Review

Urinary Tract Injury at Benign Gynecologic Surgery and the Role of Cystoscopy

A Systematic Review and Meta-analysis

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OBJECTIVE: To calculate the rates of urinary tract injury detected during and after benign gynecologic surgery. To explore the role of routine intraoperative cystoscopy and determine if it helps in reducing injuries detected postoperatively.

DATA SOURCES: We conducted a literature search for urinary tract injuries at benign gynecologic surgery in PubMed, EMBASE, ClinicalTrials.gov, and Web of Science from January 2004 to August 2014. We combined our results with a database from a previously published systematic review to include earlier studies.

METHODS OF STUDY SELECTION: A total of 79 studies met our inclusion criteria. Excluded were letters to the editor, studies involving only selective cystoscopy in higher risk patients, case reports, and reports that included injuries resulting from obstetric or oncologic procedures.

TABULATION, INTEGRATION, AND RESULTS: Data from each report were classified according to type of surgery into vaginal hysterectomy, abdominal hysterectomy, laparoscopic hysterectomy, other (nonrobotic) gynecologic and urogynecologic surgery, robotic hysterectomy, and other robotic gynecologic and urogynecologic surgery. We determined the ureteric and bladder injury rates for each surgery type from studies in which routine intraoperative cystoscopy was performed and separately from studies in which it was not performed. Intraoperatively detected rates of ureteric and bladder injury were markedly higher with routine intraoperative cystoscopy. We obtained an adjusted ureteric injury rate of 0.3% and a bladder injury rate of 0.8%. The estimated postoperative ureteric injury detection rates per 1,000 surgeries were 1.6 without routine cystoscopy and 0.7 with routine cystoscopy. Postoperative bladder injury detection rates per 1,000 surgeries were 0.8 without routine cystoscopy and 1.0 with routine cystoscopy.

CONCLUSION: Although routine cystoscopy clearly increases the intraoperative detection rate of urinary tract injuries, this systematic review of 79 mostly retrospective studies shows that it does not appear to have much effect on the postoperative injury detection rate.

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See related editorial on page 1136.

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Gynecologic surgery can have major perioperative morbidity, including urinary tract and bowel injuries, infection, hemorrhage, thromboembolism, and death.[1] Injuries to the urinary tract, even if they occur relatively infrequently, can cause significant morbidity. The effects of the injury, its management, and its sequelae may result in temporary or permanent loss of employment, pain, anxiety, depression, and adverse effects on interpersonal relationships and quality of life.[2] Hospitalizations from delayed diagnosis result in 1.72 times greater cost to the health care system than those with immediate detection of injury.[3] Thus, intraoperative detection and recognition of urinary tract injuries remain very important for patients and gynecologists because they decrease morbidity[4] and result in less litigation.[5]

In 2007, the American College of Obstetricians and Gynecologists issued a guideline on the selective use of intraoperative cystoscopy after all prolapse or incontinence procedures.[6] The American Association of Gynecologic Laparoscopists in 2012 recommended that routine cystoscopic evaluation be carried out after all laparoscopic total hysterectomy procedures.[7] The National Quality Forum also published quality indicators (NQF 2063) regarding the selective use of routine cystoscopy. However, no strict recommendations on the role of universal cystoscopy in benign gynecologic surgery exist to date.

Our objectives were to estimate the rates of urinary tract injury after benign gynecologic surgery, to explore the role of routine intraoperative cystoscopy at benign gynecologic surgery, and to measure the extent that routine cystoscopy helps reduce postoperatively detected injuries.

SOURCES

Using our previously published combination of MeSH terms and single-search strategies,[8,9] we performed a comprehensive search of PubMed, EMBASE, and ClinicalTrials.gov from January 2004 to August 2014 identifying studies that describe the rates of urinary tract injuries in benign gynecologic surgery that used or did not use intraoperative cystoscopy. We used the following MeSH and non-MeSH terms to search for studies involving robotics in benign gynecologic surgery: gynecologic surgical procedures, adverse events, complications, intraoperative, postoperative, robotics, adverse, injury, tear, perforation, puncture, robotic gynecologic surgery, gynecologic, intervention, procedure, operation, operative, da Vinci, ureter, urinary, bladder. Because studies involving robotic surgery are fairly new, we additionally searched Web of Science. Searches in all these databases were limited to female human studies published in English. We also examined and hand-searched the reference lists of all eligible review articles to identify any additional studies not found with our search strategy.

STUDY SELECTION

The study design was a systematic review and the study population comprised case series of urinary tract injuries in benign gynecologic surgery. We retrieved 321 citations in PubMed and 284 citations in EMBASE for studies involving urologic injury without cystoscopy. Studies mentioning cystoscopy in benign gynecologic surgery amounted to 77 citations in PubMed and 64 citations in EMBASE. Abstracts involving robotic surgery with and without cystoscopy included 34 in PubMed, 159 in EMBASE, and 44 in Web of Science. Many of these studies were duplicated across databases. We did not find any ongoing or completed trial in ClinicalTrials.gov that was relevant to our study. There were 465 unduplicated abstracts screened independently by two authors (B.T. and D.G.) for possible inclusion in our study. From this, 61 studies were reviewed in detail as per our inclusion and exclusion criteria. A summary of our article selection process is shown in Figure 1.

For studies that do not involve cystoscopy at all, we only selected studies with more than 500 patients. For studies that used routine intraoperative cystoscopy, because those are fewer in the literature and many involve fewer than 500 patients, we selected them irrespective of the number of patients involved. Studies that were selected included transurethral and transvesical cystoscopy with a 0°, 30°, or 70° lens. For the majority of reports, the most common route for performing cystoscopy was transurethral and the type of lens used was not specified. Cystotomies at the supratrigone have increased risk for morbidity, including vesicovaginal fistula formation, compared with cystotomies at the dome. Unfortunately, because of the way information is reported, we were unable to accurately differentiate among these cystotomy sites and therefore included all these cases as per our inclusion criteria. Excluded were letters to the editor, studies involving only selective cystoscopy in higher risk patients, case reports, and reports in which injuries resulting from benign gynecologic surgery could not be distinguished from injuries resulting from obstetric or oncologic procedures.

From this updated search, we found 31 studies that matched our inclusion and exclusion criteria: 19 on the frequency of lower urinary tract injury during benign gynecologic surgery, four on the frequency of injury with routine intraoperative cystoscopy after benign gynecologic surgery, and eight that dealt with complications of robotic surgery in benign gynecologic

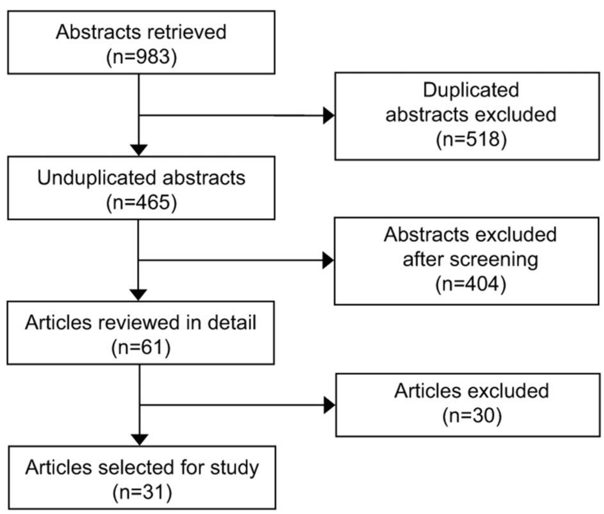

Fig. 1. Summary of study selection.

Teeluckdharry. Urinary Tract Injury Rates and Cystoscopy. Obstet Gynecol 2015.

Table 1. Studies Without Routine Intraoperative Cystoscopy*

Study	Year	Study Type	Location	Description From Study	No. of Patients in Each Category for Analysis
Cho et al[16]	2012	Retrospective	Korea	Vaginal hysterectomy	Vaginal hysterectomy: 778
Song et al[17]	2012	Retrospective	Korea	LAVH	Laparoscopic hysterectomy: 2,012
Siedhoff et al[18]	2012	Retrospective	U.S.	Laparoscopic hysterectomy	Laparoscopic hysterectomy: 834
Duong et al[19]	2011	Retrospective	U.S.	TAH, vaginal hysterectomy	Abdominal hysterectomy: 3,305; vaginal hysterectomy: 1,937
Brummer et al[20]	2011	Prospective	Finland	Laparoscopic hysterectomy, TAH, vaginal hysterectomy	Laparoscopic hysterectomy: 1,679; abdominal hysterectomy: 1,255; vaginal hysterectomy: 2,345
Gross et al[21]	2011	Retrospective	Germany	Laparoscopic-assisted supracervical hysterectomy	Laparoscopic hysterectomy: 1,584
Anpalagan et al[22]	2011	Retrospective	Australia	Laparoscopic hysterectomy	Laparoscopic hysterectomy: 991
Doganay et al[23]	2011	Retrospective	Turkey	TAH, vaginal hysterectomy	Abdominal hysterectomy: 4,398; other gynecologic and urogynecologic surgery: 1,944
Kavallaris et al[24]	2011	Retrospective	Germany	LAVH	Laparoscopic hysterectomy: 1,255
Clopin et al[25]	2009	Retrospective	France	Laparoscopic hysterectomy	Laparoscopic hysterectomy: 1,460
Jung and Huh[26]	2008	Retrospective	Korea	Supracervical hysterectomy	Abdominal hysterectomy: 1,163
Donnez et al[27]	2008	Prospective	Belgium	Laparoscopic hysterectomy, LAVH	Laparoscopic hysterectomy: 3,190; vaginal hysterectomy: 906
Leonard et al[28]	2007	Retrospective or prospective	France	Laparoscopic hysterectomy	Laparoscopic hysterectomy: 1,300
Leung et al[29]	2007	Retrospective	Hong Kong	TAH	Abdominal hysterectomy: 934
Bojahr et al[30]	2006	Retrospective	Germany	Laparoscopic-assisted supracervical hysterectomy	Laparoscopic hysterectomy: 1,706
Akyol et al[31]	2006	Retrospective	Turkey	Vaginal hysterectomy	Vaginal hysterectomy: 886
Kafy et al[32]	2006	Retrospective	Canada	TAH	Abdominal hysterectomy: 1,349
Kaloo et al[33]	2006	Prospective	Australia	Laparoscopic excisional surgery for endometriosis	Other gynecologic and urogynecologic surgery: 790
Garry et al[34,†]	2004	Retrospective	Australia	Abdominal and laparoscopic hysterectomies	Laparoscopic hysterectomy: 584

LAVH, laparoscopic-assisted vaginal hysterectomy; TAH, total abdominal hysterectomy.
* Studies from January 2004 to August 2014.
† Data sets with less than 500 abdominal or laparoscopic hysterectomies were not included.

surgery. Characteristics of these newer studies are shown in Tables 1–3. Together with our previous search results, we obtained a total number of 79 studies with 50 reporting on the frequency of urinary tract injury during benign gynecologic surgery, 21 on the frequency of urinary tract injury during benign

Table 2. Studies With Routine Intraoperative Cystoscopy*

Study	Year	Study Type	Location	Description From Study	No. of Patients in Each Category for Analysis
Ibeanu et al[5]	2009	Prospective	U.S.	TAH, LAVH, other gynecologic and urogynecologic surgery	Other gynecologic and urogynecologic surgery: 832
Jelovsek et al[35]	2007	Retrospective	U.S.	Laparoscopic hysterectomy	Laparoscopic hysterectomy: 126
Gustilo et al[36]	2006	Retrospective	U.S.	Other gynecologic and urogynecologic surgery	Other gynecologic and urogynecologic surgery: 700
Vakili et al[15]	2005	Prospective	U.S.	TAH, vaginal hysterectomy, LAVH	Other gynecologic and urogynecologic surgery: 471

TAH, total abdominal hysterectomy; LAVH, Laparoscopic-assisted vaginal hysterectomy.
* Studies from January 2004 to August 2014.

Table 3. Studies With Robotic Surgery for Benign Disease*

Study	Year	Study Type	Location	Description From Study	No. Patients in Each Category for Analysis
Patzkowsky et al[37]	2013	Retrospective	U.S.	Robotic hysterectomy	Robotic hysterectomy: 288
Martinez et al[38]	2013	Prospective	Spain	Robotic hysterectomy	Robotic hysterectomy: 51
Robinson et al[39]	2013	Retrospective	U.S.	Robotic urogynecologic surgery	Robotic other gynecologic and urogynecologic surgeries: 70
Germain et al[40]	2013	Retrospective	France	Robotic-assisted sacrocolpopexy	Robotic other gynecologic and urogynecologic surgeries: 52
Paraiso et al[41]	2011	Retrospective	U.S.	Robotic sacrocolpopexy	Robotic other gynecologic and urogynecologic surgeries: 35
Matthews et al[42]	2010	Retrospective	U.S.	Robotic hysterectomy	Robotic hysterectomy: 70
Boggess et al[43]	2009	Retrospective	U.S.	Robotic-assisted hysterectomy	Robotic hysterectomy: 152
Akl et al[44]	2008	Retrospective	U.S.	Robotic-assisted sacrocolpopexy	Robotic other gynecologic and urogynecologic surgeries: 80

There were no studies identified that involved the use of routine intraoperative cystoscopy.
* Studies from January 2004 to August 2014.

gynecologic surgery with intraoperative cystoscopy, and eight studies dealing with complications of robotic surgery for benign indications.

Data were extracted from the 79 reports in a systematic fashion by two independent authors (B.T. and D.G.) and two separate audits were performed to ensure its accuracy. Discrepancies were resolved via a consensus among all three authors (B.T., D.G., and G.F.). For each report, lower urinary tract injuries were categorized into ureteric and bladder injuries. When a patient sustained more than one injury in one category (ie, both ureters injured), it was counted as one event. If two injuries in the same individual were of different categories (ie, a bladder and a ureteric injury), they were treated as two separate events. Data from each report were classified according to type of surgery into vaginal hysterectomy, abdominal hysterectomy, laparoscopic hysterectomy, robotic hysterectomy, other gynecologic and urogynecologic surgery, and other robotic gynecologic and urogynecologic surgery. Each category may or may not include bilateral salpingo-oophorectomy. The other gynecologic and urogynecologic surgery and other robotic gynecologic and urogynecologic surgery categories included studies in which we could not separate out the various types of hysterectomies to be able to classify these studies in a particular hysterectomy category or participants had other concomitant gynecologic or urogynecologic procedures performed. Few studies reported on urinary tract injuries during subtotal abdominal hysterectomy and thus these were merged into the abdominal hysterectomy group. Similarly, studies reporting on laparoscopic-assisted vaginal hysterectomy and laparoscopic-assisted supracervical hysterectomy were combined into the laparoscopic hysterectomy group.

For the statistical analysis, we used SAS PROC GLIMMIX software to estimate the injury rate separately for each combination of injury site, type of surgery, and cystoscopy group adjusting for a random study effect. Specifically, the log odds of the injury probability for study i was modeled as $\beta_0 + \beta_i$, where β_0 is the population log odds for the combination of interest and β_i is a random study effect having zero mean. Confidence intervals (CIs) for the injury rate and *t* tests for the effect of cystoscopy were obtained from the intercept estimates and associated standard errors and degrees of freedom provided in the SAS software printout. There was no significant variation by study size or year of publication. The CIs are wider than would result if we were to ignore the systematic variation in rates between studies.

Because the use of intraoperative cystoscopy could increase the intraoperatively detected injury rate but was not expected to lower it, and because it could lower the postoperatively detected injury rate but was not expected to increase it, we used one-sided tests of hypotheses. Ureteric injuries and bladder injuries were analyzed separately because the publications had reported the numbers of ureteric and bladder injuries separately. Given that the rates are generally low and ureteric injuries occur somewhat independently of bladder injuries, a rough estimate for ureteric and bladder injuries combined could be obtained by adding the two rates together. However, we do not report estimates for the two sites combined in this article.

RESULTS

Results of the data analysis are reported separately for ureteric and bladder injuries in Tables 4 and 5, respectively. Both tables report the crude and adjusted intraoperative and postoperative injury detection rates by

Table 4. Ureteric Injury Rates

When Injury Was First Detected	Surgery Type	Cystoscopy Not Used Routinely			Cystoscopy Used Routinely		
		Crude Rate	Adjusted Rate/1,000	95% CI	Crude Rate	Adjusted Rate/1,000	95% CI
Intraoperative	Total	33/115,007	0.4	0.2–0.8	102/7,230	11.3	6.9–18.6*
	Vaginal hysterectomy	0/13,845	0.0	—	—	—	—
	Abdominal hysterectomy	11/63,876	0.5	0.1–2.3	—	—	—
	Laparoscopic hysterectomy	12/22,263	0.5	0.3–1.1	6/415	14.0	1.1–152.2*
	Robotic hysterectomy	1/203	4.9	—	—	—	—
	Other gynecologic and urogynecologic surgery	9/14,688	0.2	0.0–2.7	96/6,815	10.8	6.1–19.0†
	Robotic other gynecologic and urogynecologic surgeries	0/132	0.0	—	—	—	—
Postoperative	Total	154/115,007	1.6	1.1–2.3	5/7,230	0.7	0.3–1.8‡
	Vaginal hysterectomy	2/13,845	0.1	0.0–0.8	—	—	—
	Abdominal hysterectomy	44/63,876	1.6	0.6–4.3	—	—	—
	Laparoscopic hysterectomy	69/22,263	2.0	1.1–3.8	0/415	0.0	—
	Robotic hysterectomy	0/203	0.0	—	—	—	—
	Other gynecologic and urogynecologic surgeries	38/14,688	2.3	1.0–5.2	5/6,815	0.7	0.3–2.0§
	Robotic other gynecologic and urogynecologic surgeries	1/132	7.6	—	—	—	—
Intraoperative or postoperative‖	Total	360/163,085	2.6	2.0–3.4	107/7,230	12.1	7.5–19.5*
	Vaginal hysterectomy	10/26,400	0.4	0.2–1.0	—	—	—
	Abdominal hysterectomy	102/81,285	2.6	1.5–4.5	—	—	—
	Laparoscopic hysterectomy	166/34,518	3.1	2.0–5.0	6/415	14.0	1.1–152.2
	Robotic hysterectomy	2/491	4.1	0.2–79.4	—	—	—
	Other gynecologic and urogynecologic surgeries	79/20,259	3.1	1.6–6.3	101/6,815	11.7	6.8–20.0†
	Robotic other gynecologic and urogynecologic surgeries	1/132	7.6	—	—	—	—

CI, confidence interval.
Dash (—) indicates that insufficient data were available to calculate a CI and *P* value using the random-effects model.
* $P<.001$ (one-sided test).
† $P<.01$ (one-sided test).
‡ $P<.054$ (one-sided test).
§ $P=.03$ (one-sided test).
‖ Intraoperative and postoperative injuries were not reported separately in every study. When not reported separately, the data are included in the tally for intraoperative and postoperative combined but not in the separate tallies.

injury type for studies that used or did not use routine intraoperative cystoscopy.

We obtained an adjusted ureteric injury rate of 0.3% and a bladder injury rate of 0.8% (Tables 4 and 5), which agree with reported rates of 0.03–1.5% for ureteric injury and 0.2–1.8% for bladder injury in the literature.[5,10–12] Using crude data from the same tables, we found that the proportion of ureteric and bladder injuries detected intraoperatively without routine cystoscopy is approximately 18% and 79%, respectively. However, when cystoscopy is performed, the proportion of ureteric or bladder injuries detected intraoperatively increases to approximately 95%. Because of more easily discernable clues such as hematuria, urine extravasation, and air in the Foley catheter after laparoscopic procedures, bladder injuries are up to 15 times more likely to be detected intraoperatively when compared with ureteric injuries,[2] although cystoscopy also increases their intraoperative detection rate.

There were no reports where routine intraoperative cystoscopy was performed after vaginal hysterectomy, abdominal hysterectomy, or robotic hysterectomy on their own. Most of the cases in which routine cystoscopy was performed after these types of hysterectomies were classified as other

Table 5. Bladder Injury Rates

When Injury Was First Detected	Surgery Type	Cystoscopy Not Used Routinely			Cystoscopy Used Routinely		
		Crude Rate	Adjusted Rate/1,000	95% CI	Crude Rate	Adjusted Rate/1,000	95% CI
Intraoperative	Total	435/120,628	5.8	3.7–9.3	105/5,105	20.0	13.1–30.4*
	Vaginal hysterectomy	106/16,606	4.2	0.9–18.6	—	—	—
	Abdominal hysterectomy	95/66,984	2.4	0.8–7.7	—	—	—
	Laparoscopic hysterectomy	143/30,033	5.3	3.2–8.7	7/297	23.6	—
	Robotic hysterectomy	1/51	19.6	—	—	—	—
	Other gynecologic and urogynecologic surgeries	77/6,717	7.6	1.9–30.1	98/4,808	19.3	11.9–31.3
	Robotic other gynecologic and urogynecologic surgeries	13/237	49.8	12.1–183.9	—	—	—
Postoperative	Total	116/120,628	0.8	0.4–1.3	5/5,105	1.0	0.4–2.5
	Vaginal hysterectomy	4/16,606	0.2	0.1–0.9	—	—	—
	Abdominal hysterectomy	72/66,984	1.3	0.6–3.1	—	—	—
	Laparoscopic hysterectomy	38/30,033	0.9	0.4–2.1	1/297	3.4	—
	Robotic hysterectomy	0/51	0.0	—	—	—	—
	Other gynecologic and urogynecologic surgeries	2/6,717	0.3	0.0–3.3	4/4,808	0.8	0.3–2.4
	Robotic other gynecologic and urogynecologic surgeries	0/237	0.0	—	—	—	—
Intraoperative or postoperative†	Total	751/152,489	7.5	5.6–10.0	110/5,105	21.2	14.2–31.6*
	Vaginal hysterectomy	165/28,998	5.1	2.4–10.8	—	—	—
	Abdominal hysterectomy	248/78,501	5.8	3.4–9.8	—	—	—
	Laparoscopic hysterectomy	232/35,048	7.3	5.1–10.4	8/297	26.9	—
	Robotic hysterectomy	2/121	16.5	—	—	—	—
	Other gynecologic and urogynecologic surgeries	91/9,584	6.7	3.0–15.1	102/4,808	20.2	12.7–32.2‡
	Robotic other gynecologic and urogynecologic surgeries	13/237	49.8	12.1–183.9	—	—	—

CI, confidence interval.
Dash (—) indicates that insufficient or no data were available to calculate crude rate, adjusted rate, CI, and *P* value using the random-effects model.
* $P<.001$ (one-sided test).
† Intraoperative and postoperative injuries were not reported separately in every study. When not reported separately, the data are included in the tally for intraoperative and postoperative combined but not in the separate tallies.
‡ $P<.01$ (one-sided test).

gynecologic and urogynecologic surgery because other concomitant gynecologic and urogynecologic surgeries were performed in addition to the hysterectomy. In the studies without routine cystoscopy, when the authors did not report the number of injuries detected intraoperatively, for simplicity, we assumed this number to be zero, although such an assumption may not always be true. Thus, these values may underestimate the number of injuries detected intraoperatively for studies without routine cystoscopy.

DISCUSSION

When examining the two surgery types in Tables 4 and 5 for which there are reported injury rates for studies with and without routine intraoperative cystoscopy, notably laparoscopic hysterectomy and other gynecologic and urogynecologic surgery, we find that there is up to a fivefold increase in the injury detection rates when cystoscopy is used intraoperatively. However, we did not find evidence in our data that routine intraoperative cystoscopy provided any meaningful reduction in the number of postoperatively detected injuries. The postoperative detection rates per 1,000 surgeries for ureteric injury were 1.6 with routine cystoscopy and 0.7 without routine cystoscopy ($P<.054$). For bladder injury they were in the opposite direction at 0.8 with routine cystoscopy and 1.0 without routine cystoscopy. From Table 4, although the postoperatively detected ureteric injury rate for other gynecologic and urogynecologic surgery was significantly lower when cystoscopy was used routinely ($P=.03$), the postoperatively detected injury rate for all surgery combined was still lower but was not statistically significant ($P<.054$). There are several possible explanations. Postoperatively detected injuries may have been underreported when routine cystoscopy was not used because of undiagnosed injuries (eg, silent renal death) or loss to follow-up (eg, patients presenting at other institutions). It could also be that intraoperative cystoscopy was detecting a small number of injuries that would otherwise have resolved spontaneously.

Although of rare occurrence, there is always an inherent risk of damaging the urinary tract in most major gynecologic surgeries. Up to 75% of ureteric injuries are caused by gynecologic surgery and interestingly, most injuries occur during procedures for benign diseases.[13] The timely detection of a urinary tract injury by cystoscopy intraoperatively allows for immediate referral and repair by a urologist or a urogynecologist during the same surgical procedure. It should be borne in mind, however, that cystoscopy is not 100% sensitive or specific. Injuries of thermal nature, secondary to devascularization or suture necrosis, can still be missed intraoperatively by cystoscopy, even with visualization of ureteric jets or an intact bladder.

In North America, because of the amount of gynecologic surgery performed yearly, there could be significant costs for a policy of routine intraoperative cystoscopy after all major gynecologic surgical procedures. A prospective study by Ibeanu et al[5] found a ureteric injury rate of 1.7% in total abdominal hysterectomy and 2.6% in transvaginal hysterectomy. This would make routine cystoscopy cost-effective according to Visco et al,[14] which established cost-effectiveness for cystoscopy at a ureteric injury rate exceeding 1.5% for abdominal hysterectomy and 2% for vaginal or laparoscopically assisted vaginal hysterectomy. However, the study by Visco et al,[14] which was reported more than a decade ago, needs to be interpreted with caution. Also, because of the low specificity of cystoscopy, prospective studies might tend to overestimate injury rates.[15]

The idea of using cystoscopy as a routine screening tool in major gynecologic procedures continues to intrigue surgeons. However, it remains unclear from our study whether its universal use should be advocated. A multicenter randomized controlled trial would require approximately 25,500 patients in each of the two cystoscopy groups for 80% power to detect a difference between one postoperatively detected injury per 1,000 surgeries and two postoperatively detected injuries per 1,000 surgeries. We feel that, even if statistical significance was reached, the clinical significance would be questionable. Although this review combined studies from two previous databases and pooled data from a total of 79 reports, the majority of these studies was retrospective in nature and would thus tend to underestimate the actual injury rates. This article therefore specifically cautions its readers that until more evidence is accumulated, clinicians should learn the skills and maintain a low threshold for performing cystoscopy selectively in any cases in which there is suspicion of ureteric or bladder injury.

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