4 Concomitant Management of Occult and Symptomatic Stress Urinary Incontinence

Steven J. Weissbart and Ariana L. Smith

Introduction

Millions of women worldwide have stress urinary incontinence (SUI) and experience significant bother from the inability to adequately store urine during laughing, sneezing, or exertion [1]. Women suffering from SUI may feel socially embarrassed, experience perineal skin irritation, and avoid exercise [1–3]. Additionally, many women with SUI incur significant financial costs from managing their incontinence [4]. Unfortunately, despite the morbidity associated with SUI, many women with SUI do not seek medical care and may consider SUI to be a normal aspect of aging [5]. Therefore, health care providers should consistently ask women about the presence of urinary incontinence and provide appropriate management when indicated.

Women with pelvic organ prolapse (POP) are at elevated risk of having SUI [6], and SUI management in women undergoing prolapse repair can be challenging. While many women with POP experience SUI preoperatively, a considerable proportion of women develop new SUI after reconstructive surgery and in essence have SUI "unmasked" by prolapse repair. Therefore, pelvic surgeons must address the presence of preexisting SUI during prolapse repair and additionally consider the possibility of SUI occurring postoperatively.

In this chapter, we discuss the concomitant management of SUI during robotic female pelvic floor reconstruction. Although information in this chapter is intended to aid surgeons performing robotic surgery, the majority of data on this topic has been accumulated from studies that predate the widespread use of robotic technology in the field of female pelvic medicine and reconstructive surgery. Nonetheless, the principles of managing SUI during prolapse repair that were gleaned from the open and straight-laparoscopic surgical experience are extremely applicable to managing SUI during robotic pelvic floor reconstruction.

S.J. Weissbart, M.D. (✉)
Department of Urology, Stony Brook University, Health Science Tower, Level 9, Room 040, Stony Brook, NY 11794, USA
e-mail: steven.weissbart@stonybrookmedicine.edu

A.L. Smith, M.D.
Department of Surgery, Perelman School of Medicine, University of Pennsylvania Health System, 800 Walnut Street, Philadelphia, PA 19107, USA
e-mail: ariana.smith@uphs.upenn.edu

J.T. Anger, K.S. Eilber (eds.), *The Use of Robotic Technology in Female Pelvic Floor Reconstruction*, DOI 10.1007/978-3-319-59611-2_4

Background

Definitions

Women with POP may report the symptom of SUI and/or demonstrate the sign of SUI during consultation. The International Continence Society (ICS) defines the symptom of SUI as the "complaint of involuntary leakage on effort or exertion, or on sneezing or coughing" and the sign of SUI as the "observation of involuntary leakage from the urethra, synchronous with exertion/effort, or sneezing or coughing" [7]. SUI on prolapse reduction, or "occult" SUI, is defined by the ICS as "stress incontinence only observed after reduction of coexistent prolapse" [8]. Although not defined by the ICS, de novo SUI is commonly referred to as new SUI that occurs, or is "unmasked," after prolapse repair.

These definitions have been fundamental to categorizing three different subgroups of women with POP that may be seen during preoperative consultation: (1) women with POP and the symptom and/or sign of SUI (i.e., complain of SUI or demonstrate SUI on nonreduced testing), (2) women with POP who only have the sign of SUI on prolapse reduction (i.e., women with occult SUI), and (3) women with POP without any symptom or sign of SUI.

As will be discussed in this chapter, classifying women with POP according to these subgroups is clinically meaningful as women in each subgroup have different probabilities of experiencing SUI after prolapse repair.

Pathophysiology

The pathophysiology of SUI in women with POP is not without controversy. While on an elementary level, SUI ensues when increased intra-abdominal pressure on the bladder overcomes outlet resistance, the precise anatomical and physiological deficiencies leading to SUI are debatable, and there are likely differing etiologies of SUI in women with POP. SUI has traditionally been classified as occurring as a result of urethral hypermobility, intrinsic sphincter deficiency (ISD), or both.

The two widely held theories describing the pathophysiology of urethral hypermobility and SUI are *the hammock theory* (Fig. 4.1) and *the integral theory* (Fig. 4.2). According to DeLancey's hammock theory, SUI ensues due to a deficiency of a so-called "hammock" to support and compress the bladder neck/urethra during states of increased abdominal pressure [9]. Using cadaveric dissection, he described that the bladder neck/urethra rests on a hammock formed by the pubocervical fascia, which is attached to the levator ani muscle at the arcus tendineus fascia pelvis. During states of increased intra-abdominal pressure, this hammock acts as a backboard, which compresses the bladder neck/urethra and prevents incontinence. Anatomic deficiencies of the pubocervical fascia and/or neuromuscular injury to the levator ani muscle can therefore compromise the hammock and cause SUI. The hammock theory also substantiates the common co-occurrence of SUI and POP. Deficiencies of the pubocervical fascia are also considered to be an etiology for anterior vaginal wall prolapse [11].

Petros and Ulstem's integral theory suggests that pelvic floor disorders such as SUI, POP, urinary urgency, impaired bowel and bladder emptying, and some forms of pelvic pain are all related to laxity in the vagina or its supporting structures, such as its ligaments [12]. Pertaining to SUI, their theory suggests that urethral closing is under muscle control via ligamentous/connective tissue

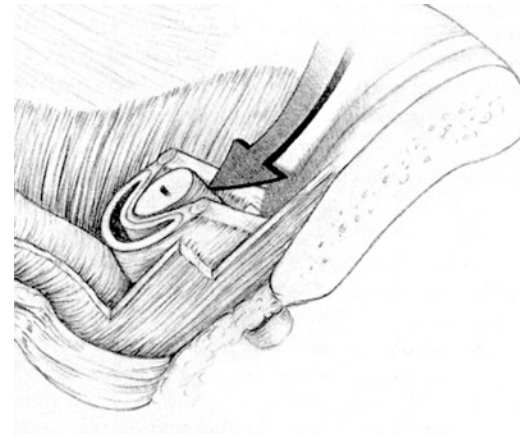

Fig. 4.1 As suggested by the *hammock theory*, the urethra is compressed against the pubocervical fascia of the anterior vaginal wall to provide continence. From DeLancey [9]; with permission

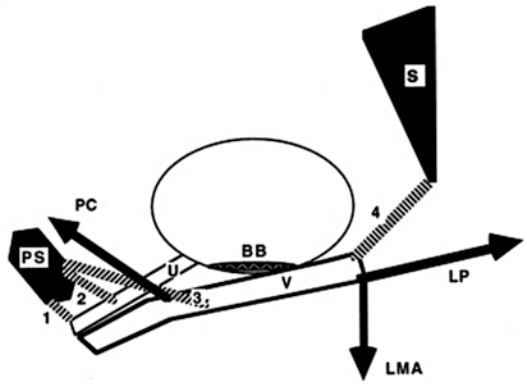

Fig. 4.2 As suggested by the *integral theory*, the urethra (U) is closed via muscle contraction/forces (*arrows*). Other structures represented in this figure include the vagina (V), bladder base (BB), anterior pubourethral ligament (1), midurethral part of pubourethral ligament (2), vaginal part of pubourethral ligament (3), uterosacral ligament (4), Hammock closure muscle (PC), Levator plate (LP), longitudinal muscle of the anus (LMA), sacrum (S), and pubic symphysis (PS). From Petros [10]; with permission

attachments to the urethra. Therefore, injury to the urethral ligaments/connective tissue can prevent appropriate transmission of the muscle activity required to close the urethra. Similar ligamentous/connective tissue injury may additionally contribute to the development of POP.

The hammock and integral theories have been pivotal to explaining the pathophysiology of SUI and its relationship to POP, although they do not describe the pathophysiology of ISD, which was introduced by McGuire [13]. SUI may be caused by inherent failure of the urethral sphincter to close, and this may occur in the presence or absence of urethral hypermobility. Among other factors, urethral sphincter competence is dependent upon intact neurologic control and appropriate watertight apposition of the urethral mucosa. Therefore, neural injury, as well as urethral mucosal deficiency (e.g., due to radiation, trauma, or ischemia), may lead to ISD and SUI. Clinically, ISD may be a potential reason for diminished SUI treatment efficacy [14]. In fact, it can be argued that, since most women develop urethral hypermobility after vaginal delivery yet have no SUI, some degree of ISD must be present for SUI to develop, regardless of the presence of urethral hypermobility.

While the underlying mechanism for SUI in women with POP may be urethral hypermobility, ISD, or both, advanced POP is well-known to potentially "mask" underlying SUI by displacing the bladder neck and "kinking" the urethra. In a study of 237 women with symptomatic POP, prolapse stage was inversely related to reported SUI [15], and in a urodynamic study of women with advanced prolapse, maximum urethral closure pressure decreased by 31% upon prolapse reduction [16]. Thus, underlying anatomic and physiologic deficiencies responsible for causing SUI may be obscured by POP and first become apparent postoperatively.

Incidence

Women with POP have a markedly elevated overall incidence of concomitant SUI versus women without POP, and studies have reported SUI occurring in as many as 80% of women with POP [17–19]. However, the exact overall rate of SUI in women with POP is unclear, owing to varying SUI definitions used in the literature and the dynamic nature of SUI in women with POP. While the natural history of POP progression (from low stages to high stages) is debatable [20], women with low-stage POP and SUI may potentially have continence restored by advancement of prolapse to a higher stage. Not uncommonly, women with POP who are presently continent can report a history of SUI that resolved without treatment. Therefore, the exact overall incidence of SUI in women with POP is difficult to determine. Nonetheless, it is clearly important for surgeons to appreciate the strong epidemiological relationship between POP and SUI.

Likewise, it is imperative for robotic pelvic surgeons to understand the general rates of SUI that can occur after pelvic floor reconstruction. Over the past decade, considerable research has been conducted to ascertain these rates and has provided a basis for performing an anti-incontinence procedure at the time of prolapse repair in some women (Table 4.1). While reported rates of postoperative SUI vary across studies, the data have generally suggested that the occurrence of postoperative SUI is dependent upon two factors: (1) the

Table 4.1 Randomized clinical trials reporting rates of subjective and objective postoperative SUI

Study	Randomization arms	Rate of postoperative subjective SUI	Rate of postoperative objective SUI
Brubaker et al. [21] (CARE) [*n* = 322](women in the trial did not report preoperative SUI)	1. Open sacrocolpopexy and Burch colposuspension	1. 19% (at postoperative month-3)	1. 4.7% (at postoperative month-3)
	2. Open sacrocolpopexy only	2. 39.7% (at postoperative month-3)	2. 8.6% (at postoperative month-3)
Liapis et al. [22] [*n* = 82] (women in the trial had occult SUI)	1. Vaginal POP repair and TVT-O	1. 18.6% (at postoperative month-3)	1. 9.3% (at postoperative month-3)
	2. Vaginal POP repair only	2. 23% (at postoperative month-3)	2. 28.1% (at postoperative month-3)
Schierlitz et al. [23] [*n* = 80] (women in the trial had preoperative occult SUI or asymptomatic urodynamic SUI and the study included vaginal and abdominal POP repairs)	1. POP repair and TVT	Rates not reported	1. 15% (at postoperative month-6)
	2. POP repair only	No change in Median UDI-6 question 3 score in either group (at postoperative months- 6 and 24)	2. 66% (at postoperative month-6)
van der Ploeg et al. [24] (CUPIDO-1) [*n* = 138](women in the trial had subjective SUI or objective SUI on non-reduced test)	1. Vaginal POP repair and midurethral sling	1. 22% (at postoperative month-12)	1. 16% (at postoperative month-12)
	2. Vaginal POP repair only	2. 61% (at postoperative month-12)	2. 44% (at postoperative month-12)
van der Ploeg et al. [25] (CUPIDO-2) [*n* = 91](women in the trial had occult SUI)	1. Vaginal POP repair and midurethral sling	1. 14% (at postoperative month-12)	1. 0% (at postoperative month-12)
	2. Vaginal POP repair only	2. 52% (at postoperative month-12)	2. 35% (at postoperative month-12)
Wei et al. [26] (OPUS) [*n* = 337](women in the trial did not report preoperative SUI and the postoperative incontinence outcome was not restricted to SUI, i.e., incuded stress, urgency, or mixed incontinence)	1. Vaginal POP repair and midurethral sling	1. 9.4% (at postoperative month-3)	1. 6.3% (at postoperative month-3)
	2. Vaginal POP repair only	2. 24.8% (at postoperative month-3)	2. 34.4% (at postoperative month-3)

Abbreviation: *TVT* tension-free vaginal tape

presence of preoperative SUI and (2) the performance of an anti-incontinence procedure at the time of surgery [21, 26–28].

Women with preoperative SUI (i.e., complain of SUI or demonstrate SUI on a non-reduced test) who do not undergo a concomitant anti-incontinence procedure appear to have the highest rate of postoperative SUI. The CUPIDO-1 study was a European multicenter randomized trial comparing vaginal prolapse repair with and without concomitant midurethral sling in women with POP and symptomatic or objective SUI (on non-reduced testing). Fifty-seven percent of women undergoing isolated prolapse repair reported bothersome SUI, had objective evidence of SUI, or were treated for SUI at 1 year postoperatively [24]. Another randomized trial, which compared prolapse repair with and without concomitant midurethral sling in women with POP and preoperative SUI (women with SUI upon prolapse reduction with a pessary were included), found that 71% of women undergoing isolated prolapse repair experienced SUI at postoperative month three [29].

Women with preoperative SUI who undergo a concomitant anti-incontinence procedure have a lower rate of postoperative SUI. In the CUPIDO-1 study, 78% of women undergoing concomitant midurethral sling placement experienced absence of SUI in comparison to 39% of women undergoing isolated prolapse repair [24]. Additionally, while 16% of women receiving a concomitant midurethral sling demonstrated SUI postoperatively, 44% of women who underwent an isolated prolapse repair had demonstrable SUI. The 16% objective failure rate of concomitant midurethral sling placement in this trial appears similar to the objective failure rate of midurethral slings in the Trial Of Mid-Urethral Slings (TOMUS), a multicenter randomized trial comparing retropubic to transobturator midurethral slings [30]. Failure rates could be due to surgical technique, as prophylactic slings at the time of POP repair may potentially be tensioned to loosely and result in postoperative SUI.

Women with occult SUI prior to prolapse repair appear to be at elevated risk of postoperative SUI (i.e., de novo SUI) compared to stress continent women, and performing a concomitant anti-incontinence procedure decreases their risk of postoperative incontinence [27, 28, 31]. The Colpopexy and Urinary Reduction Efforts (CARE) study was a large multicenter trial investigating the effects of performing a concomitant Burch colposuspension at the time of sacrocolpopexy in women without SUI symptoms [21]. Participants in the study were randomized to sacrocolpopexy versus sacrocolpopexy with concomitant Burch colposuspension, and participants underwent urodynamic testing preoperatively (with and without prolapse reduction). The rate of occult SUI in the study was 27%, and women with preoperative occult incontinence more frequently reported SUI postoperatively whether or not they underwent concomitant Burch colposuspension [31]. Among women who did not undergo a Burch colposuspension, 58% with preoperative occult SUI reported SUI postoperatively compared to 38% who did not demonstrate occult SUI preoperatively. Among women undergoing concomitant Burch colposuspension, 32% with preoperative occult SUI reported SUI postoperatively, compared to 21% who did not demonstrate occult SUI preoperatively.

Another multicenter randomized trial (Outcomes Following Vaginal Prolapse Repair and Midurethral Sling, OPUS), which investigated the effects of concomitantly placing a midurethral sling at the time of vaginal prolapse repair, confirmed an elevated rate of postoperative SUI in women with preoperative occult SUI [26]. This trial also substantiated a role for concomitant SUI treatment. In the OPUS trial, 34% of women demonstrated SUI on preoperative prolapse reduction testing, and there was a clear reduction in postoperative urinary incontinence in these women by placement of a concomitant midurethral sling (at postoperative month three, 30% of women receiving a concomitant midurethral sling experienced urinary incontinence compared to 72% of women who did not).

Women who are stress continent before surgery (i.e., no subjective/objective SUI, including no occult SUI) appear to have the lowest risk of postoperative SUI [26, 31]. However, the rate of postoperative SUI is also decreased in these women by performing an anti-incontinence procedure at the time of POP repair [26, 31]. As previously mentioned, the rates of postoperative SUI in women who did not have occult incontinence in

the CARE trial were 38% (no Burch group) and 21% (Burch group) [21, 31]. In the OPUS trial, the rates of postoperative urinary incontinence in women who did not have occult SUI were 38% (no midurethral sling group) and 21% (midurethral sling group) [26]. These results were similar to the findings in the CUPIDO-2 study, which also compared postoperative SUI rates among women with and without occult SUI [25]. Thus, although stress continent women may have a lower rate of postoperative SUI, they still remain at risk.

Other factors, such as type of prolapse repair, may potentially influence the incidence of postoperative SUI. While large randomized trials have established the safety and efficacy of robotic pelvic floor repair, there is no high-quality evidence at this time that assesses if using robotic technology in pelvic floor reconstruction affects postoperative SUI rates [32]. However, findings from a meta-analysis suggested that between 10 and 25% of women undergoing isolated robotic sacrocolpopexy need subsequent anti-incontinence surgery [32]. The excellent support of the anterior vaginal wall with sacrocolpopexy (either open, laparoscopic, or robotic) is likely to result in higher rates of postoperative SUI than other POP procedures that have less of a "straightening" effect on the bladder neck.

Preoperative Decision Making

Deciding whether or not to perform an anti-incontinence procedure at the time of robotic pelvic floor reconstruction can be challenging. As discussed in the previous section (*Incidence*), women with POP have a high rate of SUI preoperatively and a considerable risk of experiencing persistent SUI or developing de novo SUI after prolapse repair. On the other hand, concomitantly treating SUI during prolapse repair poses additional surgical risks and not all women undergoing isolated prolapse repair experience SUI postoperatively. Therefore, pelvic surgeons are faced with a clear dilemma during reconstructive surgical planning. Adding another layer of complexity to this dilemma is the fact that opposing conclusions can be drawn from examining the same data on the topic [33, 34]. For example, data from the CARE trial can be used to support one of three strategies: (1) always perform an anti-incontinence procedure during POP repair, (2) never perform an anti-incontinence procedure during POP repair, and (3) selectively perform an anti-incontinence procedure during POP repair.

Multiple strategies for managing SUI at the time of pelvic floor reconstruction have been adapted, and there is no gold standard method of management [35]. While SUI can be markedly bothersome to women, it is rarely life-threatening, and treatment is considered elective. Therefore, the decision to perform an anti-incontinence procedure at the time of robotic pelvic floor reconstruction should be handled on an individual basis and reflect the patient's risk of postoperative SUI and treatment goals [36, 37]. The risks and benefits of performing a concomitant anti-incontinence procedure should always be discussed with the patient during counseling and the informed consent process. Understanding the advantages and disadvantages of concomitantly performing an anti-incontinence procedure provides the foundation for counseling.

Advantages of Performing a Concomitant Anti-incontinence Procedure

There are multiple benefits of performing a concomitant anti-incontinence procedure at the time of prolapse repair. In many clinical trials, concomitant anti-incontinence procedures led to a reduction in the rate of postoperative SUI [27, 28]. Thus, for many women, performing an anti-incontinence procedure at the time of prolapse repair can obviate the need for further SUI therapy. As many as 56% of women with preoperative SUI undergoing isolated prolapse repair may proceed to subsequent anti-incontinence surgery [29]. Needless to say, those women undergoing subsequent anti-incontinence surgery are then exposed to the risks of an initial anti-incontinence operation (e.g., voiding dysfunction, mesh exposure, pain), plus the additional risks of undergoing a second operative intervention, including anesthetic risks. Therefore, performing a concomitant

anti-incontinence procedure during prolapse repair may potentially prevent the need for a future operative intervention.

After an isolated prolapse repair, some women with postoperative SUI may elect to not undergo subsequent incontinence surgery and may experience continued bother from SUI. While as many as 56% of women undergoing isolated prolapse repair proceeded to subsequent anti-incontinence surgery, 21% of women with postoperative SUI elected not to return to the operating room for treatment [29]. Furthermore, in a retrospective study of 100 women who underwent isolated POP repair, 32% of women with postoperative SUI reported their incontinence to be bothersome [38]. Therefore, these women may have potentially benefitted from the performance of a concomitant anti-incontinence procedure; granted, the relationship between SUI bother and the decision to undergo anti-incontinence surgery is unclear. However, aside from operative intervention, women undergoing isolated prolapse repair more frequently undergo additional non-operative SUI treatment, such as physiotherapy, compared to women undergoing concomitant anti-incontinence surgery [24].

Thus, the overall advantages of performing anti-incontinence surgery at the time of prolapse repair are: (1) decreased occurrence of postoperative SUI, (2) decreased need for future SUI surgical therapy, (3) decreased need for further non-operative SUI therapy, and (4) empiric treatment of women who may experience bothersome postoperative SUI, yet wish to avoid a second operative intervention.

Disadvantages of Performing a Concomitant Anti-incontinence Procedure

There are also disadvantages of performing concomitant anti-incontinence surgery at the time of prolapse repair. While anti-incontinence surgery decreases the rate of postoperative SUI, many women undergoing isolated prolapse repair do not experience bothersome SUI postoperatively. In women without preexisting SUI, data from the CARE trial demonstrated that only 25% reported bothersome SUI after isolated prolapse repair [21]. Thus, performing an anti-incontinence procedure in women without preexisting SUI may be unnecessary. Furthermore, approximately 39% of women with preexisting SUI reported resolution of SUI after isolated prolapse repair [39]. Thus, prolapse repair alone may, perhaps, lead to SUI resolution in some women [40].

Women who experience postoperative SUI may not be significantly bothered by their incontinence, and women with postoperative SUI still frequently report surgical satisfaction [41, 42]. In the CUPIDO-1 study, although 61% of women undergoing isolated prolapse repair reported SUI, only 17% underwent subsequent anti-incontinence surgery [24]. Additionally, 7 year CARE data found that only 13 women who underwent isolated prolapse repair underwent subsequent SUI surgery (including injection therapy) [43]. Therefore, it may be unnecessary to perform an anti-incontinence procedure in women at the time of prolapse repair, as postoperative SUI may not always be bothersome or result in further treatment.

Undergoing concomitant anti-incontinence surgery at the time of prolapse repair exposes women to additional adverse events. Women undergoing concomitant midurethral sling placement in the OPUS trial had more urinary tract infections (31% vs. 18%; $p = 0.008$), more episodes of major bleeding or vascular complications (3% vs. 0%; $p = 0.03$), incomplete bladder emptying (at multiple time points), and the need for urethrolysis (2.4% vs. 0%; $p = 0.06$) [26]. Furthermore, women undergoing concomitant midurethral sling had longer operative times and larger operative blood loss, albeit only by 11 min ($p = 0.05$) and 24 mL ($p = 0.03$), respectively. Notably, in a different study of women undergoing transvaginal POP repair, the rate of surgical intervention to correct obstruction after concomitant midurethral sling placement was equal to the rate of subsequent surgical intervention for SUI (8.5% vs. 8.3%) [44].

Thus, the overall disadvantages of performing anti-incontinence surgery at the time of prolapse repair are: (1) unnecessarily treating women for SUI (i.e., overtreatment) and (2) potentially exposing women to adverse events.

De Novo Storage Symptoms

Developing new urinary urgency and/or urge incontinence is a well-known phenomenon that can occur after isolated anti-incontinence surgery [45]. While women who undergo concomitant anti-incontinence surgery at the time of prolapse repair may theoretically be at increased risk of experiencing de novo storage symptoms, the data suggests otherwise. In the CARE and OPUS trials, women who underwent concomitant anti-incontinence procedures did not have worse storage symptoms, and a meta-analysis found that the development of postoperative urge urinary incontinence was unrelated to whether an anti-incontinence procedure at the time of prolapse repair [21, 26, 28, 46]. Notably, storage symptoms can often improve after isolated prolapse repair [47], and whether anti-incontinence surgery diminishes or augments this improvement is unclear. Therefore, in regard to storage symptoms, there is no clear advantage or disadvantage to performing concomitant anti-incontinence surgery at the time of prolapse repair.

Approach to Treatment

Ideally, an anti-incontinence procedure would only be performed in women who would experience postoperative SUI, be bothered by SUI, and be at low risk of having complications. Unfortunately, accurately identifying women with these exact characteristics is challenging. Therefore, three common strategies to manage SUI at the time of prolapse repair have been adopted: the universal approach, the staged approach, and the selective approach (Fig. 4.3).

In the universal approach, surgeons perform an anti-incontinence procedure in all women undergoing prolapse repair, irrespective of preoperative testing and SUI risk factors (women who have already undergone midurethral sling placement may be excluded from this approach). While this approach minimizes undertreatment, it exposes women to overtreatment and additional surgical complications. In the staged approach, surgeons never perform a concomitant anti-incontinence procedure, irrespective of preoperative testing and SUI risk factors, and subsequently offer anti-incontinence surgery to only those women with bothersome SUI postoperatively. While this approach minimizes overtreatment, it exposes women to undertreatment, as some women will have to undergo a subsequent anti-incontinence intervention. Additionally, with this approach, women with postoperative SUI who elect to not undergo a second operative intervention may experience persistent bother from their incontinence. In the selective approach, surgeons incorporate preoperative testing and SUI risk factors in their decision to perform a concomitant SUI procedure. This approach has the benefits of balancing overtreatment and undertreatment and is predicated on identifying those women who will be at the highest risk of postoperative SUI [35].

Understanding the number of women who need to be treated (i.e., number needed to treat [NNT]) with anti-incontinence surgery to prevent a case of postoperative SUI highlights the benefit of using a selective approach. In women with preoperative coexisting SUI (i.e., not occult SUI), data from a meta-analysis suggested that two women would need to be treated with anti-incontinence surgery to prevent a case of postoperative SUI [28]. Therefore, pelvic surgeons may elect to perform concomitant anti-incontinence surgery in women with preexisting symptomatic SUI. On the other hand, in women without symptomatic SUI preoperatively, the number of anti-incontinence procedures that would need to be performed to reduce a case of postoperative SUI is considerably higher and is markedly dependent upon the presence of occult SUI preoperatively. According to the CARE data, 5.4 Burch colposuspensions would have to be performed to prevent one case of postoperative SUI, and according to the OPUS data, 3.9 midurethral slings would have to be placed to reduce one case of postoperative SUI [21, 26, 48]. However, results of preoperative occult stress testing significantly alter the NNT. In the CARE trial, the NNT among women with occult incontinence was 3.8 as opposed to 5.7 in women without occult SUI, and the NNT among women with occult incontinence in the OPUS trial was 2.4 versus 5.7 in women without occult SUI. Therefore, preoperatively testing for occult SUI provides a key data point for surgeons using the selective approach.

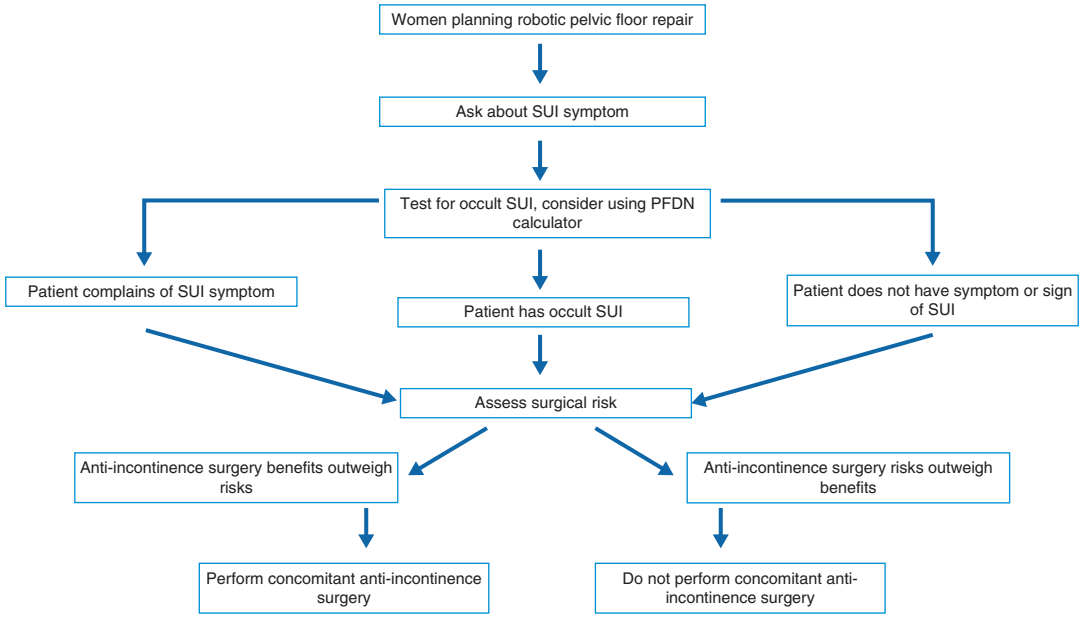

Fig. 4.3 Example of a selective approach to managing SUI at the time of POP repair. *PFDN* pelvic floor disorders network

Testing for Occult Incontinence

While it may be important to test for occult SUI for surgical planning purposes, unfortunately, there is no superior method for testing. On a basic level, testing is performed by reducing prolapse and asking women to cough or Valsalva with a filled bladder. However, the prolapse reduction technique and bladder volume during testing clearly affect test results [49]. Visco et al. investigated the test characteristics of commonly utilized methods of detecting occult SUI, including using a pessary, forceps, swab, speculum, and manual reduction [31]. They found an overall occult SUI detection rate of 19%, and that using a pessary was associated with the lowest rate of detecting occult SUI (6%), while using a speculum was associated with the highest rate of detecting occult SUI (30%). In addition to simple office testing, urodynamics may also be used to detect occult SUI (as well as measure the maximum urethral closure pressure, MUCP). While urodynamics, with or without POP reduction, may be useful for multiple reasons in women with POP [50], data have not suggested a particular benefit in detecting occult SUI compared to other office testing [48]. Furthermore, measuring the MUCP (which changes with prolapse reduction [16]) may be unnecessary as it has not been reliably shown to predict risk of occult incontinence or surgical outcomes. Although the optimal method for occult SUI testing is unclear, surgeons may find some form of testing to be useful in their practice. On the other hand, leading experts in the field are not in agreement about considering occult SUI testing as a quality of care indictor [51].

In addition to urodynamics, an online calculator (created by the Pelvic Floor Disorders Network, [PFDN], available at http://www.r-calc.com/ExistingFormulas.aspx?filter=CCQHS) can be used to predict a patient's risk of developing de novo postoperative SUI [52]. In examining the OPUS data, the PFDN found seven factors that were predictive of developing postoperative SUI and are integrated into their calculator: age at surgery, number of vaginal births, body mass index (BMI), preoperative stress test result, performance of an anti-incontinence procedure, incontinence associated with urgency, and diagnosis of diabetes [52]. Notably, their prediction model actually outperformed a panel of 22 experts as well as a preoperative prolapse reduction stress test alone.

Economic Considerations

The three different strategies of managing SUI at the time of pelvic floor reconstruction (i.e., universal, staged, selective) are not likely equivalent in cost. However, studies comparing the cost-effectiveness between strategies demonstrate conflicting results. In a cost-effectiveness analysis based upon CARE data and Medicare reimbursement rates, the universal approach was found to be the most cost-effective strategy and had an incremental cost-effectiveness ratio of $2867 per quality-adjusted life year compared to the strategy of only performing sacrocolpopexy [53]. However, a different study comparing prolapse repair with midurethral sling (n = 16) to prolapse repair alone (n = 14) reported differential cost savings when using a selective strategy to manage SUI at the time of prolapse repair [41]. Women in this study underwent different types of prolapse repair (abdominal sacrocolpopexy, sacrospinous ligament suspension, etc.).

Surgical Technique

Synthetic midurethral sling placement and Burch colposuspension are two commonly utilized procedures to treat SUI at the time of POP repair [54]. Historically, other procedures, such as anterior colporraphy, paravaginal repair, transvaginal needle suspension, and Marshall-Marchetti-Krantz urethropexy, were used to surgically treat SUI, but they have been associated with poor efficacy and/or high complication rates [55–58]. Autologous facial sling placement can be used to treat SUI during a concomitant prolapse repair [59], but the incision needed for harvesting rectus fascia or fascia lata may defeat the purpose of performing a minimally invasive robotic repair. While urethral bulking agents can be injected during prolapse repair, surgeons may elect to use bulking agents in the office setting for women who experience postoperative SUI. Artificial urinary sphincter placement is no longer routinely performed for women [60].

There are no direct comparative data examining the safety and efficacy of synthetic midurethral sling placement versus robotic Burch colposuspension at the time of robotic pelvic floor reconstruction. However, a meta-analysis (not limited to women undergoing prolapse repair) found that midurethral sling placement and laparoscopic Burch colposuspension appear to have equivalent efficacy [61]. Notably, bladder perforations were more frequent in women undergoing midurethral sling placement, while de novo storage symptoms were more common in women undergoing laparoscopic Burch colposuspension [61].

Midurethral Sling

Synthetic midurethral slings are macroporous monofilament polypropylene meshes that are placed underneath the midurethra via a retropubic or transobturator approach. Retropubic midurethral slings can be inserted in either a bottom-to-top or top-to-bottom fashion, and transobturator slings can be inserted in either an out-to-in or in-to-out fashion. While data specifically comparing midurethral sling approaches in women with prolapse are lacking, overall data from women with SUI suggests that retropubic and transobturator slings are equally effective [30, 62]. One exception may be women with ISD, for whom retropubic slings may be superior [63]. Retropubic slings and transobturator slings are associated with different complication profiles [30, 61]. Retropubic slings are associated with increased rates of bladder perforation and voiding dysfunction, while transobturator slings are associated with increased rates of groin pain [30, 61] and possibly mesh extrusion [64]. Although uncommon, retropubic slings are also associated with an increased risk of bowel injury, which may be heightened in the women with previous abdominal/inguinal surgery [45]. Studies are conflicting as to whether operative time, blood loss, and sexual function are equivalent between the two sling types.

Mini-slings are also macroporous monofilament polypropylene meshes, but they are shorter than full-length slings. These slings are placed via a single vaginal incision and are thought to pose less risk than full-length slings. However, a meta-analysis found mini-slings to be less efficacious

than full-length slings in terms of subjective and objective cure rates [65]. Regardless, they may have a role in women who are undergoing robotic pelvic floor repair, as they may improve incontinence while posing less surgical risk [66].

The surgical technique for placing a full-length midurethral sling during prolapse repair is similar to placement in women without prolapse and has been previously described [67]. In brief, after robotic pelvic floor repair is completed, the robot is undocked, and attention is turned to the vagina. Cystoscopy (with a 70° lens) may be performed at this point (to visualize ureteral jets and assess bladder wall integrity), or it may be deferred until after the midurethral sling trocars have been passed. The robot should be kept sterile until after cystoscopy is completed so that it may be quickly redocked in the event of suspected ureteral or bladder injury. Midurethral sling placement is carried forth by identifying the midurethra with the aid of a Foley catheter, dissecting bilateral vaginal flaps with Metzenbaum scissors (with or without the aid of prior hydrodissection) and passing the sling trocars in a retropubic or transobturator fashion. Cystoscopy is conducted to rule out bladder perforation and a Foley catheter is reinserted. The vaginal mucosa is inspected to rule out vaginal perforation, the sling is tensioned, and the vaginal incision is closed with a delayed absorbable suture. The trocar exit sites may be closed with skin adhesive, and vaginal packing with or without estrogen cream may be used.

Burch Colposuspension

Burch colposuspension was a frequently used procedure to correct SUI in women prior to the advent of synthetic midurethral slings. However, midurethral slings are more commonly used to treat SUI given their advantage of avoiding abdominal entry [68]. Yet, for surgeons who are already operating within the abdomen, Burch colposuspension has a valuable role in treating SUI and a robotic Burch colposuspension can be performed after robotic pelvic floor repair is completed.

The surgical technique for performing a robotic Burch colposuspension has been adapted from the open and straight-laparoscopic surgical experience and has been previously described (Fig. 4.4) [69]. In brief, after robotic prolapse repair is completed, the robot is kept docked and the Burch colposuspension proceeds through the previously placed robotic ports. A Foley catheter is inserted if not already in place. Using a monopolar scissor, the space of Retzius is entered by incising the peritoneum of the anterior abdominal wall (the bladder may be temporarily backfilled to aid in dissection) and dissection is carried to the pubic symphysis. Cooper's ligament is identified as well as an area of anterior vaginal wall that is adjacent to the midurethra to bladder neck. Bilaterally, sutures are then passed 2 cm lateral to the urethra at this anterior vaginal wall location and are gently approximated to Cooper's ligament. Special care is taken during knot-tying to avoid placing undue tension on the vagina/urethra. The robot may be undocked, but should be kept sterile until after cystoscopy is completed. Cystoscopy (with a 70° lens) is conducted to visualize ureteral jets, assess bladder wall integrity, and ensure absence of suture intravesically and intraurethrally, and a Foley catheter is reinserted. The vagina is examined to ensure absence of suture penetrating the vaginal lumen. The Burch colposuspension concludes by closure of the peritoneum with an absorbable suture and the robotic port sites are closed in the standard fashion.

Postoperative Care and Complications

The postoperative care of women who undergo concomitant anti-incontinence surgery during robotic pelvic floor repair includes providing a trial of void and ensuring adequate bladder emptying. While Foley catheters in general are ideally removed as soon as possible after surgery, the optimal timing of providing a postoperative trial of void after robotic pelvic floor repair is unclear. Needless to say, a longer period of bladder catheterization may be required in cases of

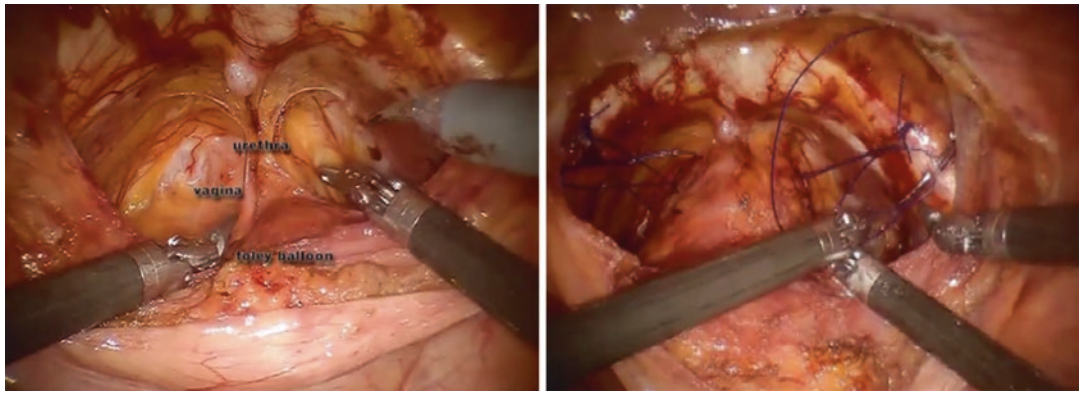

Fig. 4.4 Robotic Burch colposuspension showing sutures placed into Cooper's ligament bilaterally. From Francis et al. [69]; with permission

cystotomy, ureteral injury, or urethrotomy. The risks and benefits of administering prophylactic antibiotics to prevent urinary tract infection should be considered. If used, antibiotics may be administered while the Foley catheter is in place or at the time of Foley catheter removal [70].

Surgical trials comparing different anti-incontinence procedures have provided high-quality evidence of the complication rates associated with anti-incontinence surgery [30, 71]. Unfortunately, these complication rates may not be perfectly applicable to women undergoing concomitant anti-incontinence surgery at the time of robotic pelvic floor repair. In a study examining Medicare claims, women who underwent concomitant anti-incontinence and prolapse surgery had a higher rate of outlet obstruction compared to women who underwent isolated anti-incontinence surgery (9.4 vs. 5.5%) [72]. A different study reported a 20% midurethral sling failure rate in women undergoing concomitant tension-free vaginal tape (TVT) at the time of robotic sacrocolpopexy [73]. The authors of this study speculated that this high failure rate may be attributable to "overcorrection" of the anterior vaginal wall that may occur during robotic prolapse repair. This indicates that sling tensioning should be tailored to the degree of urethral hypermobility that results after the sacrocolpopexy. Further study is needed to clarify the effect of robotic prolapse repair on anti-incontinence outcomes.

Conclusions

Women with POP have a high rate of preexisting SUI as well as have a high rate of postoperative SUI. Performing a concomitant anti-incontinence procedure at the time of robotic pelvic floor repair can decrease postoperative SUI risk, although anti-incontinence procedures are associated with additional risks. Further, not all women undergoing isolated prolapse repair experience postoperative SUI. As there is no gold standard method of managing SUI at the time of robotic pelvic floor repair, surgeons should individually consider the advantages and disadvantages of performing a concomitant anti-incontinence procedure in each patient. Discussing and defining surgical goals with women may lead to increased patient satisfaction postoperatively.

References

1. Fultz NH, Burgio K, Diokno AC, Kinchen KS, Obenchain R, Bump RC. Burden of stress urinary incontinence for community-dwelling women. Am J Obstet Gynecol. 2003;189(5):1275–82.
2. Lagro-Janssen T, Smits A, Van Weel C. Urinary incontinence in women and the effects on their lives. Scand J Prim Health Care. 1992;10(3):211–6.
3. Gray M, Ratliff C, Donovan A. Perineal skin care for the incontinent patient. Adv Skin Wound Care. 2002;15(4):170–5.

4. Chong EC, Khan AA, Anger JT. The financial burden of stress urinary incontinence among women in the United States. Curr Urol Rep. 2011;12(5):358–62.
5. Mitteness LS. Knowledge and beliefs about urinary incontinence in adulthood and old age. J Am Geriatr Soc. 1990;38(3):374–8.
6. Bai S, Jeon M, Kim J, Chung K, Kim S, Park K. Relationship between stress urinary incontinence and pelvic organ prolapse. Int Urogynecol J. 2002;13(4):256–60.
7. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, et al. Standardisation Subcommittee of the International Continence Society. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. Neurourol Urodyn. 2002;21(2):167–78.
8. Haylen BT, De Ridder D, Freeman RM, Swift SE, Berghmans B, Lee J, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. Int Urogynecol J. 2010;21(1):5–26.
9. DeLancey JO. Structural support of the urethra as it relates to stress urinary incontinence: the hammock hypothesis. Am J Obstet Gynecol. 1994;170(6):1713–23.
10. Petros PP, Skilling P. Pelvic floor rehabilitation in the female according to the integral theory of female urinary incontinence: first report. Eur J Obstet Gynecol Reprod Biol. 2001;94(2):264–9.
11. DeLancey JO. Anatomic aspects of vaginal eversion after hysterectomy. Am J Obstet Gynecol. 1992;166(6):1717–28.
12. Petros PEP, Ulmsten UI. An integral theory of female urinary incontinence. Acta Obstet Gynecol Scand Suppl. 1990;69(S153):7–31.
13. McGuire EJ, Lytton B. Pubovaginal sling procedure for stress incontinence. J Urol. 1978;119(1):82–4.
14. Paick J-S, Ku JH, Shin JW, Son H, Oh S-J, Kim SW. Tension-free vaginal tape procedure for urinary incontinence with low Valsalva leak point pressure. J Urol. 2004;172(4):1370–3.
15. Ellerkmann RM, Cundiff GW, Melick CF, Nihira MA, Leffler K, Bent AE. Correlation of symptoms with location and severity of pelvic organ prolapse. Am J Obstet Gynecol. 2001;185(6):1332–8.
16. Mueller E, Kenton K, Mahajan S, FitzGerald M, Brubaker L. Urodynamic prolapse reduction alters urethral pressure but not filling or pressure flow parameters. J Urol. 2007;177(2):600–3.
17. Richardson DA, Bent AE, Ostergard DR. The effect of uterovaginal prolapse on urethrovesical pressure dynamics. Am J Obstet Gynecol. 1983;146(8):901–5.
18. Bergman A, Koonings PP, Ballard CA. Predicting postoperative urinary incontinence development in women undergoing operation for genitourinary prolapse. Am J Obstet Gynecol. 1988;158(5):1171–5.
19. Chaikin DC, Groutz A, Blaivas JG. Predicting the need for anti-incontinence surgery in continent women undergoing repair of severe urogenital prolapse. J Urol. 2000;163(2):531–4.
20. Dietz HP. Prolapse worsens with age, doesn't it? Aust N Z J Obstet Gynaecol. 2008;48(6):587–91.
21. Brubaker L, Cundiff GW, Fine P, Nygaard I, Richter HE, Visco AG, et al. Abdominal sacrocolpopexy with Burch colposuspension to reduce urinary stress incontinence. N Engl J Med. 2006;354(15):1557–66.
22. Liapis A, Bakas P, Georgantopoulou C, Creatsas G. The use of the pessary test in preoperative assessment of women with severe genital prolapse. Eur J Obstet Gynecol Reprod Biol. 2011;155(1):110–3.
23. Schierlitz L, Dwyer P, Rosamilia A, Murray C, Thomas E, Taylor N, et al. A prospective randomised controlled study comparing vaginal prolapse repair with and without tension free vaginal tape (TVT) in women with severe pelvic organ prolapse and occult stress incontinence. Neurourol Urodyn. 2007;26(5):743–4.
24. Ploeg J, Oude Rengerink K, Steen A, Leeuwen J, Stekelenburg J, Bongers M, et al. Transvaginal prolapse repair with or without the addition of a midurethral sling in women with genital prolapse and stress urinary incontinence: a randomised trial. BJOG. 2015;122(7):1022–30.
25. van der Ploeg JM, Rengerink KO, van der Steen A, van Leeuwen JHS, van der Vaart CH, Roovers J-PW, et al. Vaginal prolapse repair with or without a midurethral sling in women with genital prolapse and occult stress urinary incontinence: a randomized trial. Int Urogynecol J. 2016;27(7):1029–1038.
26. Wei JT, Nygaard I, Richter HE, Nager CW, Barber MD, Kenton K, et al. A midurethral sling to reduce incontinence after vaginal prolapse repair. N Engl J Med. 2012;366(25):2358–67.
27. Matsuoka PK, Pacetta AM, Baracat EC, Haddad JM. Should prophylactic anti-incontinence procedures be performed at the time of prolapse repair? Systematic review. Int Urogynecol J. 2015;26(2):187–93.
28. Ploeg J, Steen A, Oude Rengerink K, Vaart C, Roovers J. Prolapse surgery with or without stress incontinence surgery for pelvic organ prolapse: a systematic review and meta-analysis of randomised trials. BJOG. 2014;121(5):537–47.
29. Borstad E, Abdelnoor M, Staff AC, Kulseng-Hanssen S. Surgical strategies for women with pelvic organ prolapse and urinary stress incontinence. Int Urogynecol J. 2010;21(2):179–86.
30. Richter HE, Albo ME, Zyczynski HM, Kenton K, Norton PA, Sirls LT, et al. Retropubic versus transobturator midurethral slings for stress incontinence. N Engl J Med. 2010;362(22):2066–76.
31. Visco AG, Brubaker L, Nygaard I, Richter HE, Cundiff G, Fine P, et al. The role of preoperative urodynamic testing in stress-continent women undergoing sacrocolpopexy: the Colpopexy and Urinary Reduction Efforts (CARE) randomized surgical trial. Int Urogynecol J. 2008;19(5):607–14.
32. Serati M, Bogani G, Sorice P, Braga A, Torella M, Salvatore S, et al. Robot-assisted sacrocolpopexy for pelvic organ prolapse: a systematic review and

meta-analysis of comparative studies. Eur Urol. 2014;66(2):303–18.
33. Goldman HB. Occult stress urinary incontinence: what have clinical trials taught us? AUA News. 2015;20(9):1–4.
34. Kraus SR. Occult stress urinary incontinence: what have clinical trials taught us? AUA News. 2015;20(9):4–7.
35. King AB, Goldman HB. Stress incontinence surgery at the time of prolapse surgery: mandatory or forbidden? World J Urol. 2015;33(9):1257–62.
36. Elkadry EA, Kenton KS, FitzGerald MP, Shott S, Brubaker L. Patient-selected goals: a new perspective on surgical outcome. Am J Obstet Gynecol. 2003;189(6):1551–7.
37. Hullfish KL, Bovbjerg VE, Steers WD. Patient-centered goals for pelvic floor dysfunction surgery: long-term follow-up. Am J Obstet Gynecol. 2004;191(1):201–5.
38. Al-Mandeel H, Ross S, Robert M, Milne J. Incidence of stress urinary incontinence following vaginal repair of pelvic organ prolapse in objectively continent women. Neurourol Urodyn. 2011;30(3):390–4.
39. Lensen EJ, Withagen MI, Kluivers KB, Milani AL, Vierhout ME. Urinary incontinence after surgery for pelvic organ prolapse. Neurourol Urodyn. 2013;32(5):455–9.
40. Costantini E, Lazzeri M, Bini V, Del Zingaro M, Zucchi A, Porena M. Burch colposuspension does not provide any additional benefit to pelvic organ prolapse repair in patients with urinary incontinence: a randomized surgical trial. J Urol. 2008;180(3):1007–12.
41. Chermansky CJ, Krlin RM, Winters JC. Selective management of the urethra at time of pelvic organ prolapse repair: an assessment of postoperative incontinence and patient satisfaction. J Urol. 2012;187(6):2144–8.
42. Wolters JP, King AB, Rapp DE. Satisfaction in patients undergoing concurrent pelvic floor surgery for stress urinary incontinence and pelvic organ prolapse. Female Pelvic Med Reconstr Surg. 2014;20(1):23–6.
43. Nygaard I, Brubaker L, Zyczynski HM, Cundiff G, Richter H, Gantz M, et al. Long-term outcomes following abdominal sacrocolpopexy for pelvic organ prolapse. JAMA. 2013;309(19):2016–24.
44. Ballert KN, Biggs GY, Isenalumhe A, Rosenblum N, Nitti VW. Managing the urethra at transvaginal pelvic organ prolapse repair: a urodynamic approach. J Urol. 2009;181(2):679–84.
45. Daneshgari F, Kong W, Swartz M. Complications of mid urethral slings: important outcomes for future clinical trials. J Urol. 2008;180(5):1890–7.
46. Brubaker L, Nygaard I, Richter HE, Visco A, Weber AM, Cundiff GW, et al. Two-year outcomes after sacrocolpopexy with and without burch to prevent stress urinary incontinence. Obstet Gynecol. 2008;112(1):49–55.
47. Digesu GA, Salvatore S, Chaliha C, Athanasiou S, Milani R, Khullar V. Do overactive bladder symptoms improve after repair of anterior vaginal wall prolapse? Int Urogynecol J. 2007;18(12):1439–43.
48. Nager CW. Role of urodynamics in the evaluation of urinary incontinence and prolapse. Curr Obstet Gynecol Rep. 2013;2(3):139–46.
49. Svenningsen R, Borstad E, Spydslaug AE, Sandvik L, Staff AC. Occult incontinence as predictor for postoperative stress urinary incontinence following pelvic organ prolapse surgery. Int Urogynecol J. 2012;23(7):843–9.
50. Serati M, Giarenis I, Meschia M, Cardozo L. Role of urodynamics before prolapse surgery. Int Urogynecol J. 2015;26(2):165–8.
51. Anger JT, Scott VC, Kiyosaki K, Khan AA, Sevilla C, Connor SE, et al. Quality-of-care indicators for pelvic organ prolapse: development of an infrastructure for quality assessment. Int Urogynecol J. 2013;24(12):2039–47.
52. Jelovsek JE, Chagin K, Brubaker L, Rogers RG, Richter HE, Arya L, et al. A model for predicting the risk of de novo stress urinary incontinence in women undergoing pelvic organ prolapse surgery. Obstet Gynecol. 2014;123(2 Part 1):279–87.
53. Richardson ML, Elliott CS, Shaw JG, Comiter CV, Chen B, Sokol ER. To sling or not to sling at time of abdominal sacrocolpopexy: a cost-effectiveness analysis. J Urol. 2013;190(4):1306–12.
54. Raman SV, Raker CA, Sung VW. Concomitant apical prolapse repair and incontinence procedures: trends from 2001-2009 in the United States. Am J Obstet Gynecol. 2014;211(3):222.e1–5.
55. Glazener C, Cooper K. Anterior vaginal repair for urinary incontinence in women. Cochrane Database Syst Rev. 2001;1(1):CD001755.
56. Kammerer-Doak DN, Cornella JL, Magrina JF, Stanhope CR, Smilack J. Osteitis pubis after Marshall-Marchetti-Krantz urethropexy: a pubic osteomyelitis. Am J Obstet Gynecol. 1998;179(3):586–90.
57. Colombo M, Milani R, Vitobello D, Maggioni A. A randomized comparison of Burch colposuspension and abdominal paravaginal defect repair for female stress urinary incontinence. Am J Obstet Gynecol. 1996;175(1):78–84.
58. Groutz A, Gordon D, Wolman I, Jaffa AJ, Kupferminc MJ, David MP, et al. The use of prophylactic Stamey bladder neck suspension to prevent postoperative stress urinary incontinence in clinically continent women undergoing genitourinary prolapse repair. Neurourol Urodyn. 2000;19(6):671–6.
59. Barnes NM, Dmochowski RR, Park R, Nitti VW. Pubovaginal sling and pelvic prolapse repair in women with occult stress urinary incontinence: effect on postoperative emptying and voiding symptoms. Urology. 2002;59(6):856–60.
60. Rouprêt M, Misraï V, Vaessen C, Cardot V, Cour F, Richard F, et al. Laparoscopic approach for artificial urinary sphincter implantation in women with intrinsic sphincter deficiency incontinence: a single-centre preliminary experience. Eur Urol. 2010;57(3):499–505.

61. Ogah J, Cody J, Rogerson L. Minimally invasive synthetic suburethral sling operations for stress urinary incontinence in women: a short version Cochrane review. Neurourol Urodyn. 2011;30(3):284–91.
62. Ford A, Rogerson L, Cody J, Ogah J. Mid-urethral sling operations for stress urinary incontinence in women. Cochrane Database Syst Rev. 2015;(7):CD006375. doi:10.1002/14651858.CD006375.pub3.
63. Ford AA, Ogah JA. Retropubic or transobturator mid-urethral slings for intrinsic sphincter deficiency-related stress urinary incontinence in women: a systematic review and meta-analysis. Int Urogynecol J. 2016;27(1):19–28.
64. Siegel AL. Vaginal mesh extrusion associated with use of Mentor transobturator sling. Urology. 2005;66(5):995–9.
65. Schimpf MO, Rahn DD, Wheeler TL, Patel M, White AB, Orejuela FJ, et al. Sling surgery for stress urinary incontinence in women: a systematic review and metaanalysis. Am J Obstet Gynecol. 2014;211(1):71.e1–e27.
66. Botros C, Lewis C, Culligan P, Salamon C. A prospective study of a single-incision sling at the time of robotic sacrocolpopexy. Int Urogynecol J. 2014;25(11):1541–6.
67. Ulmsten U, Henriksson L, Johnson P, Varhos G. An ambulatory surgical procedure under local anesthesia for treatment of female urinary incontinence. Int Urogynecol J. 1996;7(2):81–6.
68. Suskind AM, Kaufman SR, Dunn RL, Stoffel JT, Clemens JQ, Hollenbeck BK. Population-based trends in ambulatory surgery for urinary incontinence. Int Urogynecol J. 2013;24(2):207–11.
69. Francis SL, Agrawal A, Azadi A, Ostergard DR, Deveneau NE. Robotic Burch colposuspension: a surgical case and instructional video. Int Urogynecol J. 2015;26(1):147–8.
70. Marschall J, Carpenter CR, Fowler S, Trautner BW, CDC Prevention Epicenters Program. Antibiotic prophylaxis for urinary tract infections after removal of urinary catheter: meta-analysis. BMJ. 2013;346:f3147. doi:10.1136/bmj.f3147. Review. Erratum in: BMJ. 2013;347:f5325.
71. Albo ME, Richter HE, Brubaker L, Norton P, Kraus SR, Zimmern PE, et al. Burch colposuspension versus fascial sling to reduce urinary stress incontinence. N Engl J Med. 2007;356(21):2143–55.
72. Anger JT, Litwin MS, Wang Q, Pashos CL, Rodríguez LV. The effect of concomitant prolapse repair on sling outcomes. J Urol. 2008;180(3):1003–6.
73. Osmundsen B, Gregory WT, Denman MA, Adams K, Edwards R, Clark A. Tension-free vaginal tape failure after robotic sacrocolpopexy and tension-free vaginal tape for concomitant prolapse and stress incontinence. Female Pelvic Med Reconstr Surg. 2015;21(5):244–8.