterization of incontinence (stress, urge, etc.), frequency, bother and severity of incontinence episodes, impact of symptoms on lifestyle, patient's expectations of treatment.

Additional diagnostic studies can be performed to assess the integrity and function of the lower urinary tract. These include pad testing and/or voiding diary, urodynamics, cystoscopy and imaging.

Indications for further testing include inability to make a definitive diagnosis based on symptoms and the initial evaluation, concomitant overactive bladder symptoms, prior lower urinary tract surgery, including failed anti-incontinence.

Procedures, known or suspected neurogenic bladder, negative stress test, abnormal urinalysis such as unexplained hematuria or pyuria, excessive residual urine volume, grade III or greater pelvic organ prolapse, any evidence for dysfunctional voiding.

Therapeutic Options

They can be in form of pharmacological and surgical interventions.

Surgical procedures aim to improve the support of the urethrovesical junction and to correct deficient urethral closure.

Numerous surgical methods are described, but they essentially fall in seven categories

1. Open retropubic colposuspension
2. Laparoscopic retropubic colposuspension
3. Suburethral sling procedure
4. Needle suspension
5. Periurethral injection
6. Artificial sphincter
7. Vaginal anterior repair (anterior colporrhaphy).

Choice of Surgical Technique

Genuine stress urinary incontinence could be either due to

1. Hypermobile but healthy urethra due to weakened support of proximal urethra—retropubic procedures act to restore the bladder neck and proximal urethra to a fixed retropubic position.
2. Deficiency of urethral sphincter mechanism itself—a sling procedure or an artificial sphincter is most likely to be therapy of choice.

However, many patients may be having both the components simultaneously and also it might be too difficult to differentiate between the two types.

Open Retropubic Colposuspension

1. Marshall–Marchetti–Krantz suspension of the vesicourethral junction toward the periosteum of the symphysis pubis [5].
   Krantz described a personal series of 3861 cases with follow-up of 31 years and a 96% cure rate. Short- and medium-term results were good. Placement of sutures through the pubis symphysis incurs the risk of osteitis pubis in 0.9–3.2% of patients [6].
   ICI committee [7] concluded that although short-term results are comparable to colposuspension cure rates, there is limited evidence that longer-term outcome is

poor. Hence, not recommended for SUI (grade A recommendation).

2. Burch colposuspension: This involves elevation of anterior vaginal wall and perivesical tissues toward the iliopectineal line of the pelvic sidewall with use of two to four sutures on either side [8].
   Lapitan and Cody [9] updated the Cochrane Collaboration review on open retropubic colposuspension; overall 68–88% cure rate was found. Open colposuspension is as effective as any other procedure in primary SUI (grade A recommendation). Although open colposuspension has to a large extent been superseded by the less invasive midurethral tapes, it should still be considered for those women in whom an open abdominal procedure is required concurrently (grade D recommendation) [7].
3. Vagino-obturator shelf: It aims to anchor vagina to the internal obturator fascia [10]. Limited data available. Reported cure rates of 60–80%, depending on whether a primary or secondary procedure. German et al. [11] reported less success in secondary surgeries.
4. Paravaginal procedures: They close the presumed fascial weakness laterally at site of attachment of the pelvic fascia to the internal obturator fascia [12].

Small studies have only been done so far. There is limited evidence that abdominal paravaginal defect repair is less effective than open colposuspension (evidence level 2) [7].

Laparoscopic Retropubic Suspension

Recommendations from the international consultation on incontinence committee [7]

- Laparoscopic colposuspension is not recommended for the routine surgical treatment of SUI in women (grade A recommendation).
- Laparoscopic colposuspension might be considered for the treatment of SUI in women who also require concurrent laparoscopic surgery for other reasons (grade D recommendation).
- Laparoscopic colposuspension should be carried out only by surgeons with specific training, expertise and appropriate workload in laparoscopic surgery and in the assessment and the management of urinary incontinence in women (grade D recommendation).

Complications of Retropubic Repair

As retropubic suspension is unable to correct central cystoceles, chances of further need of surgery for the same should be explained.

Slings

Evolution of Slings

Various theories emphasized the importance of three separate components that support the proximal and midurethra (pubourethral ligaments, the suburethral vaginal hammock and the pubococcygeus muscle). Based on these theories, PVSs are placed under mild tension at the bladder neck to re-establish the suburethral hammock and MUSs are placed loosely at the midurethra to prevent movement of the posterior urethral wall.

In preoperative assessment, women should undergo focused history and physical examination. Basic clinical tests such as urine analysis and a post-void residue should be measured. Urodynamics study is not needed in all, but may prove useful in unclear diagnosis: previous lower urinary tract surgery, neurogenic bladder or significant pelvic organ prolapse.

Pubovaginal Slings

Autologous materials remain the gold standard and are associated with no tissue reaction and negligible urethral perforation. To decrease operative time, hospital stay and postoperative recovery, other biomaterials are used. Synthetic materials are characterized by significant inflammation, foreign body reaction, higher rates of graft infection and perforation.

Pubovaginal slings outcome—the autologous PVS is associated with 46–97% cure rates; even for recurrent SUI, cure rates are excellent [13]. The presence of preoperative detrusor overactivity may relate to decreased quality of life and decreased urgency resolution rates after a PVS procedure. Autologous PVSs serve an important role for providing continence and robust tissue coverage in urethral reconstruction (urethral diverticulum, destroyed urethra, urethral fistula).

Voiding dysfunction after pubovaginal sling—obstruction, detrusor overactivity are manifestations of voiding dysfunction from iatrogenic outlet obstruction by PVS. There is 5% incidence of permanent retention [14], while 8–25% show symptoms of urgency [15]. Urodynamics studies are essential to diagnose and make appropriate treatment plan.

Complications—synthetic slings perforate 15 times more often in urethra and expose 14 times more often in vagina than other materials [16]. Therefore, synthetic PVS no longer used. Perforation or exposure with autologous PVS is rare.

Midurethral Slings

Mechanism, anatomy and materials of midurethral slings—the integral theory states that the most important factors to preserve continence are adequate function of the pubourethral ligaments, the suburethral vaginal hammock

and the pubococcygeus muscle. An injury to any of these three components from surgery, parturition, aging or hormonal deprivation can lead to impaired midurethral function and subsequently urinary incontinence. The initial MUSs were made of materials with smaller pore sizes. Currently, the majority of MUSs are done by using meshes of loosely woven polypropylene.

Various approaches for midurethral slings are—retropubic, transobturator (inside out, outside in), single incision (hammock style position).

Outcomes for retropubic midurethral sling in predominantly SUI patients—Initial study [17] reported almost 80% success rate. Nilsson et al. [18] provided the longest (11 years) prospective observational cohort study of 90 women with primary stress incontinence. 90% were objectively cured, and 77% of them reported subjective cure. A number of trials comparing different types of retropubic MUSs showed no statistically significant difference (Gynecare TVT with suprapubic arc sling). Outcome of transobturator midurethral slings in predominant SUI was similar to retropubic procedure. In a study in 2011, Tincello et al. [19] compared different sling types. Objective cure rates were 84.2% for single-incision sling, 87.2% for retropubic MUS and 96.4% for transobturator MUS. Complication rates were similar in all three. There is evidence in the literature that single-incision slings have decreasing efficacy with longer follow-up [20].

For recurrent SUI, studies show higher cure rate for retropubic slings than for transobturator slings. The literature supports the use of MUSs in a variety of special population of patients. Efficacy and safety of MUSs are not compromised in elderly, obese or those undergoing concomitant vaginal surgery.

Complications of MUSs include vaginal mesh exposure (0.5–8.1%), urethral perforation (0–0.6%), trocar injury (2.7–23.8% for retropubic MUS and 0–1.3% for transobturator MUS). Rates of voiding dysfunction like urgency and perioperative retention are similar in all types of MUSs. Varying degrees of sexual impairment have been reported after MUS surgery. Severe bleeding or hematoma occurs in approximately 2–3% of patients and can be managed with observation or local compression [21].

Injectable Agents

Injectable agents may provide immediate relief for some patients and are an option for patients who do not wish to undergo more invasive surgery and who understand that both efficacy and duration are inferior to surgery. Other possible indications for the use of injectable agents include patients who are elderly, those who are at high anesthetic risk or those willing to accept an improvement in their incontinence without necessarily achieving dryness.

Until it was discontinued, collagen was the most widely used material for injection. Results of injectables may be optimized if there is circumferential distribution of the injection material in the proximal urethra [22]. In two separate randomized clinical trials versus collagen, both carbon-coated zirconium beads (Durasphere) and CaHA (Coaptite) showed similar results to collagen after a 1-year follow-up. In a randomized clinical trial comparing silicone microparticles (Macroplastique) with collagen, silicone microparticles were shown to be noninferior to collagen after 1-year follow-up. PAHG (Bulkamid) was also shown to be noninferior to collagen in a North American 1-year multicenter randomized trial. Complications of currently used injectables are usually mild and may be self-limited [4]. Common ones include transient retention, urinary infection, urgency incontinence and hematuria. ACT silicone balloons were devised as a nonmigrating injectable alternative. No comparative studies have been done, and long-term durability has not been demonstrated. Cell-based therapies are in the investigational stages. Clinical reports are few and have included autologous ear chondrocytes.

Artificial Urinary Sphincters

The use of the AUS is generally restricted to children with nonfunctioning urethras (i.e., those with spina bifida), in adults with nonfunctioning urethras secondary to trauma to the nerves of the pelvis such as following automobile accidents or in male adults with post-prostatectomy incontinence. It is occasionally used in patient with severe intrinsic sphincter deficiency who has failed other surgical procedures or patients with significant SUI and poor bladder contractility such as those with diabetes or back injury. Although limited, available data on the AUS in over a decade of use demonstrate that it can be a valuable therapy with a high degree of effectiveness. Erosion, infection and device malfunction are potential complications. Based on the only recent study on complications, an anticipated erosion/extrusion rate was computed to be 28% [4].

Comparisons of Incontinence Procedures

1. Retropubic repair versus needle suspension and anterior repair—Three articles that reviewed the literature on incontinence procedures all found retropubic suspension to be more effective than either needle suspensions or anterior colporrhaphies [23–25]. Cure rates were approximately 85% for the retropubic suspensions compared with 50–70% for the needle

suspensions and anterior colporrhaphy.
International consultation on incontinence committee does not recommend endoscopic and nonendoscopic bladder neck needle suspension procedures with and without bone anchors [7].

2. Retropubic repair versus pubovaginal sling.
Most studies in the literature have not demonstrated a significant difference in cure rates between retropubic suspension and pubovaginal slings.
Several studies have concluded that urinary continence rates decreased during a period of 2–7 years postoperatively from 43 to 13% in the Burch group and from 53 to 27% in the sling group [23–25].
3. Burch colposuspension versus Marshall–Marchetti–Krantz procedure versus paravaginal repair.
Literature on paravaginal repairs is sparse. The only randomized study that compared the Burch procedure with a paravaginal repair found significantly greater subjective and objective cure rates with the Burch procedure.
In general, literature comparisons between MMK and Burch procedures have yielded similar results [23].
4. Tension-free vaginal tape procedure versus colposuspension.

A Cochrane review of open colposuspension examined seven trials comparing TVT with open colposuspension. Review concluded equally effective cure rates with more complications like bladder perforation with TVT and found TVT more cost-effective than colposuspension.

In terms of adverse events, vault and posterior vaginal wall prolapse were seen more commonly after colposuspension and that late tape erosion might occur after several years.

TVT and transobturator tape have now largely supplanted colposuspension in contemporary practice.

Compliance with Ethical Standards

Conflict of interest There is no conflict of interest for any author.

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