



AAGL Practice Report: Practice Guidelines for Intraoperative Cystoscopy in Laparoscopic Hysterectomy

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ABSTRACT Lower urinary tract injuries are a serious potential complication of laparoscopic hysterectomy. The risk of such injuries may be as high as 3%, and most, but not all, are detected at intraoperative cystoscopy. High-quality published data suggest a sensitivity of 80% to 90% for ureteral trauma. Among the injuries that may be missed are those related to the use of energy-based surgical tools that include ultrasound and radiofrequency electricity. Cystoscopic evaluation of the lower urinary tract should be readily available to gynecologic surgeons performing laparoscopic hysterectomy. To this end, it is essential that a surgeon with appropriate education, training, and institutional privileges be available without delay to perform this task. Currently available evidence supports cystoscopy at the time of laparoscopic hysterectomies. The rate of detectable but unsuspected lower urinary tract injuries is enough to suggest that surgeons consider cystoscopic evaluation following laparoscopic total hysterectomy as a routine procedure. *Journal of Minimally Invasive Gynecology* (2012) 19, 407–411 © 2012 AAGL. All rights reserved.

Keywords: Bladder injuries; Cystoscopy; Laparoscopic complications; Laparoscopic hysterectomy; Laparoscopy; Ureteral injuries

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Scope

Gynecologic surgery, including laparoscopic surgery, may lead to injuries and complications of the urinary tract. Recent evidence suggests that intraoperative cystoscopy at the time of hysterectomy is valuable in recognition of urinary tract injuries, and avoidance of subsequent postoperative complications and repeat surgical procedures [1,2]. This guideline examines the evidence regarding the role of intraoperative cystoscopy with laparoscopic hysterectomy, and is designed to provide guidance for its use in clinical care.

The purpose of this guideline is to provide clinicians with evidence-based information about intraoperative cystoscopy in laparoscopic hysterectomy. Single reprints of AAGL Practice Report are available for \$30.00 per report. For quantity orders, please directly contact the publisher of *The Journal of Minimally Invasive Gynecology*, Elsevier, at reprints@elsevier.com. 1553-4650/\$ - see front matter © 2012 by the AAGL Advancing Minimally Invasive Gynecology Worldwide. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, posted on the Internet, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the publisher. E-mail: fred_howard@urmc.rochester.edu

Submitted April 18, 2012. Accepted for publication May 2, 2012. Available at www.sciencedirect.com and www.jmig.org

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Search Methodology

Several different search methodologies were used to identify published articles for this guideline. Evidence searches were performed of MEDLINE using Ovid as of July 31, 2010.

1. Cystoscopy and gynecology as keywords yielded 41 articles for review.
2. Cystoscopy as a keyword limited to English and humans yielded 5425 articles. Those were limited to clinical trials and females, to yield 389 articles. Of those, 37 were reviewed for relevance to this guideline.
3. Cystoscopy in the title limited to English and humans and females yielded 226 articles. These were limited to the past 10 years, giving 137 articles for review for relevance.
4. Cystoscopy and hysterectomy were used as keywords and limited to humans, yielding 152 articles for review.
5. The abstracts were reviewed for possible relevance to this guideline, and full texts were obtained for all of those deemed relevant. In the final analysis, 10 articles were deemed to be directly relevant to this guideline.

Background

Gynecologic surgery may lead to urinary tract complications because of the close anatomic locations of the structures of the genitourinary tract. Although gynecologic surgeons are taught appropriate surgical techniques to minimize the frequency of such complications, urinary tract injuries still occur with many gynecologic procedures. Estimates of the rate of urinary tract injuries with all types of gynecologic surgery range from 0.2 to 15 per 1000 cases. In some studies, injury rates are higher with laparoscopic than with laparotomic or vaginal gynecologic procedures. Two of the largest reported series of hysterectomies suggest that urinary tract injuries are more common with laparoscopic hysterectomy [LH] than with abdominal (total abdominal hysterectomy [TAH]) or total vaginal hysterectomy [TVH]). An analysis of all 62 379 hysterectomies performed in Finland from 1990 to 1995 suggested that ureteral and bladder injuries were more common with LH [3] (Table 1). Similarly, a review by Gilmour et al [4] of data from 30 published studies, including more than 115 000 hysterectomies, with more than 20 000 performed laparoscopically, also suggested that ureteral and bladder injuries are more frequent with TLH than with TAH or VH (Table 1).

The eVALuate study comprised two parallel, randomized, controlled trials: one comparing LH with TAH, and the other comparing LH with TVH [5]. Only the difference in bladder injuries in the laparoscopic versus the TAH arm of the study reached statistical significance. Ureteral injuries occurred only in cases performed laparoscopically, but this difference did not reach statistical significance (Table 2).

A metaanalysis of 27 published trials of 3643 cases (including the eVALuate study reviewed above) also showed that laparoscopic hysterectomy was associated with an increased risk of urinary tract injury when compared with abdominal hysterectomy (odds ratio, 2.61; 95% confidence interval, 1.22–5.60) [6].

Published studies that show similar or lower rates of urinary tract injuries with LH are either small or they reflect the experience of a single group of surgeons, so they are not readily applicable to general gynecologic surgical practice. The best data currently available suggest that in general gynecologic practice, urinary tract injury is more frequent with LH than with TAH or VH.

Table 2

Incidence of urinary tract injuries with hysterectomies in a randomized controlled trial (eVALuate Study) [5]

Study Group	Bladder	Ureteral
	injuries/1000 Cases	injuries/1000 Cases
Laparoscopic vs laparotomic		
Laparoscopic (n = 584)	21.0 ^a	9.0 ^a
Laparotomic (n = 292)	10.0	0
Laparoscopic vs vaginal		
Laparoscopic (n = 336)	9.0	3.0
Vaginal (n = 168)	12.0	0

^a p = .09 for any urinary tract injury, laparoscopic vs laparotomic.

The conclusion that urinary tract injuries are more likely with LH must be qualified by recognizing that this may represent ongoing progression on a learning curve. For example, follow-up data from Finland from 2000 to 2005, during a time when there was transition to more laparoscopic than laparotomic hysterectomies, found that bladder injuries were 3.2 per 1000, and ureteral injuries were 3.4 per 1000 [7]. This represents a marked drop in incidence from that reported from 1990 to 1995 by Härkki-Sirén et al [3] (but still is higher than the reported rates with vaginal or abdominal hysterectomy).

Data regarding other operative laparoscopic procedures are limited. A study of use of ureteral catheterization found no ureteral injuries in 256 laparoscopic hysterectomies completed vaginally (laparoscopic-assisted vaginal hysterectomy [LAVH]), 337 laparoscopic adnexectomies, 86 laparoscopic fulgurations of endometriosis, and 54 laparoscopic myomectomies [8].

Another retrospective study found ureteral injuries in 3 patients (4.3%) after LAVH (n = 70), but none after laparoscopic salpingo-oophorectomies (n = 291), laparoscopic ovarian cystectomies (n = 414), or laparoscopic colposuspensions [9].

Clinical Considerations and Recommendations

Is It Important to Recognize Urinary Tract Injuries at the Time of Hysterectomy?

Clinical experience and published case series suggest that intraoperative detection and repair of urinary tract injuries

Table 1

Incidence of urinary tract injuries with hysterectomy

Procedure	Bladder injuries/1000 Cases		Ureteral injuries/1000 Cases	
	Härkki-Sirén et al [3]	Gilmour et al [4]	Härkki-Sirén et al [3]	Gilmour et al [4]
Total laparoscopic hysterectomy	8.9	12.1	13.9	7.3
Total laparotomic hysterectomy	1.3	2.6	0.4	1.3
Supracervical laparotomic hysterectomy	0.3	0.3	0.3	0.6
Total vaginal hysterectomy	0.2	3.6	0.2	0.2

significantly reduces morbidity and improves outcomes after such complications of gynecologic surgery [10]. Although bladder and ureteral injuries ideally should be recognized at the time of injury during the operative procedure, most studies show that many injuries, especially of the ureter, are not diagnosed intraoperatively. (U.S. Preventative Services Task Force classification II-3)

Are Most Urinary Tract Injuries Recognized at the Time of Hysterectomy?

Several studies of operative laparoscopic surgery have evaluated the value of intraoperative cystoscopy for recognition of urinary tract injuries. Most suggest that the majority of urinary tract injuries are not recognized at the time of hysterectomy. In the previously reviewed study by Gilmour et al [4], less than 50% of cases of ureteral injuries were detected intraoperatively when intraoperative cystoscopy was not performed. Bladder injuries were detected intraoperatively in less than 25% of cases when intraoperative cystoscopy was not performed. In contrast, when intraoperative cystoscopy was performed at the time of LH, 100% of ureteral injuries and 80% of bladder injuries were detected intraoperatively.

Ibeanu et al [1] reviewed urinary tract injuries with 839 hysterectomies, either TAH with or without bilateral salpingo-oophorectomy, VH, or LAVH. Only 26% of all urinary tract injuries (9 of 24 bladder injuries and 1 of 15 ureteral injuries) were detected visually during the surgical procedure, whereas intraoperative cystoscopy detected all but 1 injury. In this series, there were 61 cases of LAVH, with 2 bladder injuries and no ureteral injuries, rates of 3.3% and 0%, respectively. Blood loss of more than 800 mL, lower BMI, duration of surgery, and increased uterine size statistically correlated with increased risk of urinary tract injury in this study. (II-2)

Should Intraoperative Cystoscopy Be Performed at the Time of Hysterectomy?

A prospective study by Vakili et al [2] that evaluated universal cystoscopy at the time of 479 hysterectomies found that there were 8 ureteral injuries and 17 bladder injuries (2 cases involved both injuries). The total urinary tract injury rate was 4.8%. The rate of injury with laparoscopic hysterectomy was 2% (1 bladder injury, no ureteral injuries), which was less than with TAH (4%) and TVH (7.6%), but only 49 of the procedures were laparoscopic, which was too few to show a statistically significant difference (relative risk, 0.36; 95% confidence interval, 0.05–2.6). Only 7 injuries were detected prior to cystoscopy. Only 1 injury was not detected by cystoscopy (vesicovaginal fistula).

In Particular, Should Intraoperative Cystoscopy Be Done With Laparoscopic Hysterectomies?

The previously cited studies suggest that it is likely that urinary tract injuries are at least as common, if not more so, with total laparoscopic hysterectomies as compared with TAH or

VH [3–5]. Overall, published data suggest that surgical injury to the urinary tract with LH occurs with a clinically significant frequency (bladder injuries in 7–21 per 1000 cases, and ureteral injuries in 3–14 per 1000 cases). Several studies show that only 25% to 50% of these injuries are recognized at the time of surgery if intraoperative cystoscopy is not performed [1,2,4]. Overall, the injury incidence data and the lack of recognition without intraoperative cystoscopy suggest that cystoscopy is indicated with total laparoscopic hysterectomies. (I and II-2) There are insufficient data to evaluate the risk with laparoscopic supracerical hysterectomy.

Why Are Cystoscopies Not Performed More Frequently at the Time of Laparoscopic Hysterectomy?

It is not standard practice currently for gynecologists to perform intraoperative cystoscopy at the time of laparoscopic hysterectomy. For example, a survey done in 2005 suggested that only 19% of Canadian surgeons did intraoperative cystoscopy with laparoscopic hysterectomy [11]. Lack of training was the most common reason given for not performing intraoperative cystoscopy at the time of gynecologic surgery (59%). Lack of cystoscopy privileges was the reason in 14% of cases.

Barriers to Cystoscopy Performance After Laparoscopic Hysterectomy

Barriers to the recommendation of universal cystoscopy after LH include (1) unclear evidence of cost-effectiveness [12], (2) credentialing difficulties for many gynecologic surgeons, and (3) expense and inefficiency of routine urology consultation at the time of hysterectomy. In regard to cost-effectiveness, data calculated by Visco et al [12] suggest the cost-effectiveness of routine intraoperative cystoscopy at the time of hysterectomy depends on the rate of ureteral injury. Based on their assumptions and calculations, if the rate of injury exceeds 2% for LAVH, then routine cystoscopy is cost-effective. The best currently available data show that rates of injury are at least 0.7% to 2.1% for bladder injuries, and 0.3% to 1.4% for ureteral injuries, suggesting that routine intraoperative cystoscopy at the time of LH, according to the higher range data, is probably cost-effective. (II-2)

Is There Any Contraindication to Performing Cystoscopy at the Time of Laparoscopic Hysterectomy?

The only relative contraindication to intraoperative cystoscopy is known or suspected urinary tract infection. In general, this should not be relevant, as any urinary tract infection should be treated preoperatively.

What Is the Preferred Method of Intraoperative Cystoscopy for the Detection of Urinary Tract Injuries?

Intraoperative cystoscopy to detect urinary tract injury is best performed with a 70- or 30-degree cystoscope. If there is concern for a urethral injury, then a 0-degree cystoscope may be helpful. A 70-degree cystoscope greatly

Fig. 1**Classification of Evidence and Recommendations**

The MEDLINE database, the Cochrane Library, and PubMed were used to conduct a literature search to locate relevant articles. The search was restricted to articles published in the English language. Priority was given to articles reporting results of original research, although review articles and commentaries also were consulted. Abstracts of research presented at symposia and scientific conferences were not considered adequate for inclusion in this document. When reliable research was not available, expert opinions from gynecologists were used.

Studies were reviewed and evaluated for quality according to a modified method outlined by the U.S. Preventive Services Task Force:

- I Evidence obtained from at least one properly designed randomized controlled trial.
- II Evidence obtained from non-randomized clinical evaluation
 - II-1 Evidence obtained from well-designed, controlled trials without randomization.
 - II-2 Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one center or research center.
 - II-3 Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments also could be regarded as this type of evidence.
- III Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

Based on the highest level of evidence found in the data, recommendations are provided and graded according to the following categories:

- Level A—Recommendations are based on good and consistent scientific evidence.
- Level B—Recommendations are based on limited or inconsistent scientific evidence.
- Level C—Recommendations are based primarily on consensus and expert opinion.

facilitates a thorough inspection of the bladder for injuries in any location. Identification of ureteral function is done by visualizing ureteral ejection of blue dye after the intravenous injection of 5 mL of indigo carmine. Many clinicians also administer 5 mg of furosemide intravenously to hasten the excretion of the indigo carmine. Excretion of indigo carmine usually occurs 5 to 10 minutes after the intravenous infusion. Failure to see the dye in 20 to 30 minutes mandates further investigation. An intraoperative intravenous pyelogram, retrograde ureteropyelogram, and/or ureteral catheter placement is usually performed to verify ureteral integrity in such cases. (III)

Visualization of urinary jets without prior indigo carmine injection is not a reliable way to ensure ureteral integrity. Similarly, intraabdominal observation of ureteral peristalsis does not exclude ureteral injury [2]. (II-3)

Does Intraoperative Cystoscopy Detect All Ureteral Injuries?

Not all ureteral injuries are detected by intraoperative cystoscopy with intravenous indigo carmine injection. One study suggested that operatively unrecognized ureteral injuries are missed in as many as 60% of cases (3 of 5) by cystoscopy performed after completion of the procedure [13]. Two of the 3 missed injuries were with pelvic reconstructive procedures. There were only 30 laparoscopic hysterectomies among the 2681 procedures in this report, and none of the ureteral injuries occurred with a laparoscopic procedure. Most published data suggest that almost all bladder injuries

are detected and that 80% to 90% of ureteral injuries are detected by intraoperative cystoscopy [4,14]. (II-2) Proposed sources of injuries “missed” by intraoperative cystoscopy are those related to postoperative swelling of nonocclusive suture ligatures and thermal injuries that initially do not cause mechanical obstruction. (III)

What Is the Complication Rate With Intraoperative Cystoscopy?

The complication rate of intraoperative cystoscopy to evaluate for urinary tract injury is not reported, but would be expected to be extraordinarily low, with iatrogenic infection or injury as the major concerns. (III)

Summary of Recommendations

1. Most but not all lower urinary tract injuries are detected by intraoperative cystoscopy. Published data suggest a sensitivity of 80% to 90% for ureteral trauma. (Level A) Among the injuries that may be missed are those related to the use of energy-based surgical tools that include ultrasound and radiofrequency electricity. (Level C)
2. Current evidence supports the conclusion that cystoscopic evaluation of the lower urinary tract should be readily available to gynecologic surgeons performing laparoscopic hysterectomy. To this end, it is essential that a surgeon with appropriate education, training, and institutional privileges be available without delay to perform this task. (Level A)
3. Based on the currently available evidence (II-2), it appears that routine cystoscopy following laparoscopic hysterectomy will detect most unsuspected injuries to the lower genital tract. (Level B) At this time, the AAGL Practice Committee recommends that surgeons and institutions consider routine implementation of cystoscopy at the time of laparoscopic total hysterectomy. (Level B)
4. The data support the concept of more liberal use of cystoscopy with laparoscopic hysterectomy, but the level of evidence and the limited data currently available preclude recommendation for making cystoscopy an integral component of laparoscopic hysterectomy. (Level B)

The MEDLINE database, the Cochrane Library, and PubMed were used to conduct a literature search to locate relevant articles. The search was restricted to articles published in the English language. Priority was given to articles reporting results of original research, although review articles and commentaries also were consulted. Abstracts of research presented at symposia and scientific conferences were not considered adequate for inclusion in this document. When reliable research was not available, expert opinions from gynecologists were used.

Studies were reviewed and evaluated for quality according to a modified method outlined by the US Preventive Services Task Force (Fig. 1).

Acknowledgment

This report was developed under the direction of the Practice Committee of the AAGL as a service to their members and other practicing clinicians. The members of the AAGL Practice Committee have reported the following financial interest or affiliation with corporations: Malcolm G. Munro, MD, FRCS(C), FACOG—Consultant: Karl Storz Endoscopy-America, Inc., Conceptus, Inc., Ethicon Women's Health & Urology, Boston Scientific, Ethicon Endo-Surgery, Inc., Bayer Healthcare, Gynesonics, Aegea Medical, Idoman; Jason A. Abbott, PhD, FRANZCOG, MRCOG—Speaker's Bureau: Hologic, Baxter, Bayer-Sherring; Ludovico Muzii, MD—Nothing to disclose; Togas Tulandi, MD, MHCM—Consultant: Ethicon Endo-Surgery, Inc.; Tommaso Falcone, MD—Nothing to disclose; Volker R. Jacobs, MD—Consultant: Top Expertise, Germering, Germany; William H. Parker, MD—Grant Research: Ethicon, Consultant: Ethicon.

The members of the AAGL Guideline Development Committee for Intraoperative Cystoscopy in Laparoscopic Hysterectomy have reported the following financial interest or affiliation with corporations: Tommaso Falcone, MD—Nothing to disclose; Fred Howard, MD, MS—Consultant: Ethicon, Speakers Bureau: Abbott Labs, Ortho; Franklin D. Loffer, MD—Nothing to disclose; Ludovico Muzii, MD—Nothing to disclose; Andrew I. Sokol, MD—Nothing to disclose.

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