The Impact of Pelvic Reconstructive Surgery for Pelvic Organ Prolapse and Urinary Incontinence on Female Sexual Dysfunction: A Review

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Abstract
Symptoms of sexual dysfunction are defined as a departure from normal sensations and/or function experienced by a woman during sexual activity. The diagnosis of urinary incontinence and/or pelvic organ prolapse along with their treatments can have a psychological impact. Surgical procedures may help resolve the symptoms of the diagnosis however can contribute to worsening sexual dysfunction. There is not much literature evaluating female sexual function pre or post-operatively on women undergoing these procedures. This review will discuss how surgical treatments for pelvic organ prolapse and/or urinary incontinence affect sexual function.

INTRODUCTION

Definitions
The DSM-IV TR [1] classification system has been used for many years to define female sexual dysfunction (FSD). The DSM-5 classification of FSD has now been published and definitions are listed in (Table 1). The DSM-5 classification system is relatively new and no studies are available for evidence-based evaluation [2].

Symptoms
Symptoms of sexual dysfunction are defined as a departure from normal sensations and/or function experienced by a woman during sexual activity [3]. The type of sexual dysfunction depends on procedure and indication. Sexual behavior and partner relationship must first be evaluated pre and post-operatively. One must understand the psychological impact of the diagnoses of urinary incontinence and pelvic organ prolapse (POP) on an individual. After surgery, de novo symptoms may occur including coital incontinence (urinary and fecal), urge urinary incontinence (UUI), sexual dysfunction, dyspareunia, and partner dyspareunia. Symptoms may vary as each preoperative diagnosis indicates a specific treatment plan. For example, women that undergo a mid urethral sling for stress urinary incontinence (SUI) may develop mesh extrusion into the vagina, mesh contracture, worsening SUI and/or UUI that may impact sexual behavior. Women that undergo native tissue repair for POP may develop a shortened vagina from wound healing or scarring leading to dyspareunia. All pelvic surgical procedures have the potential to cause FSD or acutely worsen persistent symptoms through a variety of proposed mechanisms not well described in the literature.

Evaluation
Signs of FSD include any abnormality indicative of disease or a health problem discoverable on examination [3]. Pelvic evaluation may display vaginal shortening and scarring which may be the cause of a woman’s symptoms. Table (2) describes the various signs encountered during vaginal examination that may attribute to FSD. The procedure and the indication, position and mobility of the bladder neck, placement of meshes, tapes, and implants may impact FSD [3].

Outcome measures
A minimum demographic data set is recommended when documenting surgical outcomes to ensure more consistent reporting including age, parity, BMI, hormone replacement therapy (HRT), prior hysterectomy, prior POP surgery, prior continence surgery, chronic cough, chronic constipation, and smoking history [3]. Composite outcome measures for the correction of POP include pelvic organ prolapse quantification.
Table 1: DSM 5 Female Sexual Dysfunction Definitions modified from Association, A.P., Sexual Dysfunction, in Diagnostic and statistical manual of mental disorders. 2013: Washington, D.C.

<table>
<thead>
<tr>
<th>Female Sexual Interest/Arousal Disorder</th>
<th>Lack of, or significantly reduced, sexual interest or arousal, as manifested by at least 3 of the following:</th>
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<tr>
<td></td>
<td>1. Absent or decreased interest in sexual activity.</td>
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<td>2. Absent or decreased sexual/erotic thoughts or fantasies.</td>
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<td>3. Absent or decreased initiation of sexual activity, and typically unreceptive to a partner’s attempts to initiate.</td>
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<td>4. Absent or decreased sexual excitement or pleasure during sexual activity in almost all (approximately 75%-100%) sexual encounters.</td>
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<td>5. Absent or decreased sexual interest or arousal in response to any internal or external sexual and erotic cues (e.g., written, verbal, visual).</td>
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<td></td>
<td>6. Absent or decreased genital or nongenital sensations during sexual activity in almost all (approximately 75%-100%) sexual encounters.</td>
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Genito-Pelvic Pain/Penetration Disorder

Persistent or recurrent difficulties with 1 or more of the following:

1. Vaginal penetration during intercourse.
2. Marked vulvovaginal or pelvic pain during vaginal intercourse or penetration attempts.
3. Marked fear or anxiety about vulvovaginal or pelvic pain in anticipation of, during, or as a result of vaginal penetration.
4. Marked tensing or tightening of the pelvic floor muscles during attempted vaginal penetration.

Female Orgasmic Disorder

Presence of either of the following on all or almost all (75-100%) occasions of sexual activity:

1. Marked delay in, marked infrequency of, or absence of orgasm.
2. Markedly reduced intensity of orgasmic sensations.


<table>
<thead>
<tr>
<th>Sign</th>
<th>Definition</th>
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<tr>
<td>Exam for urinary incontinence best performed with comfortably full bladder</td>
<td>Urinary incontinence Observation of involuntary loss of urine</td>
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<tr>
<td>Exam for POP performed with empty bladder and in lithotomy position</td>
<td>Pelvic organ prolapse Descent of one or more compartments of vaginal walls including apex described using POP Q Staging system</td>
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<tr>
<td>Exam for urethral pathology best with empty bladder</td>
<td>Urethral caruncle Eversion of the urethral urothelium</td>
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<td>Urethral diverticulum</td>
<td>Lump or tenderness along urethral or external urethral discharge during urethral massage</td>
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<tr>
<td>Exam for vagina includes length and mobility, presence of scarring and/or pain and estrogenization</td>
<td>Vaginal dermatoses Apparent skin changes, biopsy confirms diagnosis in most instances</td>
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<tr>
<td>Vaginal atrophy</td>
<td>Distinct skin changes including paleness and loss of physiologic discharge</td>
</tr>
<tr>
<td>Vaginal cysts (Gardners or Bartholins)</td>
<td>Observation of mass in appropriate location</td>
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<tr>
<td>Vaginal foreign body</td>
<td>Includes, but not limited to, vaginal mesh, menstrual tampon, pessary devices, etc</td>
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<tr>
<td>Exam of pelvic floor muscles</td>
<td>Overactive pelvic floor muscles Muscles which do not relax</td>
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<tr>
<td>Underactive pelvic floor muscles</td>
<td>Muscles which cannot voluntarily contract</td>
</tr>
<tr>
<td>Non-functioning pelvic floor muscles</td>
<td>Muscles where there is no action palpable</td>
</tr>
<tr>
<td>Perineal descent</td>
<td>Seen on valsala; vulva, perineum and anus move outward</td>
</tr>
<tr>
<td>Anal sphincter laceration</td>
<td>Drooping or gap seen in the anal sphincter on digital exam</td>
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<tr>
<td>Neurologic Exam</td>
<td>Pelvic plexus injury Normal perineal sensation, normal levatorani and anal sphincter squeeze strength, normal bulbocavernous and anal wink reflexes, anal sphincter resting tone may be decreased</td>
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<tr>
<td>Parkinsons disease</td>
<td>Bowel and bladder dysfunction</td>
</tr>
<tr>
<td>Spinal cord lesions</td>
<td>Lower extremity hyperreflexia, sensory loss, weakness consistent with location of injury</td>
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(POP-Q) to the hymen, bulge symptoms, and re-operation rate. Sexual data are usually secondary outcomes. The onset, duration, severity, level of personal distress, improvement after surgery, frequency of sexual activity, and de novo sexual dysfunction and dyspareunia should be recorded. In these cases, sexual function remains the same post-operatively or improves in most cases. Providers should use the tool that is most appropriate for the patient’s specific situation and assess sexual function before and after surgery.

The Female Sexual Function Index (FSFI-19) and Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ) are most commonly used to assess sexual function [4-6] although there are other options to assess sexual function.

The FSFI-19 includes 19 questions in 5 domains which include desire, arousal, orgasm, pain, and satisfaction [7]. The zero category was suggested as non-applicable in scoring [8]. The cut-off score for female sexual dysfunction is 26.55 and is not condition-specific [9]. The PISQ is a validated condition specific questionnaire of 31 questions for pelvic floor disorders [10]. There are abbreviated versions of these questionnaires such as PISQ [11] and PFDI and PFIQ [12]. In 2013, the PISQ-IUGA Revised (PISQ-IR) was validated for sexually active (21 items) and non-sexually active patients (12 items), as well as patients with anal incontinence. Patients with pelvic pain were excluded. This questionnaire provides information on the impact of pelvic floor disorders on sexual function, especially sexual inactivity. The Female Sexual Distress Score (FSDS) questionnaire measures the personal distress component of female sexual dysfunction. This is assessed in a 12 item self-report questionnaire with 6 subscales [13]. The FSDS and FSFI-19 discriminates between women with and without sexual problems [14]. The FSDS-Revised increased the sensitivity for patients with hypoactive sexual desire disorder [15]. The Lemack questionnaire is an invalidated sexual function questionnaire including a question on coital incontinence [16]. The McCoy sexual inventory for sexual behavior involves 9 questions, regarding appreciation of the present extent of sexual activity, sexual interest, enjoyment, excitement, orgasm, vaginal dryness, dyspareunia, ad partner relationship [17]. Finally, the Male Sexual Health Questionnaire (MSHQ) is a 25 items survey with 4 domains; erection, ejaculation, satisfaction, and desire with a higher score indicating better sexual function and may be beneficial in a complete evaluation for FSD [18].

Surgical treatment and non-conservative minimally invasive treatment

Surgical procedures that may result in FSD include treatment of incontinence and pelvic organ prolapse. Other non-conservative, minimally invasive treatment procedures that may result in FSD include sacral neuromodulation, intravesical onabotulinumtoxinA injection, and percutaneous tibial nerve stimulation (PTNS).

Surgical outcomes

Sexual function traditionally has not been mentioned in surgical outcomes. Patients with urinary incontinence can report impairment in sexual function [19]. Prolapse is more likely to result in sexual inactivity and perceived to affect sexual relations than urinary incontinence (UI). Sexual satisfaction is independent of diagnosis or therapy for urinary incontinence or prolapse [6,20,21]. The effect of surgery on sexual function is of significant interest as demonstrated by an increased number of abstracts reporting with female sexual function over the past 15 years. There is a need for focused research regarding sexual function and dysfunction [5,22].

Overall, there is a lack of randomized controlled trials (RCTs) and follow-up. In many studies the Level of Evidence (LOE) is poor and sexual dysfunction is often a secondary outcome measure.

Urinary incontinence

Stress urinary incontinence and midurethral slings: Hoda et al., utilized the validated FSFI-19 as a primary outcome to prospectively follow 96 sexually active women for 2 years after undergoing a transobturator mesh implant. The FSFI-19 scores initially decreased in the first 3 months, followed by reported improvement in sexual function thereafter (p=0.023). The positive outcomes in this study may have been influenced by the inclusion of only sexually active women, young age (mean age 51.4 years), and peri-operative use of topical estrogen [24].

In a retrospective cohort evaluating sling revision surgery, 64% of women were satisfied with surgery and had an improvement in pain (p=0.04), dyspareunia (p< 0.001) and Patient Global Impression of Improvement questionnaire scores (p< 0.0001) [25]. Pastore et al., conducted a prospective trial including 42 women randomized to tension-free transobturator suburethral tape or single incision sling. The FSFI-19 score increased significantly in all 6 domains in both treatment groups [26]. Sixty-three women who had a tension-free vaginal tape performed for SUI completed PISQ-12 questionnaires pre-operatively and 6 months following surgery. PISQ-12 scores were significantly improved (p< 0.05) and virtually cured coital incontinence post-operatively. The improvement in sexual function may be due to the resolution of incontinence [27].

Coital urinary incontinence and midurethral slings: Coital incontinence is present in 23-56% of incontinent women and associated with decreased frequency of sexual intercourse [28]. Improvement in coital incontinence after SUI surgery led to the greatest improvement in sexual function in a retrospective study [29]. Pastore et al. conducted a prospective trial including 42 women randomized to tension-free transobturator suburethral tape or single incision sling. The FSFI-19 score increased significantly in all 6 domains in both treatment groups [26]. Sixty-three women who had a tension-free vaginal tape performed for SUI completed PISQ-12 questionnaires pre-operatively and 6 months following surgery. PISQ-12 scores were significantly improved (p< 0.05) and virtually cured coital incontinence post-operatively. The improvement in sexual function may be due to the resolution of incontinence [27].
incontinence during sexual activity was significantly decreased in women undergoing prolapse surgery [27].

**Stress urinary incontinence and prolapse repair**: In a prospective study of women undergoing SUI and POP surgery, 81 of 165 patients (49%) were sexually active pre and postoperatively. Post-operative introital caliber and length were significantly decreased in women after surgery (p < 0.001) however, were not correlated with sexual function measured by dyspareunia, frequency of intercourse, vaginal dryness and satisfaction [5]. Celik et al., studied 116 women who underwent procedures for incontinence and/or pelvic organ prolapse and grouped patients into POP, UI, and UI + POP procedures. PISQ-12 scores did not worsen among any of the groups, however there was a significant improvement in the UI and UI + POP groups [36].

**Pelvic organ prolapse**

A third of sexually active women with POP complain that prolapse interferes with sexual function [37]. The resolution of POP symptoms after treatment can improve female sexual function [38]. Multiple studies have shown that total and supra-cervical hysterectomy have an equivocal impact on sexual function [39-41]. Some have argued that rhythmic uterine contractions at time of orgasm are pleasurable and are adamant about keeping their uterus and cervix [39]. Helstrom et al., evaluated 118 sexually active women who underwent surgery for UI or POP, of whom 88 had deterioration in sexual activity on the McCoy inventory for sexual behavior and a decreased sexual frequency at 1 year follow-up. Dyspareunia was not significantly increased postoperatively but quality of life was improved [42].

Jelovsek et al., evaluated the association between the modified body image scale (MBIS) and the PFDI demonstrating that worse body image and the feeling of less sexually attractive was correlated with POP [37]. Two hundred thirty-five women who had pessary treatment or POP reconstructive surgery were followed 6 months after treatment. The surgical group had improved MBIS, PFDI, and PISQ scores as compared to the pessary group demonstrating an improvement in POP symptoms, sexual function, and body image perception [38]. Women with a total vaginal length of less than 7cm post-operatively appear to have a negative impact on sexual function, so shortening of the vagina should be avoided [39]. Patients undergoing native tissue repair for POP had an improvement in the PISQ-12-SF of 72% 6 months post-operatively [27].

**Anterior repair**: In a recent Cochrane review, there were no differences in de novo dyspareunia among native tissue and mesh augmented repairs for anterior prolapse [43]. Nguyen et al., found de novo dyspareunia was less in the anterior mesh group than in the native tissue group post operatively, 9% vs 16% respectively after one year [44]. To further support this finding, Weber et al., evaluated 16 patients after vaginal mesh placement at 6 month follow up and found mesh did not decrease vaginal vasocongestion or vaginal wall sensibility under erotic conditions. Sexual function was unchanged using various validated questionnaires [45]. An RCT comparing anterior repair with and without mesh showed 100 of 202 patients (50%) were sexually active preoperatively with no significant deterioration at 3 years follow-up in both groups. There was no difference between groups in coital frequency, satisfaction, ability to reach orgasm, or dyspareunia pre and post-operatively [46]. Alternatively, Altman et al., compared transvaginal mesh repair with anterior colporrhaphy showed the mesh to have higher success but also higher rates of surgical complications and post-operative adverse events at 12 months follow-up. The PISQ-12 scores at baseline were similar among both groups at baseline and moderately improved and partner satisfaction at one year. De novo dyspareunia was found in 2% of the colporrhaphy group and 7.3% in the mesh group (P = 0.07) [47].

**Posterior repair**: Traditional fascial plication has been described with and without levatorani pllication to correct posterior defects. According to Paraizo et al., posterior colporrhaphy has a lower anatomic failure rate than site-specific fascial defect repair. The rate of dyspareunia was 20% in the posterior colporrhaphy group compared to 14% in the site-specific group [48]. Due to the increased risk of dyspareunia, levatorani plication should be rarely used in patients undergoing native tissue repair. There is insufficient evidence to support the use of specific surgical techniques base on defect [49]. Schimpf et al., reviewed the use of graft and mesh use for posterior defect repair and found there is no difference in anatomic and quality-of-life outcomes when using synthetic absorbable mesh, synthetic nonabsorbable mesh, or biologic graft compared with native tissue. Furthermore, data on sexual function outcomes do not show a significant improvement with mesh or graft use [50]. The most recent literature does not support the use of biologic grafts in the posterior compartment [48,51]. In sexually active women undergoing surgery for urinary incontinence and/or POP repair, a study found that 30 out of 73 women who underwent posterior repair reported a higher dyspareunia rate compared to women who did not have a posterior repair (57% vs 28%, respectively) [52].

**Apical repair**: Apical repairs can be approached vaginally or abdominally using open or laparoscopic/robotic techniques. The gold standard approach is the abdominal sacrocolpopexy in which polypropylene mesh is attached to the vagina. Mesh extrusion into the vagina is a known complication of the sacrocolpopexy procedure and can occur up to 11%. The mesh extrusion rate depends on graft material, operator technique and length of follow up [53]. Newer reviews report mesh extrusion as low as 2% [54].

A metaanalysis of sexual function following uterosacral ligament suspension was lacking in comprehensiveness [55]. Silva f reported that of the 34 (47.2%) women that were sexually active pre and postoperatively following uterosacral ligament suspension, 7 (20.6%) complained of dyspareunia preoperatively that were cured after surgery. Seven patients described denovo dyspareunia after surgery that was associated with vaginal atrophy, tight introitus and decreased libido. Of the 31 who responded to the satisfaction domain on the FSFI, 29 (94%) reported normal satisfaction [56].

In the 2004 Cochrane review, Maher et al., found that abdominal sacrocolpopexy was found to have less postoperative dyspareunia compared to vaginal colpopexies [57]. A prospective randomized study with 95 women undergoing sacrocolpopexy or sacrospinouscolpopexy showed 40% with pre-operative
dyspareunia had post-operative resolution of dyspareunia and de novo dyspareunia occurred in 5.7% of cases regardless of the surgical approach [58].

Maher’s follow up review in 2011 comparing abdominal sacrocolpopexy to sacrospinous fixation shows similar results to the 2004 review. There was less dyspareunia in the sacrocolpopexy group than the sacrospinous group (RR 0.39, CI 0.18 - 0.86) [43].

Newer studies such as Geller et al., reported 160 women undergoing pelvic surgery with mesh including abdominal and laparoscopic sacrocolopexies, midurethral slings, transvaginal placement and concomitant mesh implants for POP and incontinence. Of the 54% that reported sexual activity, 19% reported dyspareunia postoperatively. Pelvic pain at one year after surgery was 15.8% however women with pain were younger, with fibromyalgia, worse physical health and less successful surgical outcomes (p< 0.5) [59].

Laparoscopic sacrocolpopexy procedures have limited data especially reporting the rate of dyspareunia. In a small prospective study with 22 women undergoing laparoscopic sacrocolpopexy, no new onset dyspareunia was reported at 2 years [60]. Fewer studies have reported sexual function outcomes following robotic sacrocolpopexy. Culligan et al., reported out of 64 patients that were sexually active without dyspareunia preoperatively, 3 (3.7%) reported de novo dyspareunia at 12 months [61].

**Mesh complications**

Pelvic organ prolapse recurrence after surgery led surgeons to seek more durable interventions through the use of synthetic mesh. In 2010, the Food and Drug Administration in the United States (U.S. FDA) placed a public health notification highlighting the increase in reported complications associated with the use of vaginal mesh [62]. The prevalence of vaginal mesh exposure/extrusion averages 10.3%, dyspareunia 9.1% and wound granulation 7.8% [63]. The use of polytrafluoroethylene and tobacco use was found to be a significant contributor to mesh erosion in a study evaluating risk factors following abdominal sacrocolpopexy [64].

Brubaker in 2006 coined the term “hispureunia” identifying partner dyspareunia in women with vaginal mesh exposure. Partners have reported penile laceration and bleeding after intercourse [65]. The specific effect of mesh complications on sexual function using validated questionnaires remains to be determined.

**Non-conservative minimally invasive treatment**

**Sacral neuromodulation**: Sacral nerve stimulation (SNS) was approved by the FDA for three indications; refractory urinary urgency/frequency, non-obstructive urinary retention, and fecal incontinence. A lead with 4 electrodes is placed in the S3 foramen and tested for 1 to 3 weeks. If urinary/bowel symptoms are more than 50% improved, an impulse generator is placed lateral to the sacrum. Neuromodulation of the pudendal, pelvic, and lateral femoral cutaneous nerves provide therapeutic decrease in incontinence, urinary frequency, post void residuals [66]. The level of evidence for sacral nerve stimulation and female sexual function is weak.

In a small prospective pilot study, 43% (7 patients) had a significant increase in the FSFI score from 20.74 to 30.22 at 5.7 months follow-up [67]. A significant improvement in FSFI and FSDS with a follow-up of up to 23 months was seen in 4 of 11 neurogenics and 2 of 8 idiopathics with permanent SNS in sexually active patients [68]. A prospective observational study of 167 women with voiding dysfunction showed a significant increase in FSFI score at 12 months following SNS [69]. Another prospective observational study of 23 sexually active women followed at least 4 months after SNS showed a significant increase in the total FSFI score (p=0.011) and the desire and orgasm component scores (p=0.014 and p=0.035, respectively). There was no correlation between FSFI scores and quality of life [70].

Nine of 16 sexually active women undergoing SNS for fecal incontinence completed a non-validated Sex Life Questionnaire. All had a significant reduction in fecal incontinence from 12 to 1.5 episodes per week (p=0.008). Seven of the 9 sexually active patients reported a median improvement of 40% in their sexuality up to 36 months follow-up [71].

**Percutaneous tibial nerve stimulation**: Percutaneous tibial nerve stimulation (PTNS) has been shown to be effective in treating overactive bladder (OAB), chronic pelvic pain (CPP), and non-obstructive urinary retention. One hundred twenty one patients with lower urinary tract dysfunction underwent 12 weeks of PTNS therapy prospectively. Men and women completed a validated sex questionnaire, Sexual Functioning, and Dutch language version (NSF-9) in which sexual frequency and satisfaction were significantly improved in men however greater response was seen in women [72]. More recently, Musco et al., conducted a prospective study for women with dry OAB receiving PTNS. All patients completed an FSFI, OAB-short form questionnaire, and 24-hour bladder diary at baseline and at 3 months. All FSFI domains showed statistically significant improvement in women with FSD. This study may show the improvement in urinary function did not correlate with improvement in sexual function and possibly related to PTNS treatment rather than the improvement in OAB [73].

**Chemodenervation with Onabotulinumtoxin A**

OnabotulinumtoxinA has been used more recently to help treat symptoms of high-tone pelvic floor dysfunction (HTPFD) associated with CPP. OnabotulinumtoxinA is a neurotoxin that acts on the presynaptic motor neuron and inhibits release of acetylcholine thus inducing muscle paralysis. A pilot study was conducted evaluating electromyographic guided onabotulinumtoxinA injections into trigger points of patients with refractory high tone pelvic floor dysfunction. At 24 weeks after injection, 15 of 18 sexually active patients reported a significant decrease in dyspareunia on visual analog scale for pain (7.8 to 5.4). The FSDS improved from 33.5 at baseline to 22.6 at 24 weeks follow-up (p ≤ 0.001) [74]. In a randomized controlled trial in women with evidence of pelvic floor muscle spasm that received 80u of onabotulinumtoxinA or saline, the VAS for dyspareunia decreased from 6.6 to 1.2 after intra-muscular injection of onabotulinumtoxinA with a follow-up of 6 months [75].

OnabotulinumtoxinA intravesical injection is now
recommended as a third-line treatment of urinary urgency/ frequency. In a systematic review including a total of 11 studies and 2149 patients, intravesical injections of 100 U compared to placebo showed a significant improvement in the treatment of urinary urgency/frequency at 12 weeks after injection. Adverse events associated with onabotulinumtoxinA include urinary retention and urinary tract infections. There is no significant difference in infection rates between patients being treated with 100 U and those receiving higher doses [76].

SUMMARY

Further metanalyses, prospective studies and RCTs are needed that address sexual function with the utilization of validated questionnaires. The recording of vaginal dimensions and their relevance are sparse in the current literature. The validated questionnaires. The recording of vaginal dimensions needed that address sexual function with the utilization of

REFERENCES


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