Adverse events over two years after retropubic or transobturator midurethral sling surgery: findings from the Trial of Midurethral Slings (TOMUS) study

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OBJECTIVE: To describe surgical complications in 597 women over a 24-month period after randomization to retropubic or transobturator midurethral slings.

STUDY DESIGN: During the Trial of Midurethral Slings study, the Data Safety Monitoring Board regularly reviewed summary reports of all adverse events using the Dindo Surgical Complication Scale. Logistic regression models were created to explore associations between clinicodemographic factors and surgical complications.

RESULTS: A total of 383 adverse events were observed among 253 of the 597 women (42%). Seventy-five adverse events (20%) were classified as serious (serious adverse events); occurring in 70 women. Intraoperative bladder perforation (15 events) occurred exclusively in the retropubic group. Neurologic adverse events were more common in the transobturator group than in retropubic (32 events vs 20 events, respectively). Twenty-three (4%) women experienced mesh complications, including delayed presentations, in both groups.

CONCLUSION: Adverse events vary by procedure, but are common after midurethral sling. Most events resolve without significant sequelae.

Key words: adverse events, midurethral slings, surgical complications

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Retropubic and transobturator midurethral synthetic slings are now considered gold standard procedures for primary surgical treatment of stress urinary incontinence in women.[1] The less invasive nature of the midurethral slings (MUS) has significantly reduced many forms of surgical morbidity; however, long-term follow-up had not been available to address clinical concerns about delayed complications including mesh-related complications over time. Although mesh-associated complications are common to all mesh midurethral slings, adverse events (AEs) specific to the retropubic midurethral sling include bladder perforation, postoperative voiding dysfunction, de novo urgency and urge incontinence, and rare complications such as bowel perforation, vascular injury, and neurologic injuries.[1,2] Although the transobturator midu-

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TABLE 1
Complications by treatment group at 24 months

Variable	No. of events/No. patients (% complication rate) Retropubic	Transobturator	*P* value[a]
Total no. of patients	298	299	
SAEs			
Bladder perforation	15/15 (5.0%)	0/0	< .0001
Urethral perforation	1/1 (0.3%)	0/0	.50
Pulmonary embolus	0/0	1/1 (0.3%)	> .99
Postoperative bleeding	1/1 (0.3%)	0/0	.50
Mesh complication: erosion	1/1 (0.3%)	1/1 (0.3%)	> .99
Mesh complication: exposure	10/9 (3.0%)	6/6 (2.0%)	.45
Surg site inf: deep incisional	0/0	1/1 (0.3%)	> .99
Surg site inf: organ/space	0/0	2/2 (0.7%)	.50
Recurrent UTI	3/3 (1.0%)	0/0	.12
Neurologic symptoms	1/1 (0.3%)	0/0	.50
Granulation tissue	0/0	1/1 (0.3%)	> .99
Vaginal epithelium perforation	6/6 (2.0%)	13/13 (4.4%)	.16
Voiding dysfunction requiring surgery (and/or catheter use)	9/9 (3.0%)	0/0	.002
Other	0/0	3/3 (1.0%)	.25
Total SAEs	47/45 (15.1%)	28/25 (8.4%)	.01
AEs			
Intraoperative bleeding	14/14 (4.7%)	7/7 (2.3%)	.13
Postoperative bleeding	6/6 (2.0%)	0/0	.02
Mesh complication: exposure	4/4 (1.3%)	2/2 (0.7%)	.45
Surg site inf: superficial incisional	2/2 (0.7%)	0/0	.25
UTI culture proven	27/25 (8.4%)	16/14 (4.7%)	.07
Empiric	16/15 (5.0%)	9/9 (3.0%)	.22
Recurrent	18/16 (5.4%)	10/10 (3.4%)	.24
Neurologic symptoms	20/15 (5.0%)	32/29 (9.7%)	.04
Voiding dysfunction	10/10 (3.4%)	6/6 (2.0%)	.33
Pain per patient self-report ≥6 wk	7/7 (2.3%)	7/6 (2.0%)	.79
De novo urge incontinence	0/0	1/1 (0.3%)	> .99
Persistent urge incontinence	42/42 (14.1%)	38/38 (12.8%)	.63
Other	8/7 (2.3%)	6/6 (2.0%)	.79
Total AEs	174/121 (40.6%)	134/98 (32.8%)	.051

AE, adverse event; *SAE*, serious adverse event; *UTI*, urinary tract infection.

[a] *P* values were from Fisher exact test comparing the rate.

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rethral sling was designed to minimize bladder and bowel perforation, complications such as thigh pain and neurologic pain are known to occur.[3]

The investigators of the Urinary Incontinence Treatment Network (UITN) recently reported 1 year outcomes of a randomized equivalence design trial (the Trial of Mid-Urethral Slings [TOMUS] study) comparing these 2 approaches.[4,5] The 12-month objective success rates for the retropubic and transobturator procedures were relatively high at 80.8% and 77.7%, and met the prespecified criteria for equivalence.[5] In that report, we also briefly summarized adverse events during the first postoperative year. These included bladder perforation and voiding dysfunction, which were uncommon and occurred only in the retropubic group; women in this group were also more likely than women in the transobturator group to have postoperative urinary tract infections. In contrast, the frequency of neurologic symptoms was higher in the transobturator-sling group.

This report details the 2-year AE experience of women enrolled in the TOMUS Study. The relationship between clinical and demographic factors measured at baseline with the occurrence was also examined.

Materials and Methods

To ensure standardization across the participating sites, uniform definitions of AEs and serious AEs (SAEs) were established before trial initiation. AEs were collected at each study visit or between visits when known to the research team. AEs were classified with a modified version of the Dindo classification system as described previously.[6] A complications work group, comprised of 5 principal investigators, reviewed all AE reports for quality control purposes and accuracy. The Complications Work Group members were masked to site, surgeon, and randomization assignment, although for some of the complications, narrative descriptions may have revealed treatment assignment. The group met regularly to review each AE report. Before each meeting, 2 work group members independently reviewed each AE report, graded the event using the modified Dindo classification and assigned the body system that was affected. During the group meetings, if there was consensus of the 2 primary reviewers and no concerns expressed by other members, the AE coding was entered into the data system. In case of disagreement, the work group

members discussed the case until consensus was reached. For internal consistency, an on-going record of prior consensus decisions was maintained to facilitate recollection of previous decision. Participants were asked to identify specific locations of pain, using anatomic pictures, and rate the intensity of the pain associated with the study surgery. Patient self-reports were collected daily for the first 2 weeks after surgery, then at each subsequent study visit. Patients who reported surgical pain at the 2-week follow-up visit were asked to complete a daily pain diary for an additional 2 weeks.

Neurologic symptoms were defined as new paresthesias or alterations in motor function that developed within the first 6 weeks after surgery. Participants were considered to have a neurologic complication related to TOMUS surgery if the patient responded affirmatively to either of the following questions; "do you have any *numbness* in your legs or pelvic area that has developed since surgery?" and "do you have any *weakness* in your legs or pelvic area that has developed since surgery?" Patients who responded affirmatively were asked to specify the location and magnitude of the symptoms. They were also asked about bother with response categories of "not at all, slightly, moderately or greatly bothersome."

Reporting of urinary tract infections (UTIs) was based on the time from study surgery. Within the first 6 weeks postoperatively, bother from presumed (not culture-proven) and/or culture-proven UTIs was reported. In the interval between 6 weeks and 1 year postoperative, only recurrent UTIs were considered as AEs and were defined as ≥3 episodes of symptoms characteristic of UTI symptoms that resulted in antibiotic treatment, regardless of urine culture results.

Mesh-related AEs included erosion (defined as occurring after primary healing, into an organ or surrounding tissue) or exposure (defined as mesh visualized through a prior incision area with or without an inflammatory reaction). There was no time limit for reporting mesh-related AEs.

Descriptive statistics were generated for the following clinical and demographic factors: age, body mass index (BMI), self-reported pelvic surgical history, concomitant surgery, operative time, blood loss, prolapse stage, self-reported history of UTI, smoking, menopausal status/hormone replacement therapy use, and diabetes. Bivariate associations between these factors and presence/absence of any AE were explored; odds ratios were calculated from logistic regression models. We compared intraoperative vs postoperative complications by event type between treatment groups. *P* values were calculated using Fisher exact test. Logistic regression models were created to explore associations between clinical-demographic factors and surgical complications.

TABLE 2
Bivariate analysis of clinicodemographic factors associated with S/AE within 24 months

Factors	OR (95% CI)[a]	*P* value[a]	*P* value[b]
Treatment group		.003[c]	
Retropubic vs transobturator	1.63 (1.18–2.26)		
Age (per 10 y interval)	1.01 (0.87–1.17)	.88	.83
BMI (per 5 units)	1.12 (0.99–1.26)	.08	.10
Diabetes		.87	.73
Yes vs no (ref)	1.05 (0.55–2.03)		
Prior UI surgery		.005[c]	.004[c]
Yes vs no (ref)	1.99 (1.23–3.22)		
Prior POP surgery		.051	.04[c]
Yes vs no (ref)	0.37 (0.13–1.01)		
Previous hysterectomy surgery		.07	.052
Yes vs no (ref)	0.71 (0.49–1.03)		
Concomitant surgery		.25	.23
Yes vs no (ref)	1.24 (0.86–1.80)		
Operative time (per 30 min interval)	1.23 (1.09–1.37)	< .001[c]	< .001[c]
Blood loss -Entire case (per 50 mL)	1.24 (1.11–1.39)	< .001[c]	< .001[c]
-Mid-urethral sling (per 50 mL)	1.82 (1.40–2.37)	< .0001[c]	< .0001[c]
POP-Q stage		.87	.87
Stage 0/1 vs Stage 3/4	0.87 (0.47–1.61)		
Stage 2 vs Stage 3/4	0.85 (0.46–1.57)		
History of UTI		.009[c]	.005[c]
Yes vs no (ref)	2.37 (1.24–4.52)		
Smoking		.97	.93
Never smoker vs current smoker (ref)	1.05 (0.64–1.72)		
Former smoker vs current smoker (ref)	1.07 (0.63–1.81)		
Menopausal status/HRT		.56	.57
No vs premenopausal (ref)	1.21 (0.82–1.79)		
Yes vs premenopausal (ref)	1.23 (0.80–1.88)		

BMI, body mass index; *HRT*, hormone replacement therapy; *OR*, odds ratio; *POP*, pelvic organ prolapse; *POP-Q*, pelvic organ prolapse questionnaire; *UTI*, urinary tract infection.

[a] Unadjusted; [b] Adjusted for treatment; [c] *P* value < .05 level.

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Results

Baseline clinical and demographic characteristics and primary results of the TO-

TABLE 3
Complications stratified by continence surgery alone vs continence surgery with concomitant surgery and by treatment group at 24 months

	No. of events/No. of patients (% complication rate)					
	Continence only			Continence + concomitant		
Variable	Retropubic	Transob.	*P* value[a]	Retropubic	Transob.	*P* value[a]
Total no. of patients	225	221		73	78	
SAEs						
Bladder perforation	10/10 (4.4%)	0/0	.002	5/5 (6.8%)	0/0	.02
Urethral perforation	1/1 (0.4%)	0/0	> .99	0/0	0/0	—
Pulmonary embolus	0/0	0/0	—	0/0	1/1 (1.3%)	> .99
Postoperative bleeding	0/0	0/0	—	1/1 (1.4%)	0/0	.48
Mesh complication: erosion	1/1 (0.4%)	1/1 (0.5%)	> .99	0/0	0/0	—
Mesh complication: exposure	10/9 (4.0%)	5/5 (2.3%)	.42	0/0	1/1 (1.3%)	> .99
Surg site inf: deep incisional	0/0	1/1 (0.5%)	.50	0/0	0/0	—
Surg site inf: organ/space	0/0	0/0	—	0/0	2/2 (2.6%)	.50
Recurrent UTI	2/2 (0.9%)	0/0	.50	1/1 (1.4%)	0/0	.48
Neurologic symptoms	0/0	0/0	>.99	1/1 (1.4%)	0/0	.48
Granulation tissue	0/0	0/0	—	0/0	1/1 (1.3%)	> .99
Vaginal epithelium perforation	6/6 (2.7%)	9/9 (4.1%)	.44	0/0	4/4 (5.1%)	.12
Voiding dysfunction requiring surgery (and/or catheter use)	6/6 (2.7%)	0/0	.03	3/3 (4.1%)	0/0	.11
Other	0/0	1/1 (0.5%)	.50	0/0	2/2 (2.6%)	.50
Total SAEs	36/35 (15.6%)	17/16 (7.2%)	.008	11/10 (13.7%)	11/9 (11.5%)	.81
AEs						
Intraoperative bleeding	10/10 (4.4%)	6/6 (2.7%)	.45	4/4 (5.5%)	1/1 (1.3%)	.20
Postoperative bleeding	4/4 (1.8%)	0/0	.12	2/2 (2.7%)	0/0	.23
Mesh complication: exposure	3/3 (1.3%)	1/1 (0.5%)	.62	1/1 (1.4%)	1/1 (1.3%)	> .99
Surg site inf: superficial incisional	2/2 (0.9%)	0/0	.50	0/0	0/0	—
UTI culture proven	15/14 (6.2%)	10/9 (4.1%)	.39	12/11 (15.1%)	6/5 (6.4%)	.11
Empiric	11/11 (4.9%)	7/7 (3.2%)	.47	5/4 (5.5%)	2/2 (2.6%)	.43
Recurrent	13/12 (5.3%)	7/7 (3.2%)	.35	5/4 (5.5%)	3/3 (3.8%)	.71
Neurologic symptoms	16/13 (5.8%)	21/18 (8.1%)	.36	4/2 (2.7%)	11/11 (14.1%)	.02
Voiding dysfunction	4/4 (1.8%)	6/6 (2.7%)	.54	6/6 (8.2%)	0/0	.01
Pain per patient self-report ≥6 wks	5/5 (2.2%)	3/3 (1.4%)	.72	2/2 (2.7%)	4/3 (3.8%)	> .99
De novo urge incontinence	0/0	1/1 (0.5%)	.50	0/0	0/0	—
Persistent urge incontinence	34/34 (15.0%)	33/33 (14.9%)	> .99	8/8 (11.0%)	5/5 (6.4%)	.39
Other	3/2 (0.9%)	2/2 (0.9%)	> .99	5/5 (6.8%)	4/4 (5.1%)	.74
Total AEs	120/85 (37.8%)	97/71 (32.1%)	.23	54/36 (49.3%)	37/27 (34.6%)	.07

AE, adverse event; *SAE*, serious adverse event; *Transob*, transobturator; *UTI*, urinary tract infection.

[a] *P* values were from Fisher exact test comparing the rate.

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MUS Study have been previously described.[5] Five hundred twenty-eight of the original 597 randomized participants completed the 24-month assessments or failed treatment at or before that visit (258 [86.6%] retropubic and 270 [90.3%] transobturator). Over a period of 24 months, 42% (253/597) of all study participants experienced at least 1 AE including 12% (70/597) that experienced at least 1 SAE. These 253 patients experienced a total of 383 AEs; 75 AEs (20%) were classified as SAEs (Table 1). Most (77%) of the AEs had an onset date on or before 6-week postoperative visit. Participants were more likely to experience at least one AE (Table 2) if they reported a prior UTI (odds ratio, 2.37; 95% confi-

dence interval, 1.24–4.52; $P = .01$, prior continence surgery (odds ratio, 1.99; 95% confidence interval, 1.23–3.22; $P = .01$), experienced longer surgical times or increased blood loss. AEs had no effect on subjective or objective surgical success.

Of 597 women who were randomly assigned in the TOMUS trial (298 retropubic, 299 transobturator), one-quarter (25%) had concomitant procedures, most often vaginal surgery to repair pelvic organ prolapse. Table 3 lists adverse events stratified by study surgery and concomitant surgery. Mesh-related complications (exposures and erosions) affected 3-5% of participants (retropubic 4.7% vs transobturator 3.0%). During months 12-24, there were 3 new mesh-related SAEs.

The distribution of AEs differed by sling type. Intraoperative bladder perforation occurred only in the retropubic group. Intraoperative blood loss (more than 100 mL) was the second most common intraoperative complication in both study surgery groups and occurred twice as frequently in the retropubic group.

Over a period of 24 months after surgery, 53 AEs from neurologic symptoms were reported, including 1 SAE. In women without concomitant surgery, postoperative neurologic symptoms were the most common AE. Neurologic AEs were more common in the transobturator group, regardless of concomitant surgery (retropubic 16 [5.4%] vs transobturator 29 [9.7%] $P = .06$ from Fisher exact test). Most neurologic symptoms were mild in nature and had resolved by 6 weeks postoperatively; however, at 24 months 4 remain unresolved. Neurologic symptoms sometimes occurred in groin areas when a retropubic approach was used, and occurred in suprapubic areas when a transobturator approach was used. Of the 53 neurologic symptom AEs, 49 were resolved with a mean resolution time of 105 days.

Although concomitant surgery did not increase the overall occurrence of an SAE, it appears to influence the frequency of AEs. For example, in women who underwent concomitant surgery, a postoperative UTI was the most common AE, occurring more frequently in this group compared with women who underwent MUS only (19.2% vs 12.3%, $P < .05$).

The most common SAEs were intraoperative vaginal epithelial perforation, (n = 19) and intraoperative bladder perforation (n = 15). Perforations of the vaginal epithelium and the bladder were defined a priori by the Dindo classification system as SAEs (because they required procedures to resolve the problem during the index surgery), but these events were managed during surgery with no short- or long-term consequences.

UTI was common. When combining all a priori defined UTI categories (culture-proven, empiric, recurrent) they accounted for 25.8% of AEs (16.7%, retropubic; 9.1%, transobturator) (Table 4).

TABLE 4
UTI events and number of women (percent of total randomized) who reported any UTI by interval treatment group

Postoperative period[a]	No. of events/No. of patients (% transobturatoral) Retropubic (n = 293)	Transobturator (n = 297)	*P* value[b]
Any UTI in first 6 wk	47/39 (13)	26/23 (8)	.03[d]
Recurrent UTI (≥3) from 6 wk to 24 mo	25/17 (7)	12/10 (4)	.17
Total[c]	64/52 (21)	35/32 (13)	.02[d]

UTI, urinary tract infection.

[a] Overall no. of patients are those who had data on either time interval; [b] *P* value based on Fisher exact test testing incidence rate (% women); [c] If a patient had UTI during any time interval, the patient was considered having had UTI, if a patient did not have UTI in 1 time interval but unknown at the other, then the status was set to missing; [d] *P* value < .05 level..

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Comment

In the first 2 years after midurethral sling surgery, 42% of women undergoing TOMUS midurethral sling procedures experienced at least 1 AE. Most of these complications occurred during surgery or within the first 6 weeks after surgery. Complication patterns differed by surgical approach, with bladder perforation, voiding dysfunction requiring surgical treatment and UTI occurring more commonly in the retropubic group and neurologic symptoms occurring more commonly in the transobturator group. Because surgical efficacy is similar for these 2 procedures, the differences in type and frequency of AEs may influence the decision on which type of surgery is to be performed. Postoperative mesh complications occurred in both groups with new problems occurring in the second postoperative year in a minority of women. Longer-term follow-up of such sequelae will be important to further inform preoperative counseling.

Recent systemic reviews and meta-analyses of midurethral slings similarly reported higher rates of bladder perforation and voiding dysfunction with retropubic procedures compared with the transobturator procedures. UTI and neurologic symptoms are poorly reported in most series.[1,2,6-9]

UTI was the most common AE in both surgical groups. Most events occurred within the first 6 weeks after surgery. The higher incidence of UTIs in the retropubic group may be related to the higher rate of voiding dysfunction. Data from both the SISTEr and TOMUS trials demonstrate a high incidence of UTI after surgery for stress incontinence. Although it has been difficult to reach a consensus on an exact definition of a UTI, there is no question that a large number of women receive antibiotic therapy for UTI symptoms after surgery for stress incontinence. Given the morbidity of both UTI and the antibiotic therapy to treat them, there should be further efforts to understand the cause and to develop methods of prevention.

The number of mesh complications was similar to what has been reported elsewhere. Most are vaginal exposures

that did not require surgical treatment. Mesh-related complications continued to occur up to 2 years after surgery, however, events were infrequent.

Demographic variables associated with a higher likelihood of AEs included, history of previous incontinence or pelvic prolapse surgery and a prior history of UTI. Clinical variables associated with a higher complication rate included retropubic approach, intraoperative blood loss, and operative time. Postoperative mesh complications and UTIs occurred in both groups with new events continuing into the second postoperative year in a minority of women. Concomitant surgery did not appear to increase the risk of AEs for either treatment group.

Previous studies found difference in AEs in women who had concomitant surgery. However, in the SISTEr trial comparing Burch and pubovaginal sling, concomitant surgery was associated with significantly higher rates of both AEs and SAEs.[10] The SISTEr trial allowed both vaginal and abdominal pelvic prolapse repair, whereas concomitant surgery was limited to the vaginal approach in the TOMUS trial. The TOMUS concomitant surgery group demonstrated a number of statistical differences in AE patterns; however, it is not clear that these differences are clinically significant given the small number of events.

This data is unique in that the TOMUS SAE and AE data were collected prospectively and robustly as part of a large, randomized surgical trial. Quality controls included a predefined list of AEs to monitor. Cross-checks of related variables on study forms were performed at every visit and patients were also queried about office visits outside of their follow-up time points. Furthermore, a complications work group reviewed, categorized and graded all complications in blinded fashion using a validated surgical complication instrument.

Assessment of clinically important AEs in surgical trials remains a challenge. AE definitions and reporting vary between investigators making it difficult to compare data from 1 study to the next. Standardization of event classification with a surgical complication scale (such as Dindo) is a good first start; however, the instrument was not developed for assessment of the complications profile typical for midurethral slings. Moreover, these scales do not take into account the patient perception of complications that may differ from the physician perspective. We found that although the Dindo scale allowed us to reliably define and capture events across multiple investigators and clinical sites, at times the events were allocated to categories that were not compatible with the patient's clinical course; for example, a perforation of the bladder during retropubic sling requires a simple replacement of the sling needles, but is categorized as an SAE because in the Dindo classification, any additional procedures, however small, are categorized as "severe." Although bladder or vaginal perforations are undesirable events, we did not detect clinically relevant consequences in a 2-year follow-up.

Two years postoperatively, the retropubic procedures demonstrate higher rates of voiding dysfunction and UTI, whereas the transobturator procedures were associated with higher rates of transient neurologic symptoms. Mesh-related problems are not common but continue to occur throughout the 2-year period. The frequency and distribution of AEs after midurethral slings found in this study may be used by surgeons when counseling patients about known risks of midurethral sling procedures with their patients who are candidates for these procedures. ■

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REFERENCES

1. Ogah J, Cody JD, Rogerson L. Minimally invasive synthetic suburethral sling operations for stress urinary incontinence in women. Cochrane Database Syst Rev 2009:CD006375.

2. Latthe PM, Foon R, Toozs-Hobson P. Transobturator and retropubic tape procedures in stress urinary incontinence: a systematic review and meta-analysis of effectiveness and complications. BJOG 2007;114:522-31.

3. Barber MD, Kleeman S, Karram MM, et al. Transobturator tape compared with tension-free vaginal tape for the treatment of stress urinary incontinence: a randomized controlled trial. Obstet Gynecol 2008;111:611-21.

4. Albo ME. The trial of mid-urethral slings (TOMUS): design and methodology. J Appl Res 2008;8:1-13.

5. Richter HE, Albo ME, Zyczynski HM, et al. Retropubic versus transobturator midurethral slings for stress incontinence. N Engl J Med 2010;362:2066-76.

6. Dindo D, Demartines N, Claiven PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg 2004;240:205-13.

7. Tsivian A, Kessler O, Mogutin B, et al. Tape related complications of the tension-free vaginal tape procedure. J Urol 2004;171(Pt 1):762-4.

8. Latthe PM, Singh P, Foon R, Toozs-Hobson P. Two routes of transobturator tape procedures in stress urinary incontinence: a meta-analysis with direct and indirect comparison of randomized trials. BJU Int 2010;106:68-76.

9. Novara G, Artibani W, Barber MD, et al. Updated systematic review and meta-analysis of the comparative data on colposuspensions, pubovaginal slings, and midurethral tapes in the surgical treatment of female stress urinary incontinence. Eur Urol 2010;58:218-38.

10. Albo ME, Richter H, Brubaker L, et al. Burch colposuspension versus fascial sling to reduce urinary stress incontinence. N Engl J Med 2007;356:2143-55.