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Female Bladder Outlet Obstruction after Anti-Incontinence Surgery

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Abstract

Urinary incontinence is a significant medical problem affecting quality of life in women. Numerous surgical treatment options are available for management of stress urinary incontinence, including urethral bulking agents, pubo-vaginal slings, retropubic bladder neck suspensions, mid-urethral slings, and even artificial urinary sphincters. We will discuss the incidence, etiology, diagnosis, evaluation, and management of outlet obstruction after anti-incontinence surgery in females. Symptoms of bladder outlet obstruction (BOO) after anti-incontinence surgery can have a wide range of symptoms, including straining to void, valsalva voiding, sense of incomplete emptying, weak stream, acute urinary retention, suprapubic fullness or pain in the setting of patients with prior normal voiding is the single most useful diagnostic parameter. Urodynamic diagnosis of obstruction is not always straight forward, but is another helpful clinical tool. Management options for urinary obstruction post anti-incontinence surgery range from conservative to invasive and surgical treatment options include sling loosening, sling incision and excision, as well as urethrolysis. Optimal timeline for surgical intervention is still not well defined, but general guiding principles of management are presented. Comprehensive review of current literature is also performed.

Keywords: Obstruction; Bladder; anti-incontinence surgery

Introduction

Urinary incontinence is a prevalent medical condition impacting quality of life amongst women. The lifetime incidence is reported to be 30-80% [1–3]. The International Continence Society (ICS) reports the annual incidence of stress urinary incontinence (SUI) to be 4-10% [4]. There are a number of surgical treatment options available for incontinence in women, ranging from urethral bulking agents, pubo-vaginal slings (PVS), retropubic bladder neck suspensions, mid-urethral slings, and rarely artificial urinary sphincters [5]. Sling materials include synthetic polypropylene, autologous fascia, and cadaveric fascia. In the United States, the most commonly used operation in the treatment of incontinence currently is sling surgery, including synthetic mid-urethral slings (MUS) or non-synthetic bladder neck slings, which account for 80% of all incontinence surgeries. The next most commonly utilized procedures are the Burch colposuspension (10.5%) and peri-urethral bulking agents (4.5%) [6,7]. A lot of recent negative publicity regarding synthetic mesh use in vaginal surgery has arisen; however, it is important to highlight that this is only in the setting of synthetic mesh use in transvaginal prolapse repairs and not in incontinence surgery. Numerous organizations including the American College of Obstetrics and Gynecology (ACOG), American Urogynecological Society (AUGS), American Urological Association (AUA)/Society of Urodynamics, Female Pelvic Medicine and Urogenital Reconstruction (SUFU), and Canadian Urology Association (CUA) support synthetic mesh use in anti-incontinence surgery. Some societies even indicate that polypropylene mid-urethral sling mesh is recognized world-wide as standard of care for SUI [1,8]. Over 3 million synthetic MUS have been inserted since they were introduced in the early 1990s, and 80% of these have been in the USA [9]. Over 99% of AUGS members report using MUS as first line surgical treatment for SUI [9,10]. The integral theory by Petros in 1990 identified laxity in the vagina and supporting ligaments as the cause of associated prolapse, incontinence and pelvic pain [11,12]. Normally, the urethra and bladder neck are supported on the underside by a 'hammock' of connective tissue which creates urethral compression and closure during increases in intra-abdominal pressures. Disruption and laxity of the 'hammock' cause stress urinary incontinence. Anti-incontinence surgeries inhibit urinary leakage by increasing bladder outlet resistance or via restoring the natural shape and configuration of urethral support. A common complication regardless of the type of anti-incontinence surgery performed is iatrogenic de novo obstruction [13]. We will discuss the incidence, etiology, diagnosis, evaluation, and management of

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outlet obstruction after anti-incontinence surgery in females.

Incidence and Etiology

Normal voiding requires pelvic floor relaxation and a subsequent decrease in outlet resistance with a coordinated detrusor contraction [5,11,14]. The incidence of bladder outlet obstruction (BOO) after anti-incontinence surgery ranges from 2.5-24% [15–21]. Initially, it was believed that sling procedures had a lower overall incidence of bladder outlet obstruction compared to colposuspension, but in 2010, a meta-analysis showed that amongst all anti-incontinence surgeries, there is a similar incidence of de novo lower urinary tract symptoms (LUTS), and obstructive voiding symptoms [1,22]. 1-10% of patients have urinary retention persisting beyond 28 days after surgery [23]. The incidence of BOO is also likely under reported with a common explanation felt to be patient satisfaction as a result of being dry leading to less reporting of de novo lower urinary tract symptoms. In addition, 50-75% of patients who do need sling revision seek a different surgeon which may lead to fewer cases of BOO being reported [1,24].

Although BOO is a complication in any type of anti-incontinence surgery, the reported incidence is variable amongst the different procedures. In general, it appears that MUS have lower rates of obstruction (4%) compared to other transvaginal procedures such as PVS, Marshall-Marchetti Krantz (MMK), and Burch colposuspension [13,23,25,26]. On the contrary, Blaivas et al. [27] showed that the incidence of retropubic slings requiring intervention is 0-8.9% compared to transobturator tape (TOT), which is 0-21.3% [1]. There are a few mechanisms of obstruction following anti-incontinence surgery. Obstruction occurs when there is increased dynamic or static change in the urethral resistance [24]. Obstruction after incontinence surgery is generally related to one of several technical factors. During retro-pubic or transvaginal suspension surgery, increased urethral deviation scarring from prior surgery, or kinking can occur if the sutures are placed too medially. Additionally, sutures or slings placed too distally can physically obstruct and kink the distal urethra. Finally, the most common cause is an overly tight suture or sling during attempt to recreate the natural hammock configuration, leading to hyper-suspension and subsequent bladder neck and/or proximal urethral obstruction [28]. In a study of 3747 women undergoing anti-incontinence surgery, the problem of obstruction after post-incontinence surgery appears to be improving. This is reflected by a decreasing incidence of reoperations for sling incision or loosening; 1.2% of retropubic surgeries and 1.9% for TOT [29]. The TOMUS trial studied 528 patients randomized to either retropubic or transobturator sling insertion; 9 patients developed voiding dysfunction necessitating catheterization or surgery. The overall incidence of iatrogenic obstruction was low at 3%, but the results suggested that retropubic slings may be more obstructing than TOT [26]. Another comprehensive study looked at 188,000 women with MUS insertion followed for 9 years [30]. Causes and rates of sling revision and removal were studied; over 9 years, 1.3% of patients required sling revision/removal for urinary retention. Also, women aged 18-29 and those with concomitant anterior or apical prolapse had a higher incidence of requiring sling revision or removal. In addition to iatrogenic obstruction from improper technique, (commonly over tensioning of the sling) other causes of postoperative de novo obstruction include preoperative detrusor dysfunction. For example, valsalva voiding, increased preoperative detrusor pressure, lower preoperative peak urinary flow rates have all been associated with de novo postoperative obstruction [24,31]. These factors likely indicate some degree of pre-existing dysfunctional voiding from impaired contractility.

Diagnosis and Evaluation

Bladder outlet obstruction after anti-incontinence surgery can present with a range of symptoms, often vague and subtle, mandating a high index of suspicion. Perhaps the most important factors in diagnosis are symptomatology and the temporal relationship to sling surgery. Symptoms such as straining to void, valsalva voiding, sense of incomplete emptying, weak stream, acute urinary retention, suprapubic fullness or pain in the setting of patients with prior normal voiding are the most useful diagnostic parameters [28]. Other symptoms that can point to the diagnosis of obstruction, although not specific, include de novo overactive bladder (frequency, urgency, urgency incontinence). Symptoms occurring after sling insertion point towards a causal relationship between surgery and symptomatology. These symptoms are less obvious than urinary retention, and can resolve over time. Conservative treatments can be attempted initially, including timed voiding, pelvic floor relaxation/physiotherapy, and self-clean intermittent catheterizations [6,32,33]. Important components in evaluation include physical examination findings of urethral hyper-suspension. In this case, the urethra and urethral meatus appear to be pulled upwards towards the pubic bone and 'fixed'. Any bladder prolapse should also be noted as this can be obstructive [28]. Other useful diagnostic tests include urinalysis, urine culture, urodynamics and uroflowmetry. Especially important are comparisons of pre and post-operative detrusor pressure, flow rate, and post-void residual. Cystoscopy can be helpful to look for urethral angulation or kinking. Other important things to identify include obvious scarring, occlusion, mesh erosion or visible sutures that may be contributing to symptomatology [1,14,34,35]. Standing cystogram with and without straining can look at the amount of bladder and urethral prolapse and bladder displacement. Voiding cystourethrogram (VCUG) can look at dynamic bladder, bladder neck, and urethral anatomy during the voiding phase [28]. When evaluating and considering the diagnosis of post anti-incontinence obstruction, differentiating between true anatomic obstruction and functional obstruction is important. Functional obstruction can be due to dysfunctional voiding (increased EMG activity during voiding indicative of poor relaxation of the pelvic floor). These patients respond well to pelvic floor muscle therapy with biofeedback and pelvic floor relaxation, as opposed to re-operation [14].

Bladder outlet obstruction in women can also be diagnosed using urodynamic parameters; however, the definition and diagnosis is not standardized. Blaivas and Groutz introduced a nomogram with 4 categories (no obstruction, mild, moderate, and severe obstruction) calculated using $P_{det}Q_{max}$ and Q_{max}. A $P_{det}Q_{max}$ >107 cm H_2O is severe obstruction, $P_{det}Q_{max}$ between 57-107 cm H_2O is moderate obstruction. Other definitions of obstruction include Chassagne ($P_{det}Q_{max}$ >20 cm and Q_{max}< 15mL/s), Lemack and Zimmern ($P_{det}Q_{max}$>21, Q_{max}< 11mL/s) [36], and Defreitas ($P_{det}Q_{max}$ >25, Q_{max}< 12 mL/s) [37]. The highly variable nature of these parameters gives insight into the difficult nature of diagnosing obstruction in women using urodynamics alone. Findings on uroflowmetry can also be highly variable. Rodrigues et al. [38] found that in 302 women with voiding lower urinary tract symptoms or urinary retention after anti-incontinence surgery, pressure-flow patterns were highly variable, ranging from 1) elevated pressure and poor flow, 2) normal pressure

and poor flow, 3) normal pressure and flow, but prolonged flow time, 4) poor detrusor contraction and elevated PVR, and 5) increased pressure and high flow. Other important variables that can change with obstruction include increased voiding time and mean detrusor pressure, and decreased maximum flow rate.

Management and Treatment

Patients with diagnosis of iatrogenic bladder outlet obstruction definitely warrant treatment. Animal studies in rats show that even partial urethral obstruction leads to 3 different changes in the bladder over time. The first is increasing bladder capacity with early inflammation (0-2 weeks), followed by smooth muscle hypertrophy where bladder contraction strength increases (2-8 weeks), and finally bladder decompensation via late collagen deposition where capacity and contractility are affected [39]. Similar changes are hypothesized to occur in humans. Various management options for obstruction are available, ranging from conservative to pharmacologic to surgical. Conservative treatment options include self clean-intermittent catheterization. This is a good option until resolution of obstruction in patients with transient obstruction. Patients with longstanding obstruction can also be managed this way, as a subset of them may not want another operation which carries the risk of recurrent incontinence. In addition, pharmacotherapy can be utilized and targeted at the most bothersome LUTS. Anticholinergics or beta 3-agonists can help relieve storage LUTS [1]. Stand-alone anticholinergic or beta 3-agonist medications can worsen incomplete emptying and retention symptoms, and should be avoided in truly obstructed patients. Alpha blockers have also been advocated in patients with minimal or very mild obstruction. These medications will not affect sling tension, but may decrease bladder neck outlet resistance enough to relieve outlet obstruction without more invasive therapies [24]. Other reported conservative measures for management of true anatomic obstruction include urethral dilation, which is performed with urethral sounding and downward traction to loosen the sling. Some series report >80% improvement in obstruction using this technique alone; however, this is an imprecise operation and damage to surrounding tissues can occur [1,40].

Another important factor for treatment consideration is the timeline of when to apply intervention. Optimal timeline for surgical correction of obstruction is not well defined. Historically, patients who were obstructed after pubo-vaginal sling surgery were felt to need time to allow the bladder to adjust to the sling. Generally, timing of intervention depends on the type of anti-incontinence surgery. Patients with pubo-vaginal slings can undergo conservative management for 8-12 weeks before a decision for revision surgery. The logic behind this is that bladder neck slings intrinsically are believed to be more obstructive to begin with and some breakdown of the non-synthetic material can occur over time, loosening the obstruction naturally [6]. With mid-urethral synthetic slings, intervention can be done much earlier at 2-4 weeks because these slings are permanent and do not undergo further remodeling to loosen [41]. Also, earlier management is ideal before significant tissue in-growth occurs [24]. Surgical treatment options include formal sling loosening, release by incision, sling excision, and urethrolysis [42]. Studies do show though, that earlier management and treatment of obstruction may lead to better outcomes [6]. South et al. [43] evaluated 112 females with sling release for de novo LUTS, and patients who had sling release <1 year had better improvement in LUTS compared to those who had sling release > 1 year. Patients with obvious and persistent obstruction greater than 48 hours after sling surgery may benefit from immediate sling loosening or incision/excision before tissue reaction makes revision surgery more difficult [1]. Sling loosening is done simply by opening up the vaginal incision, and using a right angle dissector between the sling and the urethra to place downward traction on the sling by 1 to 2cm. Up to 96% of patients see improvement without significant compromise in continence [44–46]. Another treatment option is sling incision (midline) or partial or complete sling excision; patients do run the risk of recurrence of SUI and may still have persistent LUTS despite this treatment. The risk of recurrent SUI following sling excision is reported at 14-19% [40,43,47–53]. Various methods of sling incision have been reported. These include single lateral incision [54], midline incision [55], and bilateral incision (2 and 10 o'clock) [56]. Klutke et al. [40] demonstrated early on in 2001 the efficacy of sling loosening or incision in a cohort of 600 patients who underwent TVT insertion; 17 patients developed urinary retention and underwent sling release (either single incision release or sling loosening) at a mean of 64 days (6-228 days) after the procedure. All patients were able to void within 24 hours of release, and 16 of 17 remained dry. One patient who had an intraoperative urethral injury that was repaired but had persistent incontinence and went on to have another subsequent successful anti-incontinence surgery. Sling incision can be done in patients who have had either synthetic MUS polypropylene mesh orautologous pubo-vaginal slings. Urethrolysis is not the only treatment available for patients following a pubo-vaginal sling placement. These patients can be managed with a simple sling incision [50,51,57,58]. In patients who undergo excision, typically a partial excision of the sling is done initially; however, complete excision may be necessary for patients with pelvic pain, or mesh exposure [1]. Other than sling incision or excision, urethrolysis is another option to relieve obstruction. Urethrolysis and excision lead to much more dissection and urethral mobility compared to incision alone; also, incision is less likely to work after a few weeks from original surgery due to scarring and tissue reaction/interaction with the sling [6]. Several surgicaloptions exist for urethrolysis, which can be accomplished via transvaginal, retropubic, or supra-meatal approach. Urethrolysis surgery is typically reserved for patients who have severe obstruction or failed prior sling loosening or incision. At time of urethrolysis, tissue interposition with a Martius flap is sometimes utilizedto decrease subsequent risk of fibrosis and also increase urethral support [31]. Success rates range from 65-93% and recurrent incontinence occurs in 0-19% [31]. Due to the risk of recurrent incontinence in patients that opt for sling incision, excision, or urethrolysis, there is some controversy about whether or not to perform a concomitant anti-incontinence procedure. There are no randomized trials using this approach, and the available literature suggests that rates of recurrent incontinence are the same regardless of whether or not prophylactic anti-incontinence surgery is done [59]. We prefer to not do a concomitant anti-incontinence procedure as this may obscure the clinically important question of whether the sling incision, excision, or urethrolysis relieved the obstruction and if patients had symptomatic improvement. Videourodynamics has been recommended as an important diagnostic tool in patients after incision, excision, or urethrolysis [60]. Management of patients with persistent urinary retention after revision surgery or persistent LUTS is a challenging problem. Patients should be counselled about repeat UDS testing at 3 months, and if persistent obstruction is identified, repeat urethrolysis can be attempted with high success rates of 91% [61]. Patients that prove to not be obstructed on subsequent testing but have persistent LUTS should have therapy directed towards the

bladder [6]. Unfortunately, over 50% of patients with overactive bladder symptoms (OAB) prior to urethrolysis can have persistence of OAB symptoms following urethrolysis or sling take-down [62]. These patients have lower overall satisfaction. Starkman et al. [63,64] demonstrated that many of these patients can be effectively treated with anticholinergics, but for those who fail medical therapy, Botox and sacral neuro modulation can be used for this complex patient population.

Conclusion

Voiding dysfunction is a significant problem and can occur in 5-10% of patients following surgery for treatment of stress incontinence. The diagnosis of iatrogenic obstruction after incontinence surgery is not always obvious and there are still no standardized criteria. Hence, close follow-up and monitoring of patients is essential so that timely diagnosis and intervention can be done before the development of permanent bladder dysfunction. A high clinical index of suspicion needs to be maintained in patients with new onset voiding symptoms after surgery. Interventions for treating obstruction include conservative (CIC, biofeedback, pelvic floor relaxation), medical (alpha blockers, anticholinergics, beta 3-agonists), and surgical (sling incision, excision, urethrolysis). Medications do not appear to have significant clinical efficacy because they do not correct the underlying anatomical defect. The choice of intervention depends on the degree of obstruction and underlying etiology causing the obstruction. Patients with severe incontinence preoperatively may be content and best managed with CIC due to high risk of recurrent incontinence. The optimal timing for intervention is still not well standardized, and more studies are needed in this area. Patients should also be warned about possible recurrence of incontinence and persistence of storage symptoms. Complex problems may arise after seemingly simple anti-incontinence surgeries; hence, it is important that these operations are performed by surgeons with expertise in voiding dysfunction, so that complications may be recognized and adequately managed.

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