A. Rebecca Meekins, MD
Dr. Meekins is a Fellow in Female Pelvic Medicine and Reconstructive Surgery, Department of Obstetrics and Gynecology, Duke University School of Medicine, Durham, North Carolina.

Cindy L. Amundsen, MD
Dr. Amundsen is Roy T. Parker Professor in Obstetrics and Gynecology, Urogynecology and Reconstructive Pelvic Surgery; Associate Professor of Surgery, Division of Urology; Program Director of the Female Pelvic Medicine and Reconstructive Surgery Fellowship; Program Director of K12 Multidisciplinary Urologic Research Scholars Program; Program Director of BIRCWH, Duke University Medical Center.

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"To cysto or not to cysto?" that is the ongoing question surrounding the role of cystoscopy following benign gyn surgery. These authors review data on the procedure's ability to detect injury, an ideal method for visualizing ureteral efflux, and how universal cystoscopy can affect the rate of injury.

Using cystoscopy to evaluate ureteral efflux and bladder integrity following benign gynecologic surgery increases the detection rate of urinary tract injuries.[1] Currently, it is standard of care to perform a cystoscopy following anti-incontinence procedures, but there is no consensus among ObGyns regarding the use of universal cystoscopy following benign gynecologic surgery.[2] A number of studies, however, have suggested potential best practices for evaluating urinary tract injury during pelvic surgery for benign gynecologic conditions.

Pelvic surgeries for benign gynecologic conditions, including fibroids, menorrhagia, and pelvic organ prolapse (POP), are common. More than 500,000 hysterectomies are performed annually in the United States, and up to 11% of women will undergo at least one surgery for POP or urinary incontinence in their lifetime.[3,4] During gynecologic surgery, the urinary tract is at risk, and the injury rate ranges from 0.02% to 2% for ureteral injury and from 1% to 5% for bladder injury.[5,6]

In a recent large randomized controlled trial, the rate of intraoperative ureteral obstruction following uterosacral ligament suspension (USLS) was 3.2%.[7] Vaginal vault suspensions, as well as other vaginal cuff closure techniques, are common procedures associated with urinary tract injury.[8] Additionally, ureteral injury during surgery for POP occurs in as many as 2% of anterior vaginal wall repairs.[9]

It is well documented that a delay in diagnosis of ureteral and/or bladder injuries is associated with increased morbidity, including the need for additional surgery to repair the injury; in addition, significant delay in identifying an injury may lead to subsequent sequela, such as renal injury and fistula formation.[8]

A large study in California found that 36.5% of hysterectomies performed for POP

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were performed by general gynecologists.[10] General ObGyns performing these surgeries therefore must understand the risk of urinary tract injury during hysterectomy and reconstructive pelvic procedures so that they can appropriately identify, evaluate, and repair injuries in a timely fashion.

The best way to identify urinary tract injury at the time of gynecologic surgery is by cystoscopy, including a bladder survey and ureteral efflux evaluation. When should a cystoscopy be performed, and what is the best method for visualizing ureteral efflux? Can instituting universal cystoscopy for all gynecologic procedures make a difference in the rate of injury detection? In this Update, we summarize the data from 4 studies that help to answer these questions.

About 30% of urinary tract injuries identified prior to cystoscopy at hysterectomy (which detected 5 of 6 injuries)

FAST TRACK

At hysterectomy, the total urinary tract injury rate detected by cystoscopy was 4.8%, with the ureteral injury rate 1.7% and the bladder injury rate 3.6%

Vakili B, Chesson RR, Kyle BL, et al. The incidence of urinary tract injury during hysterectomy: a prospective analysis based on universal cystoscopy. Am J Obstet Gynecol. 2005;192(5):1599–1604.

Vakili and colleagues conducted a multicenter prospective cohort study of women undergoing hysterectomy for benign indications; cystoscopy was performed in all cases. The 3 hospitals involved were all part of the Louisiana State University Health system. The investigators' goal was to determine the rate of urinary tract injury in this patient population at the time of intraoperative cystoscopy.

Intraoperative cystoscopy beats visual evaluation

Four hundred and seventy-one women underwent hysterectomy and had intraoperative cystoscopy, including evaluation of ureteral patency with administration of intravenous (IV) indigo carmine. Patients underwent abdominal, vaginal, or laparoscopic hysterectomy, and 54 (11.4%) had concurrent POP or anti-incontinence procedures. The majority underwent an abdominal hysterectomy (59%), 31% had a vaginal hysterectomy, and 10% had a laparoscopic-assisted vaginal hysterectomy or total laparoscopic hysterectomy.

Rate of urinary tract injuries. The total urinary tract injury rate detected by cystoscopy was 4.8%. The ureteral injury rate was 1.7%, and the bladder injury rate was 3.6%. A combined ureteral and bladder injury occurred in 2 women.

Surgery for POP significantly increased the risk of ureteral injury (7.3% vs 1.2%; $P = .025$). All cases of ureteral injury during POP surgery occurred during USLS. There was a trend toward a higher rate of bladder injury in the group with concurrent anti-incontinence surgery (12.5% vs 3.1%; $P = .049$). Regarding the route of hysterectomy, the vaginal approach had the highest rate of ureteral injury; however, when prolapse cases were removed from the analysis, there were no differences between the abdominal, vaginal, and laparoscopic approaches for ureteral or bladder injuries.

Injury detection with cystoscopy. Importantly, the authors found that only 30% of injuries were identified prior to performing intraoperative cystoscopy. The majority

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of these were bladder injuries. In addition, despite visual confirmation of ureteral peristalsis during abdominal hysterectomy, when intraoperative cystoscopy was performed with evaluation for ureteral efflux, 5 of 6 ureteral injury cases were identified. The authors reported 1 postoperative vesicovaginal fistula and concluded that it was likely due to an unrecognized bladder injury. No other undetected injuries were identified.

Notably, no complications occurred as a result of cystoscopy.

WHAT THIS EVIDENCE MEANS FOR PRACTICE

The rate of urinary tract injury, including both bladder and ureteral injuries, was more than 4% at the time of hysterectomy for benign conditions. Using intraoperative peristalsis or normal ureteral caliber could result in a false sense of security since these are not reliable signs of ureteral integrity. The majority of urinary tract injuries will not be identified without cystoscopic evaluation.

Multiple surgical indications reflect real-world scenario

The study included physicians from 3 different hospitals and all routes of hysterectomy for multiple benign gynecologic indications as well as concomitant pelvic reconstructive procedures. While this enhances the generalizability of the study results, all study sites were located in Louisiana at hospitals with resident trainee involvement. Additionally, this study confirms previous retrospective studies that reported higher rates of injury with pelvic reconstructive procedures.

The study is limited by the inability to blind surgeons, which may have resulted in the surgeons altering their techniques and/or having a heightened awareness of the urinary tract. However, their rates of ureteral and bladder injuries were slightly higher than previously reported rates, suggesting that the procedures inherently carry risk. The study is further limited by the lack of a retrospective comparison group of hysterectomy without routine cystoscopy and a longer follow-up period that may have revealed additional missed delayed urologic injuries.

FAST TRACK

The majority of urinary tract injuries during hysterectomy will not be identified without cystoscopic evaluation

Universal cystoscopy policy proves protective, surgeon adherence is high

Chi AM, Curran DS, Morgan DM, Fenner DE, Swenson CW. Universal cystoscopy after benign hysterectomy: examining the effects of an institutional policy. Obstet Gynecol. 2016;127(2):369–375.

In a retrospective cohort study, Chi and colleagues evaluated urinary tract injuries at the time of hysterectomy before and after the institution of a universal cystoscopy policy. At the time of policy implementation at the University of Michigan, all faculty who performed hysterectomies attended a cystoscopy workshop. Attending physicians without prior cystoscopy training also were proctored in the operating room for 3 sessions and were required to demonstrate competency with bladder survey, visualizing ureteral efflux, and urethral assessment. Indigo carmine was used to visualize ureteral efflux.

Detection of urologic injury almost doubled with cystoscopy

A total of 2,822 hysterectomies were included in the study, with 973 in the pre–universal cystoscopy group and 1,849 in the post–universal cystoscopy group. The study period was 7 years, and data on complications were abstracted for 1 year

after the completion of the study period.

The primary outcome had 3 components:

- the rate of urologic injury before and after the policy
- the cystoscopy detection rate of urologic injury
- the adherence rate to the policy.

The overall rate of bladder and ureteral injury was 2.1%; the rate of injury during pre–universal screening was 2.6%, and during post–universal screening was 1.8%. The intraoperative detection rate of injury nearly doubled, from 24% to 47%, when intraoperative cystoscopy was utilized. In addition, the percentage of delayed urologic complications decreased from 28% to 5.9% (P = .03) following implementation of the universal cystoscopy policy. With regard to surgeon adherence, cystoscopy was documented in 86.1% of the hysterectomy cases after the policy was implemented compared with 35.7% of cases before the policy.

The investigators performed a cost analysis and found that hospital costs were nearly twice as much if a delayed urologic injury was diagnosed.

WHAT THIS EVIDENCE MEANS FOR PRACTICE

Instituting a universal cystoscopy policy for hysterectomy was associated with a significant decrease in delayed postoperative urinary tract complications and an increase in the intraoperative detection rate of urologic injuries. Intraoperative detection and repair of a urinary tract injury is cost-effective compared with a delayed diagnosis.

Study had many strengths

This study evaluated aspects of implementing quality initiatives after proper training and proctoring of a procedure. The authors compared very large cohorts from a busy academic medical center in which surgeon adherence with routine cystoscopy was high. The majority of patient outcomes were tracked for an extended period following surgery, thereby minimizing the risk of missing delayed urologic injuries. Notably, however, there was shorter follow-up time for the post–universal cystoscopy group, which could result in underestimating the rate of delayed urologic injuries in this cohort.

FAST TRACK

The percentage of delayed urologic complications decreased from 28% to 5.9% (P = .03) following implementation of a universal cystoscopy policy

Cystoscopy reveals ureteral obstruction during various vaginal POP repair procedures

Gustilo-Ashby AM, Jelovsek JE, Barber MD, Yoo EH, Paraiso MF, Walters MD. The incidence of ureteral obstruction and the value of intraoperative cystoscopy during vaginal surgery for pelvic organ prolapse. Am J Obstet Gynecol. 2006;194(5):1478–1485.

To determine the rate of ureteral obstruction and ureteral injury during vaginal surgery for POP and the accuracy of using intraoperative cystoscopy to prevent upper urinary tract morbidity, Gustilo-Ashby and colleagues performed a retrospective review study of a large patient cohort.

Cystoscopy with indigo carmine is highly sensitive

The study included 700 patients who underwent vaginal surgery for anterior and/or apical POP. Patients had 1 or more of the following anterior and apical prolapse repair procedures: USLS (51%), distal McCall culdeplasty (26%), proximal McCall culdeplasty (29%), anterior colporrhaphy (82%), and colpocleisis (1.4%). Of note, distal McCall culdeplasty was defined as incorporation of the "vaginal epithelium into the uterosacral plication," while proximal McCall culdeplasty involved plication of "the uterosacral

ligaments in the midline proximal to the vaginal cuff." All patients were given IV indigo carmine to aid in visualizing ureteral efflux.

The majority of patients had a hysterectomy (56%). When accounting for rare false-positive and negative cystoscopy results, the overall ureteral obstruction rate was 5.1% and the ureteral injury rate was 0.9%. The majority of obstructions occurred with USLS (5.9%), proximal McCall culdeplasty (4.4%), and colpocleisis (4.2%). Ureteral injuries occurred only in 6 cases: 3 USLS and 3 proximal McCall culdeplasty procedures.

Based on these findings, the authors calculated that cystoscopy at the time of vaginal surgery for anterior and/or apical prolapse has a sensitivity of 94.4% and a specificity of 99.5% for detecting ureteral obstruction. The positive predictive value of cystoscopy with the use of indigo carmine for detection of ureteral obstruction is 91.9% and the negative predictive value is 99.7%.

Impact of indigo carmine's unavailability

This study's strengths include its large sample size and the variety of surgical approaches used for repair of anterior vaginal wall and apical prolapse. Its retrospective design, however, is a limitation; this could result in underreporting of ureteral injuries if patients received care at another institution after surgery. Furthermore, it is unclear if cystoscopy would be as predictive of ureteral injury without the use of indigo carmine, which is no longer available at most institutions.

WHAT THIS EVIDENCE MEANS FOR PRACTICE

The utility of cystoscopy with IV indigo carmine as a screening test for ureteral obstruction is highlighted by the fact that most obstructions were relieved by intraoperative suture removal following positive cystoscopy. McCall culdeplasty procedures are commonly performed by general ObGyns at the time of vaginal hysterectomy. It is therefore important to note that rates of ureteral obstruction after proximal McCall culdeplasty were only slightly lower than those after USLS.

FAST TRACK

For detecting ureteral obstruction, the authors calculated that cystoscopy at the time of vaginal surgery for anterior and/or apical prolapse has a sensitivity of 94.4% and specificity of 99.5%

Sodium fluorescein and 10% dextrose provide clear visibility of ureteral jets in cystoscopy

Espaillat-Rijo L, Siff L, Alas AN, et al. Intraoperative cystoscopic evaluation of ureteral patency: a randomized controlled trial. Obstet Gynecol. 2016;128(6):1378–1383.

In a multicenter randomized controlled trial, Espaillat-Rijo and colleagues compared various methods for visualizing ureteral efflux in participants who underwent gynecologic or urogynecologic procedures in which cystoscopy was performed.

Study compared 4 media

The investigators enrolled 176 participants (174 completed the trial) and randomly assigned them to receive 1 of 4 modalities: 1) normal saline as a bladder distention medium (control), 2) 10% dextrose as a bladder distention medium, 3) 200 mg oral phenazopyridine given 30 minutes prior to cystoscopy, or 4) 50 mg IV sodium fluorescein at the start of cystoscopy. Indigo carmine was not included in this study because

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it has not been routinely available since 2014.

Surgeons were asked to categorize the ureteral jets as "clearly visible," "somewhat visible," or "not visible."

The primary outcome was subjective visibility of the ureteral jet with each modality during cystoscopy. Secondary outcomes included surgeon satisfaction, adverse reactions to the modality used, postoperative urinary tract infection, postoperative urinary retention, and delayed diagnosis of ureteral injury.

Visibility assessment results. Overall, ureteral jets were "clearly visible" in 125 cases (71%) compared with "somewhat visible" in 45 (25.6%) and "not visible" in 4 (2.3%) cases. There was a statistically significant difference between the 4 groups. Use of sodium fluorescein and 10% dextrose resulted in significantly better visualization of ureteral jets ($P<.001$ and $P = .004$, respectively) compared with the control group. Visibility with phenazopyridine was not significantly different from that in the control group or in the 10% dextrose group (**FIGURE**).

Surgeon satisfaction was highest with 10% dextrose and sodium fluorescein. In 6 cases, the surgeon was not satisfied with visualization of the ureteral jets and relied on fluorescein (5 times) or 10% dextrose (1 time) to ultimately see efflux. No significant adverse events occurred; the rate of urinary tract infection was 24.1% and did not differ between groups.

Results are widely generalizable

This was a well-designed randomized multicenter trial that included both benign gynecologic and urogynecologic procedures, thus strengthening the generalizability of the study. The study was timely since proven methods for visualization of ureteral patency became limited with the withdrawal of commercially available indigo carmine, the previous gold standard. ●

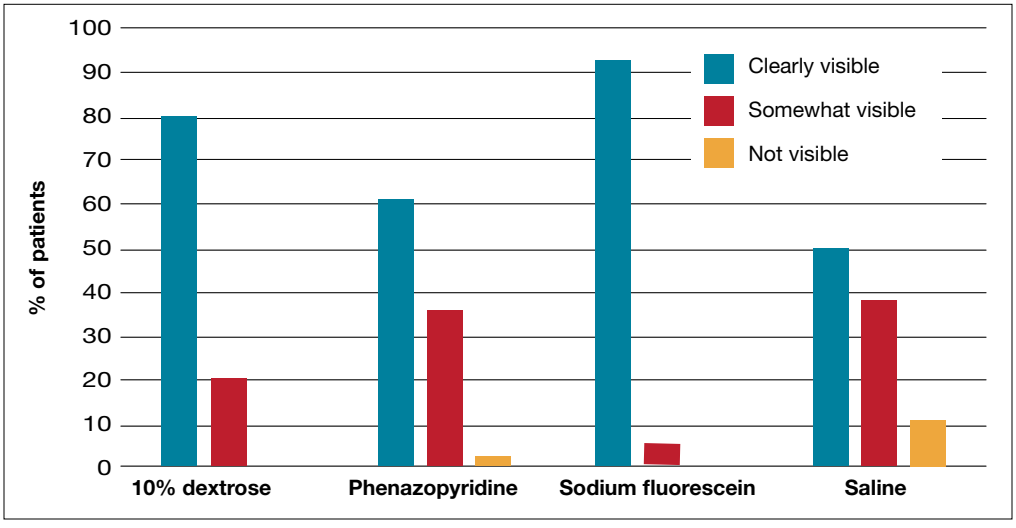
WHAT THIS EVIDENCE MEANS FOR PRACTICE

Intravenous sodium fluorescein and 10% dextrose as bladder distention media can both safely be used to visualize ureteral efflux and result in high surgeon satisfaction. Although 10% dextrose has been associated with higher rates of postoperative urinary tract infection,[11] this was not found to be the case in this study. Preoperative administration of oral phenazopyridine was no different from the control modality with regard to visibility and surgeon satisfaction.

FAST TRACK

Use of sodium fluorescein and 10% dextrose in cystoscopy resulted in significantly better visualization of ureteral jets compared with the control group

FIGURE Ratings of modalities used in cystoscopy for visualization of ureteral jets[12]



The cost-effectiveness consideration

The debate around universal cystoscopy following benign gynecologic surgery is ongoing. The studies discussed in this Update demonstrate that cystoscopy following hysterectomy for benign indications:

- is superior to visualizing ureteral peristalsis
- increases detection of urinary tract injuries, and
- decreases delayed urologic injuries.

Although these articles emphasize the importance of detecting urologic injury, the picture would not be complete without mention of cost-effectiveness. Only one study, from 2001, has evaluated the cost-effectiveness of universal cystoscopy.[1] Those authors concluded that universal cystoscopy is cost-effective only when the rate of urologic injury is 1.5% to 2%, but this conclusion, admittedly, was limited by the lack of data on medicolegal settlements, outpatient expenses, and nonmedical-related economic loss from decreased productivity. Given the extensive changes that have occurred in medical practice over the last 17 years and the emphasis on quality metrics and safety, an updated analysis would be needed to make definitive conclusions about cost-effectiveness.

While this Update cannot settle the ongoing debate of universal cystoscopy in gynecology, it is important to remember that the American College of Obstetricians and Gynecologists and the American Urogynecologic Society recommend cystoscopy following all surgeries for pelvic organ prolapse and stress urinary incontinence.[2]

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›› Update on minimally invasive gynecologic surgery

Arnold P. Advincula, MD