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The Bladder Neck Sling: What Role Remains?

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Abstract A decade ago, bladder neck slings were recognized as the gold standard technique for a majority of patients. Today, tension-free vaginal tape is widely accepted as the standard approach for index surgery in female stress urinary incontinence. Recently published articles have demonstrated a decrease in the use of bladder neck slings and a significant increase in the use of mid urethral synthetic slings. Currently, bladder neck sling procedures appear to confer a cure rate similar to open retropubic colposuspension and mid urethral sling procedures, but the long-term adverse event profiles are still unclear. Although, bladder neck slings remain in the armamentarium of pelvic surgeons, they are reserved mainly for pediatric patients and for complex patients at high risk for urethral damage, with recurrent urinary incontinence and with low-pressure urethras, as well as for the patients who may refuse having synthetic slings. This article reviews the role of bladder neck slings in the era of the midurethral slings.

Keywords Bladder neck sling · Fascial sling · Pubovaginal · Stress urinary incontinence · Low pressure urethra · Recurrent stress urinary incontinence · Mixed urinary incontinence · Complicated stress urinary incontinence

Introduction

Despite recent successes in the treatment of urinary incontinence in women, some complicated cases remain challenging for health care specialists. Since the last century, many surgical techniques have been developed for the surgical treatment of urinary incontinence. A decade ago, bladder neck slings were recognized as the gold standard technique for a majority of patients. Today, mid urethral synthetic slings (MUS) are widely accepted as the standard approach for index surgery in patients with female stress urinary incontinence (SUI). Use of bladder neck slings had been commonly reserved for patients with complicated, severe or recurrent stress urinary incontinence related to intrinsic sphincter damage. Indeed, some authors still advocate this method for all types of urinary incontinence [1].

Since the introduction of the bladder neck fascial sling by Goebel [2] in 1910, many modifications of the original technique have been published [3-7]. Most of these modified techniques used autograft or allograft slings, as well as different synthetic materials, while in all cases, the slings have been used with the intention of repairing intrinsic sphincter failure. One of the most popular surgeries was Aldridge's technique, which was published in 1942 and included placing a strip of autologous rectus fascial tissue beneath the urethrovesical junction [3]. Currently, many factors influence the surgeon's decision about which technique to use. Because sling procedures have been associated with higher rates of postoperative obstructive voiding dysfunction, they are often reserved for patients with complicated stress incontinence, such as intrinsic urethral sphincter weakness, or recurrent incontinence. However, bladder neck fascial slings have successfully been used in female myelodysplastic patients [8, 9] and in male neurogenic patients [10, 11]. The aim of this article was to review the role of bladder neck slings in the armamentarium of pelvic floor specialists in the era of the midurethral sling.

Cochrane Review

A Cochrane review by Rehman [12••], which was dedicated to traditional slings, including bladder neck slings, was

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published in 2011. The traditional sling operation aims to hold up the bladder with a strip of material, which may be biological or synthetic. This review included 26 trials involving 2284 women. The quality of evidence was moderate for most trials, and follow-ups were generally short in duration, ranging from 6 to 24 months. The main conclusions of the authors were that bladder neck slings seemed to be as effective as minimally invasive slings, but they were associated with higher rates of adverse effects. The authors did indicate that these results should be interpreted with some caution, however, as the quality of evidence for the studies was variable, the follow-ups were short, and the populations were small, particularly for the purpose of identifying complication rates. Traditional sling procedures appeared to confer a cure rate similar to open retropubic colposuspension, but the long-term adverse event profile remained unclear. In this review, there were few high quality trials that compared slings with other forms of surgery, with only one study comparing sling surgery to non-surgical treatment.

SISTEr Study

The SISTEr study was one of the most important, best-designed and highest-quality studies related to the treatment of stress urinary incontinence in women [13]. A total of 655 women were randomized to receive an autologous fascial pubovaginal sling or Burch colposuspension.

Primary Results

Albo [14] published two-year follow up data that were collected from 520 patients out of a total of 655. The other patients were lost to follow-up. Overall success was defined as no self-reported symptoms of incontinence, a negative stress test and no re-treatment. Within 2 years, 38.1 % (101/265) of the patients who underwent Burch procedures and 50.1 % (130/255) of the patients in the fascial sling group reported subjective failure. Positive pad tests were reported in 14 % (37/265) and 15 % (38/255) of Burch procedure and fascial sling patients, respectively [15].

Complications

All of the serious adverse events noticed in the study were reported to the National Institute for Diabetes, Digestive and Kidney Diseases. The Safety Monitoring Board regularly reviewed the summary reports of all adverse events [16•]. The work group for complications was blinded to site, surgeon and randomization assignment. This study showed that complications in women who underwent bladder neck sling procedures and Burch procedures were associated with surgical factors only and were not associated with patient-related factors. Lower urinary tract infections were the most common complications after continence surgery. Patients who received bladder neck slings had higher cystitis rates compared to those who underwent Burch colposuspension. Blood loss and operative time were significantly associated with adverse events but were similar in both groups. Intermittent self-catheterization increased the cystitis rates by 17 % and 23 % in the Burch and sling groups, respectively.

Long-Term Results

Extended follow-up of the SISTEr participants provides an important view into the long-term results for women who have undergone bladder neck surgery for SUI (E-SISTEr study) [17•]. The study participants were contacted via phone and mail every 6 months, starting from 30 months after randomized surgery, for data collection. The follow-ups continued until the administratively defined end of the study in February 2010, providing a minimum of 5 years of follow-up after surgery. The 5-year follow-up rates were similar between the treatment groups, with 200 of 243 (82 %) patients in the sling group and 199 of 239 (83 %) patients in the Burch group followed up. The median duration of follow-up in the E-SISTEr study was 6 years. According to the results of this study, continence rates decreased regularly over 7 years in both groups of patients, and the continence rates were lower in the Burch cohort compared to the bladder neck sling group. The urinary continence rate decreased in the sling group markedly, from 52 % at baseline to 34 % in year 5 and to 27 % in year 7, though this decrease was less dramatic than that of the Burch group. The average yearly decrease in the continence rate was 6 % from the end of SISTEr.

Factors Associated with Long-Term Continence

The high rates of postoperative incontinence led authors to examine the preoperative and postoperative factors associated with long-term continence rates [18]. The baseline factors associated with decreasing continence were the Burch procedure itself, a history of previous UI surgery, being postmenopausal without the use of an HRT and a higher MESA urge index. Among the postoperative factors assessed, only increasing urgency incontinence symptoms were associated with decreasing continence rates.

Low-Pressure Urethra

Intrinsic sphincter deficiency (ISD) can lead to higher failure rates of anti-incontinence surgery. Sand found that the

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group of women with urethral closure pressures ≤20 cm H_2O had a 54 % objective failure rate at 3 months after surgery, compared with an 18 % objective failure rate in the group with higher closure pressures [19]. The authors concluded that patients with such "low-pressure urethras" might be better served by sling procedures for the correction of stress incontinence. Several studies have attempted to evaluate and compare the results of using bladder neck slings for the treatment of women with low-pressure urethras.

Maher published a study that evaluated the efficacy of bladder neck slings in women with ISD diagnosed as having a maximum urethral closure pressure (MUCP) ≤20 cm H_2O who failed to respond to conservative treatment [20]. In this study, bladder neck slings were compared to urethral bulking agents. Follow-ups were conducted at 6 months and 1 year. According to the authors, the symptomatic and patient-satisfaction success rates were similar following the sling procedures and bulking agents, with the objective success rate being significantly greater following the sling procedure (81 % vs. 9 %). Urethral bulking agents resulted in significantly lower morbidity, but they were more expensive than slings ($P<0.001$). The response rate at 62 months of follow-up was 60 % in both groups, with the sling group reporting better rates of continence success (69 % vs. 21 %) and satisfaction (69 % vs. 29 %). The authors concluded that bladder neck fascial slings were more efficient and cost-effective than transurethral bulking agents for the treatment of SUI and ISD.

Another study related to the use of bladder neck slings in patients with low-pressure urethras was published by Sand in 2000 [21]. Included in the study were 36 women with genuine stress incontinence and a maximum urethral closure pressure ≤20 cm H_2O. They were randomly assigned to undergo either a modified Burch procedure with an increased number of tensioned stitches (n=19) or to receive a bladder neck synthetic sling (n=17). All of the sling procedures were performed as described by Horbach [22], with a continuous polytetraflouroethylene (Gore-Tex Soft Tissue Patch; W.L. Gore) strip running from the rectus fascia into the retropubic space and beneath the urethra at the level of the urethrovesical junction. The objective and subjective cure rates at 3 months after surgery were the primary outcome measurements. After surgery, the sling groups had statistically similar cure rates and voiding functions. Urethral closure pressure, pressure transmission ratios, and maximum detrusor pressure during voiding were significantly higher in the sling group.

In contrast, Wadie [23, 24] found that urethral pressure had no value in terms of predicting the success of incontinence surgery. According to the author, measuring MUCP and identifying patients with low-pressure urethras did not help with follow-up and led to unnecessary expenditures of time and money.

Bladder Neck Slings in Children with Neurogenic Bladders

In children with neurogenic bladders, dysfunction can result in disabling incontinence. The management of urinary incontinence in this category of patients is a significant challenge to urologists. Urinary incontinence has been rarely attributed to an incompetent bladder outlet. Abnormalities in detrusor muscle activity, causing uninhibited contractions, as well as poor compliance, are often successfully treated with anticholinergics and with detrusor injections of botulinum toxin or even augmentation cystoplasty. Treating incompetent bladder necks remains a significant challenge; although a small number of children with neurogenic dysfunction might respond to asympathomimetic agents and clean intermittent catheterization, the majority require surgical manipulation of the bladder neck to restore continence.

There are many surgical techniques to achieve urinary continence in children with neuropathic bladders, including artificial urinary sphincters, bladder neck reconstruction procedures and injections of bulking agents. Although bulking agents are less invasive to administer than other agents, their continence effects have been found to be less durable in long-term observations of children with neuropathic bladders. Bladder neck reconstruction and artificial urinary sphincter placement occlude the bladder neck and outlet, increase detrusor leak point pressure and, thus, pose significant risks to the upper tracts if the bladder is not drained in a timely fashion. There is a contrasting opinion that bladder neck slings do not result in an increase in the detrusor leak point pressure. However, this surgical technique does increase the abdominal leak point pressure [25, 26].

Austin et al. investigated the use of bladder neck fascial slings [27]. Ten female patients and eight male patients with neuropathic bladders secondary to myelodysplasia or traumatic spinal cord injuries underwent fascial sling procedures. The mean patient age was 14 years, with a range 8 to 18 years, and all of the patients were incontinent despite medical management. In conjunction with the rectus fascial slings, four patients underwent simultaneous augmentation cystoplasty, whereas two had undergone augmentation previously. In this article, the immediate continence rate was observed to be 78 %; with secondary procedures, the continence rate increased to 94.4 %. In another review of the literature regarding the outcomes of bladder neck sling procedures in children, Perez noted a 75 % complete continence rate in a combined series of 122 patients [28].

Bladder Neck Slings in Male Children

The majority of fascial slings have been used in female children, although a number have also been used in male

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children. The consensus of these reports has been that the fascial sling is the procedure of choice for female children with neuropathic bladders. Although most of these series have reported good results, the number of male patients in each series has been small. It remains unclear whether slings will have the same durable, long-term success in male children.

Nguyen et al. reported the results of a retrospective review of seven boys who underwent placement of bladder neck fascial slings for neurogenic sphincteric incontinence [29]. The etiology of neurogenic incontinence was myelodysplasia in five cases, sacral agenesis in one patient and spinal trauma in one patient. Despite the administration of anticholinergic and asympathomimetic agents and clean intermittent catheterization every 2 hours, the boys had daytime and nighttime incontinence. Of the six boys (out of seven) who were continent after surgery, three of them were followed up for 1 year, and the other three had more than 6 years of follow-up. These six patients all reported significant improvement of their incontinence. They performed clean intermittent catheterization every 4 to 6 hours to remain continent and were not on any asympathomimetic agents.

Management of Mixed Incontinence

Mixed urinary incontinence is a troublesome condition for both patients and incontinence specialists because both the stress and urge components of the incontinence must respond to therapy if the therapy is to be considered [30]. Osman reported the results of a study that included 75 women with mixed incontinence symptoms and with no detrusor overactivity during filling cystometry [31]. The patients were randomized into two groups: patients treated with an anticholinergic (oxybutynin) and patients treated with bladder neck sling procedures. The results were analyzed in terms of patient-reported incontinence within one year. The study showed that most patients with mixed incontinence were cured of both symptoms with fascial sling surgery. The authors suggested that slings are significantly better for treating mixed urinary incontinence than oxybutynin alone. The incidence of residual urgency symptoms in patients who underwent fascial sling surgery was no higher than that of de novo urge symptoms after surgery in patients with genuine SUI.

Bladder Neck Fascial Slings vs. Xenografts

Guerrero [32] reported the data from a randomized clinical trial comparing the efficacy and safety of bladder neck fascial slings to both the Pelvicol sling (Acellular Collagen Matrix) and to mid urethral synthetic slings. A total of 201 women with urodynamically proven stress incontinence were randomized into three groups and were assessed at baseline, 6 weeks, 6 months and 1 year. At 6 months, the bladder neck fascial sling group had better improvement rates (95 %) than the Pelvicol group (73 %). At 1 year, only 61 % of patients who had received Pelvicol slings remained improved vs. 90 % of patients who had received fascial slings. The bladder neck sling patients had better dry rates (48 %) at 1 year than the Pelvicol sling patients (22 %). However, the fascial bladder neck slings were found to be as effective as MUS. One in five women in the Pelvicol group underwent further surgery for SUI within 1 year, but none of the patients in the other groups required further surgery. However, fascial sling surgery took longer to perform (54 minutes versus 35 minutes for MUS and 36 minutes for Pelvicol) and had higher self-catheterization rates. The authors of the study concluded that fascial bladder neck slings were as effective as retropubic mid urethral slings and were superior to the Pelvicol slings, even though bladder outlet obstruction was more common after bladder neck slings procedures. Similar findings were reported by Lucas and co-authors [33].

Mid Urethral Slings vs. Bladder Neck Slings

Amaro [34] reported on an RCT that compared autologous fascial slings with MUS. This was a single-blind trial with follow-ups at 1, 6, 12 and 36 months. The subjects included 21 patients with autologous fascial slings and 20 patients with MUS. The authors used the King's Health Questionnaire (KHQ). There were no statistically significant differences between groups with regard to general health conditions, the impact of incontinence, roles, physical and social limitations, personal relationships, emotions, sleep or severity perception of urinary incontinence at 36 months. Amaro concluded that tension-free synthetic midurethral sling operations appeared to be as effective as bladder neck sling operations.

Sharifiaghdas randomized one hundred women to either MUS or bladder neck fascial sling procedures and followed them for 3 years. The objective cure rates were similar in the MUS (76 %) and sling (72 %) groups [35]. Another study confirmed that the long-term cure rates also appeared similar, with estimated 7-year cure rates of 59 % for the fascial slings and 55 % for MUS [36].

Complex Incontinence

Bladder neck fascial slings are often used in patients with complex stress incontinence, such as that characterized by intrinsic urethral sphincter weakness, or with recurrent

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incontinence; they are also used during simultaneous urethral reconstructions. A study by Flisser [37] included 74 women who underwent urethral reconstruction, including 56 who had concomitant bladder neck slings. The authors reported that 87 % of the subjects were cured/improved in terms of SUI. Another study [38] reported a 50 % cure rate in 14 patients who received secondary fascial slings after failure of their initial slings. Migliari and colleagues [39] reported an SUI cure rate of 80 % in 32 women treated with AF-PVS at the time of urethral diverticulum repair.

A recent study, published in 2012 by Welk [40], included 18 complex patients: ten had symptomatic urethral, bladder or vaginal mesh erosions; two had urethral diverticulectomies; two had pelvic fractures; two had iatrogenic urethral injuries; one had previous pelvic radiation; and one had obstetrical trauma. Patients with mesh erosions were treated with initial surgery to remove the eroded mesh, and then a subsequent operation was performed for the fascial sling. Among the erosion patients, six were urethral erosions and two were vaginal erosions of tension-free vaginal tape. There were two erosions due to previous synthetic bladder neck slings (one eroded into the bladder and one into the vagina). The outcomes in this challenging patient group were reasonable, with successful outcomes in approximately two thirds of patients. Thus, these slings can be used to salvage difficult SUI cases.

Urethrovaginal Fistulae

Urethrovaginal fistulae are still rare problems in female urology. In developed countries, urethral diverticulectomies, paraurethral cyst removals and anti-incontinence procedures are the major causes of this condition. Pushkar and co-authors reported retrospective data from 71 patients suffering from urethrovaginal fistulae [41]. After the fistula repair, 52.1 % (37/71) developed stress urinary incontinence due to incompetence of the urethral sphincter. Some of these patients were managed with autologous skin/fascial bladder neck slings (17/37). Others were managed with tension-free vaginal tape. Twenty-two (59.5 %) patients were objectively cured, and many others were satisfied with their results because of improvement (12/37). The authors concluded that bladder neck autologous slings, as well as mid urethral synthetic sling, can be used for the management of urinary incontinence after urethrovaginal fistula repair.

Conclusions

Recently published data from the US National Hospital Discharge Survey demonstrated a decrease in the use of bladder neck slings and a significant increase in the use of tension-free vaginal tape [42].

There is no doubt that tension-free vaginal tape is replacing the autologous fascial sling as the gold-standard treatment for uncomplicated stress urinary incontinence in women. Tension-free vaginal tape operations appear to be as effective as traditional suburethral slings in both the short term and long term. However, it has not been possible to determine whether either type of sling is more effective in women who have previous failed continence surgery. The data on healthcare costs are also limited. Data regarding relative costs might be particularly important in clinical situations in which the advantages of minimally invasive procedures, such as shorter operative times and hospital stays, could overcome the cost of the synthetic tape.

To conclude, bladder neck slings remain in the armamentarium of pelvic surgeons and are reserved mainly for pediatric patients and for complicated cohorts of patients at high risk for urethral damage.

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