Findings of universal cystoscopy at incontinence surgery and their sequelae

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OBJECTIVE: The purpose of this study was to report the frequency of abnormal cystoscopy at incontinence surgery and to identify risk factors and sequelae of injury.

STUDY DESIGN: Findings of cystoscopy were collected prospectively in 3 multicenter surgical trials. Clinical, demographic, and procedure characteristics and surgeon experience were analyzed for association with iatrogenic injury and noninjury abnormalities. Impact of abnormalities on continence outcomes and adverse events during 12 months after the procedure were assessed.

RESULTS: Abnormal findings in the bladder or urethra were identified in 95 of 1830 women (5.2%). Most injuries (75.8%) were iatrogenic. Lower urinary tract (LUT) injury was most common at retropubic urethropexy and retropubic midurethral sling (MUS) procedures 6.4% each), followed by autologous pubovaginal sling procedures (1.7%) and transobturator MUS (0.4%). Increasing age (56.9 vs 51.9 years; $P = .04$), vaginal deliveries (3.2 vs 2.6; $P = .04$), and blood loss (393 vs 218 mL; $P = .01$) were associated with LUT injury during retropubic urethropexy; however, only age (62.9 vs 51.4 years; $P = .02$) and smoking history ($P = .04$) were associated for pubovaginal sling procedures. No factors correlated with increased risk of injury at retropubic and transobturator MUS. Notably, previous incontinence surgery, concomitant procedures, anesthesia type, and trainee participation did not increase LUT injury frequency. Although discharge with an indwelling catheter was more common after trocar perforation compared with the noninjury group (55.6% vs 18.5%; $P < .001$), they did not differ in overall success, voiding dysfunction, recurrent urinary tract infections, or urge urinary incontinence.

CONCLUSION: Universal cystoscopy at incontinence surgery detects abnormalities in 1 in 20 women. Urinary trocar perforations that are addressed intraoperatively have no long-term adverse sequelae.

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Background and Objective

Cystoscopy is often performed at the time of incontinence surgery to identify lower urinary tract (LUT) injury. The goal of this secondary analysis was to report the frequency of LUT injury and other nontrauma-related diseases of the urethra and bladder that are recognized in women who undergo stress urinary incontinence (SUI) surgery.

We also sought to identify patient, procedure, and surgeon characteristics that are associated with these abnormalities. Using available 12- and 24-month postoperative outcome and adverse event data, we sought to estimate the false-negative rate of intraoperative cystoscopy and the sequelae of urinary trocar injuries during midurethral sling procedures.

Materials and Methods

This is a secondary analysis of several surgical trials that were conducted by the Urinary Incontinence Treatment Network. In the Stress Incontinence Surgical Treatment Efficacy Trial (SISTEr), Trial Of Mid-Urethral Slings (TOMUS), and Value of Urodynamic Evaluation (ValUE) trials, all subjects underwent cystoscopy at the time of their index SUI surgery under standardized protocols.

At the time of incontinence surgery, details on LUT injury and bladder/urethral anatomy and disease were collected prospectively. We collected information about patient and procedure-related factors that were associated with cystoscopically recognized LUT injury, which included trainee involvement and concurrent procedures. Our secondary analysis reports on subjects and their clinical outcomes

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TABLE

Comparison of patients with and without lower urinary tract injury diagnosed by cystoscopy during incontinence procedures

Characteristic	Autologous pubovaginal sling			Retropubic urethropexy			Retropubic midurethral sling			Transobturator midurethral sling		
	Injured (n = 6)	Uninjured (n = 341)	*P* value	Injured (n = 21)	Uninjured (n = 308)	*P* value	Injured (n = 43)	Uninjured (n = 633)	*P* value	Injured (n = 2)	Uninjured (n = 458)	*P* value
Age, y[a]	62.9 ± 12.0	51.4 ± 9.9	.02	56.9 ± 10.3	51.9 ± 10.5	.04	52.8 ± 11.6	52.0 ± 10.5	.55	54.0 ± 6.0	52.2 ± 10.8	.66
Body mass index, kg/m^2[a]	26.5 ± 4.6	30.3 ± 6.1	.13	32.2 ± 7.3	29.6 ± 6.0	.06	28.6 ± 6.5	29.7 ± 6.5	.18	27.7 ± 4.9	29.8 ± 6.2	.65
Parity, n[a]	2.7 ± 1.8	3.3 ± 1.7	.42	3.6 ± 1.4	3.3 ± 1.8	.23	3.0 ± 1.8	2.9 ± 1.6	.86	2.5 ± 0.7	3.1 ± 1.7	.59
Vaginal deliveries, n[a]	2.2 ± 1.3	2.5 ± 1.5	.60	3.1 ± 1.0	2.6 ± 1.6	.04	2.3 ± 1.2	2.1 ± 1.3	.24	2.5 ± 0.7	2.3 ± 1.4	.71
Hormone therapy/ menopausal status, n (%)												
No	4 (66.7)	112 (33.5)	.17	8 (38.1)	109 (35.4)	.26	11 (32.4)	117 (24.1)	.52	1 (50.0)	115 (29.8)	> .99
Yes	2 (33.3)	111 (33.2)		10 (47.6)	107 (34.7)		10 (29.4)	145 (29.8)		0	110 (28.5)	
Premenopausal	0	111 (33.2)		3 (14.3)	92 (29.9)		13 (38.2)	224 (46.1)		1 (50.0)	161 (41.7)	
Smoking status, n (%)												
Never	1 (16.7)	173 (50.7)	.04	15 (71.4)	179 (58.1)	.19	26 (60.5)	367 (58.0)	.54	2 (100)	269 (58.7)	.64
Former	5 (83.3)	112 (32.8)		6 (28.6)	90 (29.2)		14 (32.5)	183 (28.9)		0	140 (30.6)	
Current	0	56 (16.4)		0	39 (12.7)		3 (7.0)	83 (13.1)		0	49 (10.7)	
Stage of prolapse, n (%)												
Stage 0 & 1	1 (20.0)	75 (23.4)	> .99	10 (47.6)	75 (24.3)	.06	7 (46.7)	123 (43.5)	.13	1 (100)	136 (45.6)	.54
Stage 2	3 (60.0)	189 (59.1)		10 (47.6)	185 (60.1)		5 (33.3)	139 (49.1)		0	138 (46.3)	
Stage 3 & 4	1 (20.0)	56 (17.5)		1 (4.8)	48 (15.6)		3 (20.0)	21 (7.4)		0	24 (8.1)	
Medical, Epidemiological, and Social aspects of Aging questionnaire urge index at baseline, %[a]	33.2 ± 30.7	35.4 ± 21.8	.80	42.8 ± 19.9	36.1 ± 21.8	.11	34.7 ± 25.0	33.0 ± 21.5	.86	27.5 ± 7.8	34.2 ± 22.2	.71
Any urinary incontinence surgery, n (%)	1 (20.0)	42 (13.1)	.51	6 (28.6)	44 (14.3)	.11	3 (20.0)	35 (12.4)	.42	0	41 (13.8)	> .99
Previous urinary incontinence surgery, n (%)[b]												
1	1 (100.0)	35 (83.3)	> .99	6 (100.0)	33 (75.0)	.67	3 (100.0)	28 (80.0)	> .99	0	33 (80.5)	Not available
2	0	6 (14.3)		0	9 (20.4)		0	5 (14.3)		0	8 (19.5)	
3	0	1 (2.4)		0	2 (4.6)		0	1 (2.9)		—	—	
4	—	—		—	—		0	1 (2.9)		—	—	

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TABLE

Comparison of patients with and without lower urinary tract injury diagnosed by cystoscopy during incontinence procedures *(continued)*

Characteristic	Autologous pubovaginal sling			Retropubic urethropexy			Retropubic midurethral sling			Transobturator midurethral sling		
	Injured (n = 6)	Uninjured (n = 341)	*P* value	Injured (n = 21)	Uninjured (n = 308)	*P* value	Injured (n = 43)	Uninjured (n = 633)	*P* value	Injured (n = 2)	Uninjured (n = 458)	*P* value
Previous Burch, n (%)	0	4 (1.2)	> .99	0	1 (0.3)	> .99	2 (13.3)	7 (2.5)	.07	0	7 (2.3)	> .99
Previous sling, n (%)	1 (20.0)	6 (1.9)	.10	0	8 (2.6)	> .99	1 (6.7)	8 (2.8)	.38	0	6 (2.0)	> .99
Previous cesarean delivery, n (%)	0	40 (11.7)	> .99	0	33 (10.7)	.25	7 (16.3)	83 (13.1)	.49	0	69 (15.0)	> .99
Anesthesia, n (%)[c]												
General	3 (60.0)	251 (78.4)	.30	16 (76.2)	261 (84.7)	.35	12 (80.0)	202 (71.4)	.57	1 (100)	212 (71.1)	> .99
Spinal/epidural	2 (40.0)	79 (24.7)	.60	7 (33.3)	55 (17.9)	.09	1 (6.7)	17 (6.0)	> .99	0	19 (6.4)	> .99
Sedation/local	—	—		—	—		3 (4.5)	64 (95.5)	> .99	0	69 (23.2)	> .99
Estimated blood loss, mL[a]	175 ± 185	239 ± 319	.44	393 ± 521	218 ± 317	.01	87 ± 100	76 ± 118	.43	200 ± —[d]	67 ± 124	.13
Concomitant surgery, n (%)	2 (33.3)	197 (57.8)	.41	9 (42.9)	175 (56.8)	.26	8 (18.6)	133 (21.0)	.85	0	98 (21.4)	> .99
Surgeon experience fellow assistance, n (%)	3 (50.0)	132 (38.7)	.68	6 (28.6)	110 (35.7)	.64	26 (60.5)	461 (72.8)	.11	0	304 (66.4)	.11

[a] Data are presented as mean ± SD; [b] The numbers of patients who had any urinary incontinence surgery were used as the denominator; [c] Primary anesthesia type as reported by the surgeon; only midurethral sling procedures were performed under local sedation; [d] Data were available for only 1 of the 2 subjects; therefore, a standard deviation could not be computed.

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over the first year after their index SUI surgery.

RESULTS

Cystoscopy was performed in 1830 SISTEr, TOMUS, and ValUE participants. Of these, 95 women (5.2%) had abnormal findings in the bladder or urethra. Iatrogenic injury accounted for most of the abnormalities (72; 75.8%); noninjury findings were noted in 23 women. When women from all 3 trials were grouped by type of anti-incontinence procedure, LUT injury was most often identified at Burch retropubic urethropexy and retropubic midurethral sling procedures (6.4% each) and less often at autologous pubovaginal sling procedures (1.7%) and transobturator midurethral sling procedures (0.4%).

Among women who underwent a Burch retropubic urethropexy, those who were older and those who had had more vaginal deliveries and greater intraoperative blood loss were more likely to have LUT injury. Former smokers and older women were at increased risk for LUT injury among those women who underwent an autologous pubovaginal sling procedure. No demographic or intraoperative factors were correlated with increased risk for LUT injury among women who underwent trocar-based retropubic and transobturator midurethral sling procedures. Previous SUI surgery, concomitant surgery for prolapse or other gynecologic indications, type of anesthesia, and trainee participation were not significantly associated with bladder or urethral injury for any of these 4 procedures (Table). Trocar perforations were recognized in the bladder of 14 TOMUS subjects: 11 laterally and 4 at the dome (1 patient sustained 2 trocar perforations). There were no perforations at the trigone. All perforations were managed exclusively by trocar removal and replacement.

Noninjury bladder abnormalities were identified by cystoscopy in 23 of 1830 women, which included 17 for SISTEr and ValUE participants. These included urothelial abnormalities (n = 8), inflammation, atypical vessels, bleeding glomerulations (n = 5), polyp (n = 1), duplicated right ureteral orifice (n = 2),

and carcinoma in situ (n = 1). No foreign bodies or invasive cancers were identified. When comparing demographic and perioperative factors in subjects with noninjury abnormalities with all other women (those with normal cystoscopy as well as those with findings of iatrogenic injury), we found that only a history of cesarean delivery had a significant association.

Trocar injuries were identified in 16 TOMUS subjects and 29 ValUE subjects. Women found to have urinary trocar perforations were significantly more likely than those with normal cystoscopy to be discharged with an indwelling Foley catheter (55.6% vs 18.5%, respectively; $P < .001$). Women with urinary trocar injury were as likely as those without injury to pass their voiding trials (75.7% vs 100%, respectively; $P = .34$).

We investigated the sequelae of urinary trocar perforations by comparing the functional outcomes of women with perforation with those with normal cystoscopy in the ValUE and TOMUS trials. We found no statistically significant differences between women with recognized trocar perforations vs normal cystoscopy in overall success in voiding dysfunction, in recurrent urinary tract infections (≥ 3) during the first 12 months after surgery or in symptoms of persistent or de novo urgency urinary incontinence.

COMMENT

The general tenets regarding LUT injury at the time of stress incontinence surgery are prevention, recognition, treatment (if needed), and postoperative care tailored to the injury. Compared with detected and appropriately managed injuries, unrecognized injuries are associated with increased morbidity.

We found that the rate of iatrogenic bladder injury varied by choice of SUI procedure, with the highest rate of 6.4% rate in both retropubic midurethral sling procedure and Burch urethropexy. The autologous sling and transobturator midurethral sling procedures had lower rates of cystoscopically detected iatrogenic injury (1.7% and 0.4%, respectively), but none were entirely free of injury risk. In addition, we found limited utility in preoperative prediction to triage "routine" vs "selective" cystoscopy. Thus, it seems reasonable to provide the same safety measures to all women who are at risk, that is, who undergo SUI surgery.

An important finding is that iatrogenic bladder injury with a trocar, when immediately identified with intraoperative cystoscopy, was not associated with a difference in surgical outcome. Clinicians and patients can be reassured that a bladder perforation by trocar is not likely to influence continence outcomes or increase the risk for de novo or worsening urgency symptoms, voiding dysfunction, or postoperative recurrent urinary tract infections despite repeated intraoperative cystoscopy or subsequent management with longer catheterization.

Surgeons will detect an abnormality in approximately 1 in 20 women, which includes noninjury- and injury-related abnormalities. Given the safety and efficiency of intraoperative cystoscopy, it is prudent to provide this safeguard to all patients.

CLINICAL IMPLICATIONS

- There is a minimum rate of abnormal cystoscopy or lower urinary tract injury, regardless of the type of stress incontinence procedure used.
- Universal cystoscopy will detect an abnormality, including noninjury- and injury-related abnormalities, in approximately 1 in 20 women.
- Trocar bladder perforations have no long-term adverse sequelae when immediately identified and addressed intraoperatively.
- Given the safety and efficiency of intraoperative cystoscopy, it is prudent to provide this safeguard to all patients at the time of incontinence surgery. ■