Diagnostic cystourethroscopy (cystoscopy) for gynecologic conditions

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All topics are updated as new evidence becomes available and our peer review process is complete.

Literature review current through: **Oct 2023.**
This topic last updated: **Jul 07, 2022.**

INTRODUCTION

Cystourethroscopy is used by urologists, urogynecologists, and gynecologists. Cystourethroscopy is commonly referred to as cystoscopy, which will be used in this review. The female genital and lower urinary tracts are closely related anatomically and embryologically; thus, many conditions or procedures affect both. Examples include: urinary incontinence associated with pelvic organ prolapse, urogenital fistula, metastases of gynecologic malignancies, endometriosis, and hysterectomy or pelvic reconstructive procedures. This procedure is particularly useful in gynecologic practice for the evaluation of operative lower urinary tract injury.

This topic will discuss cystoscopy for gynecologic indications and evaluation of lower urinary tract injury. Prevention, evaluation, and management of lower urinary tract injury in gynecologic surgery, as well as placement or ureteral stents, are reviewed separately.

- (See "Urinary tract injury in gynecologic surgery: Epidemiology and prevention".)
- (See "Urinary tract injury in gynecologic surgery: Identification and management".)
- (See "Placement and management of indwelling ureteral stents".)

In this topic, when discussing study results, we will use the terms "woman/en" or "patient(s)" as they are used in the studies presented. However, we encourage the reader to consider the specific counseling and treatment needs of transgender and gender diverse individuals.

INDICATIONS

Gynecologic indications for cystoscopy are discussed in this section. These overlap with some, but not all, urologic indications for cystoscopy.

- **Common gynecologic indications –** Cystoscopy is performed for women with gynecologic conditions for evaluation of [1,2]:
  - Suspected operative urinary tract injury (eg, ureteral injury, cystotomy, intravesical placement or erosion of mesh or suture)
  - Unrecognized lower urinary tract injuries during surgery (eg, hysterectomy)
  - Urinary urgency or frequency or urgency incontinence in the absence of urinary tract infection (UTI)
  - Suspected urinary tract involvement by endometriosis or gynecologic malignancies
  - Leakage of urine from the vagina (etiology may be a genitourinary fistula)
  - Suspected involvement of the urinary tract following lower genital tract trauma
  - Postvoid dribbling of urine (etiology may be a urethral diverticulum)
  - Recurrent UTIs in the setting of prior gynecologic surgery, as this may be a sign of malignancy (gynecologic or urologic) or foreign body (eg, intravesical mesh or suture)
  - Injection of therapeutic agents for urinary incontinence (eg, periurethral bulking agents, botulinum toxin)
  - Verification of suprapubic catheter placement
- **Detection of lower urinary tract injury after gynecologic surgery –** Lower urinary tract injury occurs in approximately 1 percent of all pelvic surgeries in women [3]. However, this number rises to up to 2 percent after hysterectomy [4]. Hysterectomy, anti-incontinence procedures [5], and vaginal apical suspension procedures (uterosacral ligament suspension) are the surgeries most likely to be associated with lower urinary tract injury. Gynecologic surgeons should perform cystoscopy upon suspicion of injury intra- or postoperatively; some experts advise universal cystoscopy following hysterectomy to identify lower urinary tract injuries at the time of surgery. When lower urinary tract injuries are identified intraoperatively, they are associated with better clinical outcomes and less litigation, including decreased risk of hospital readmission and potentially life-threatening complications [6]. Ureteral injuries not

recognized intraoperatively are associated with a higher rate of acute renal insufficiency (adjusted odds ratio [aOR] 23.8, 95% CI 20.1-28.2) and death (aOR 1.4, 95% CI 1.03-1.9). The American Urogynecologic Society (AUGS) recommends universal cystoscopy during pelvic reconstructive surgery for urinary incontinence and pelvic organ prolapse [7]. (See "Urinary tract injury in gynecologic surgery: Epidemiology and prevention", section on 'Cystoscopy to detect injury'.)

- **Evaluation for synthetic mesh exposure** – Cystoscopy may also be used to evaluate women who have undergone gynecologic surgery with synthetic mesh who develop urinary tract symptoms. For these women, new onset of irritative storage symptoms (urinary frequency, urgency, urgency incontinence in the absence of UTI), hematuria, or recurrent UTIs may be symptoms of surgical mesh or suture erosion or genitourinary fistula. (See "Transvaginal synthetic mesh: Complications and risk factors".)

- **Evaluation of voiding symptoms** – Women with pelvic organ prolapse often also have irritative storage symptoms. Cystoscopy may be used in these women to exclude urethral diverticula, bladder tumors, bladder stones, bladder scarring, and findings associated with interstitial cystitis [8]. Cystoscopy should also be considered in women with irritative storage symptoms of new onset; who are not responsive to medications; with frequent UTIs; a history of prior surgeries; or risk factors such as pelvic radiation, immunosuppression, or smoking. (See "Clinical presentation, diagnosis, and staging of bladder cancer", section on 'Cystoscopy' and "Urethral diverticulum in females", section on 'Urethroscopy' and "Interstitial cystitis/bladder pain syndrome: Clinical features and diagnosis", section on 'Cystoscopy for selected patients'.)

- **Cancer staging** – Cystoscopy is used for clinical staging of cervical and vaginal cancer. (See "Invasive cervical cancer: Staging and evaluation of lymph nodes", section on 'Staging procedure' and "Vaginal cancer", section on 'Staging'.)

- **Urinary incontinence procedures** – In select patients, one can perform cystoscopic injection of periurethral bulking agents for stress urinary incontinence or botulinum toxin for urgency urinary incontinence. (See "Botulinum toxin for treatment of lower urinary tract conditions: Indications and clinical evaluation" and "Stress urinary incontinence in females: Persistent/recurrent symptoms after surgical treatment", section on 'Periurethral injection therapy'.)

- **Evaluation of hematuria** – Hematuria in the absence of infection may be a symptom of bladder cancer and is an indication for cystoscopy with visual inspection and biopsy, as appropriate, as well as other testing (eg, urine cytology, urinary tract imaging). Cystoscopy for this indication is usually performed by urologists, but may be performed by a gynecologist if there are other gynecologic indications for the procedure. During any cystoscopy procedure, even in the absence of hematuria, any findings suspicious

for malignancy should be biopsied. (See "Etiology and evaluation of hematuria in adults" and 'Evaluating bladder lesions' below.)

CONTRAINDICATIONS

There are few contraindications to cystoscopy for gynecologic conditions; these include:

- Active urinary tract infection
- Complete urethral obstruction

Cystoscopy is rarely performed in pregnant women, but pregnancy is not a contraindication. As with other procedures performed during pregnancy, anesthetic agents must be selected that do not cause fetal harm.

PREOPERATIVE EVALUATION AND PREPARATION

Informed consent — The patient should be counseled regarding potential complications and this discussion should be documented on the procedure consent form and in the medical record.

Preoperative evaluation — Cystoscopy is a minimally invasive procedure with few potential complications. A focused evaluation should be performed to guide the procedure and to assess procedural risk. This includes eliciting a history of symptoms associated with the indication for the procedure, a personal or family history of urinary tract abnormalities, and any comorbidities that may increase procedural risk. In addition, an abdominal and pelvic examination should be performed, with particular attention to the condition and position of the urethral meatus.

In general, screening for asymptomatic bacteriuria is not indicated for asymptomatic, low-risk women who are only undergoing diagnostic cystoscopy [9]. However, women with symptoms suggestive of urinary tract infection (UTI), those at high risk for infection, and for whom the cystoscopy procedure is likely to break the mucosal barrier are screened for bacteriuria and treated if urine culture is positive. For these high-risk women, we obtain a urine sample by voiding or straight catheterization on the day of the procedure and perform a dipstick test for leukocyte esterase and nitrite. If the results are positive and there is a high index of suspicion of UTI or bacteriuria, we send a urine culture and defer the procedure. Some surgeons perform a urine culture several days before the procedure in high-risk patients and treat patients with bacteriuria with antibiotics prior to the procedure. (See "Acute simple cystitis in females" and "Asymptomatic bacteriuria in adults", section on 'Patients undergoing urologic intervention'.)

Prophylactic antibiotics — We suggest antimicrobial prophylaxis for diagnostic cystoscopy only for patients at a high risk of surgical site infection, as shown in the table (table 1) [10]. Randomized trial data are inconsistent regarding whether preoperative antibiotics decrease the risk of bacteriuria or symptomatic UTI for patients undergoing cystoscopy [11,12].

The American Heart Association (AHA) does not recommend endocarditis prophylaxis for cystoscopy.

Thromboprophylaxis — Cystoscopy is typically a brief procedure and prophylaxis is not required. Thromboprophylaxis may be required for the overall procedure when cystoscopy is combined with major gynecologic surgery. (See "Overview of preoperative evaluation and preparation for gynecologic surgery", section on 'Thromboprophylaxis'.)

Operative setting — Cystoscopy for gynecologic conditions may be performed in an office setting or in the operating room as a single procedure or as part of another procedure (eg, hysterectomy, midurethral sling placement).

Anesthesia — Office cystoscopy is well tolerated by most women, including diagnostic procedures, injection of urethral bulking agents, and intravesical botulinum toxin administration.

Given that adverse effects of topical anesthetic are minimal and some data show a benefit in decreasing discomfort, we suggest the use of a topical urethral anesthetic gel for women undergoing diagnostic cystoscopy who are not under regional or general anesthesia. Randomized studies of rigid cystoscopy in women conflict regarding whether perioperative discomfort is decreased with use of anesthetic gel compared with plain lubricating gel [13-15].

We use 2 percent lidocaine gel that is typically supplied in single-use prefilled syringes. The syringe is inserted into the mid-urethra using additional gel as a lubricant. The gel is slowly injected; the procedure can be started after 5 to 15 minutes have elapsed.

Sedation or regional or general anesthesia for this procedure may be used, based upon the preferences of the physician or patient and upon whether an operative procedure will be performed. In our practice, we usually do not use sedation for diagnostic procedures unless biopsies are performed. For injection of urethral bulking agents or intravesical administration of botulinum toxin, we perform a vesical instillation of lidocaine. (See "Procedural sedation in adults in the emergency department: General considerations, preparation, monitoring, and mitigating complications".)

INSTRUMENTATION

Cystoscope — All rigid cystoscopes include the same basic components:

- Lens
- Sheath and bridge
- Light source

The cystoscope lens may have one of several viewing angles (0°, 30°, or 70°). The degree indicates the deflection of the lens, similar to other endoscopic procedures (figure 1). The choice of viewing angle impacts the ability to visualize different parts of the bladder and urethra.

- A 70° lens is usually adequate to fully evaluate the bladder surface, trigone, and ureteral orifices, and is the lens used most commonly to evaluate patients during or after gynecologic procedures.
- A 30° lens may also be used to assess the bladder and is the best choice if any operative procedure is performed (eg, bladder biopsy, stent placement, retrograde pyelogram).
- A 0° lens is used to examine the urethra.

Cystoscopy can be performed by looking directly into the lens or connecting the lens to a camera attached to a video monitor (picture 1). The use of a camera and monitor facilitates teaching of surgical trainees.

The sheath of the cystoscope holds has channels to allow fluid inflow and outflow (picture 2). Diagnostic cystoscopy can generally be performed with a size 17 French sheath. This is generally the smallest diameter sheath used in adults and provides optimal patient comfort; however, it is not large enough for an instrument port. The 21 French sheath is the preferred size for most operative procedures performed for gynecologic indications, allowing easy passage of ureteral guidewires and stents, as well as flexible biopsy forceps and electrosurgical instruments.

The bridge connects the lens to the sheath and can have one or more ports that allow insertion of operative instruments (eg, biopsy forceps, ureteral guidewires, ureteral stents). The size of the instrument that can be passed is limited by the size of the port. One type of bridge (Albarran bridge) allows deflection of instruments, which facilitates fulguration, biopsy, or passing of a ureteral guidewire, particular for bladder dome lesions or patients with distorted anatomy.

The lens is attached to a light source (picture 3). Various light sources can be used and vary depending upon the equipment available. Most modern light sources allow adjustment of the intensity of the light to permit optimal visualization.

Cystoscopy can be performed using either a rigid or flexible cystoscope. Advantages of using a rigid cystoscope (picture 4) include better optics and larger working and fluid channels. In addition, a rigid cystoscope is easier to orient to ensure complete bladder visualization. Most cystoscopies done for gynecologic office assessment and procedures use a rigid cystoscope. Flexible cystoscopes are advantageous for bedside assessment of hematuria in fresh postoperative or postpartum patients because of their increased ability to be manipulated and less dependence on patient positioning.

Distending medium — A distention medium is instilled to distend the bladder and improve visualization. The usual distending medium for diagnostic cystoscopy is isotonic saline or sterile water.

If electrosurgery is planned, it is necessary to use nonconductive solutions (electrolyte-poor fluids [eg, water, glycine]) to avoid dispersing the electrical current and thus rendering the instruments ineffective. Use of any distending medium for operative purposes requires monitoring of fluid absorption to avoid volume overload and possible hyponatremia. (See "Hyponatremia following transurethral resection, hysteroscopy, or other procedures involving electrolyte-free irrigation".)

Distending media for cystoscopy are the same as for hysteroscopy. Types of distending media are shown in the table (table 2). The use of distending media is discussed in detail separately. (See "Hysteroscopy: Managing fluid and gas distending media".)

PROCEDURE

Cystoscopy is typically a brief procedure (5 to 15 minutes), but may be longer if any additional procedures are performed. The surgical technique is similar in many ways to hysteroscopy.

Prior to starting the procedure, the surgeon should check that all of the equipment is present, assembled, and functioning properly. (See 'Instrumentation' above.)

Inserting the cystoscope — The steps of a cystoscopy procedure are:

- The patient is placed in the dorsal lithotomy position. In an office setting, patients are covered with a sheet and the urethral meatus is cleaned with a sterile solution (eg, iodine). In the operating room, the vagina and perineum are cleaned with a sterile solution and surgical drapes are placed.

- A sterile lubricant is placed on the cystoscope sheath and the fluid inflow is opened. The cystoscopic lens and sheath are inserted into the urethra with the angle of the lens directed towards the ceiling. Insertion of the cystoscope is usually done under direct

visualization, although an obturator may be used if there is difficulty cannulating the urethra meatus such as in a patient with urethral obstruction or tumor. Attention should be given to the angle of the urethra. The normal angle is slightly upward under the pubic bone. For women with pelvic organ prolapse, it is helpful to reduce the prolapse prior to performing cystoscopy.

- If urethral pathology is suspected, the urethra is examined. (See 'Urethra' below.)
- The cystoscope is then advanced past the urethrovesical junction until an air bubble is visualized in the anterior dome of the bladder. The air bubble is oriented at the superior aspect of the bladder and, thus, is useful for establishing orientation. The bladder and ureteral orifices are examined and biopsies and other procedures are performed, as appropriate. (See 'Bladder' below and 'Ureteral orifices' below.)

Anterior or apical pelvic organ prolapse or prior pelvic surgery may distort the bladder anatomy, making cystoscopy more difficult. Placing the surgeon's nondominant hand or an obturator in the vagina to support the anterior wall of the vagina will assist in placing the cystoscope and visualizing the urothelium, trigone and ureteral orifices.

Examining the lower urinary tract

Urethra — First, the urethral meatus is examined. The urethral mucosa is then examined for erythema, pallor, exudate, polyps, condylomata, or diverticula [16]. The urethra is often examined at the end of the cystoscopy procedure during removal of the cystoscope. The presence of an exudate suggests the presence of a diverticulum, although this is rarely visualized during urethroscopy. At the time of cystoscopy, the surgeon can use a 0-degree lens to attempt to visualize a diverticular ostium. However, the diverticulum is often palpated vaginally but not seen during urethral evaluation. In addition, the urethrovesical junction is also examined for polyps. (See "Urethral diverticulum in females", section on 'Urethroscopy'.)

Bladder — The entire urothelial surface should be inspected for perforation, suture or mesh, adhesions, erythema, edema, lesions, or masses [16]. As noted above, a 70° lens is typically used. The cystoscope is rotated and inserted and withdrawn to visualize all areas. Slight suprapubic pressure can facilitate visualization of the anterior bladder wall just behind the bladder neck. (See 'Cystoscope' above.)

Identifying bladder injury or erosion — If sutures or reconstructive materials (mesh or biografts) that have eroded or were inadvertently placed in the bladder from incontinence and/or prolapse surgery are found, these should be removed. The bladder should then be reinspected and any bleeding sites should be cauterized and repaired. Most cystotomies at the time of hysterectomy are located on the bladder base 2 to 3 cm above the trigone. Once a bladder injury is identified, the surgeon must repair the injury. This is ideally done along the same route of access as the initial surgery (ie, vaginal, laparoscopic, or open abdominal

approach). (See "Urinary tract injury in gynecologic surgery: Identification and management", section on 'Bladder injury'.)

Cystoscopy can detect most, but not all, bladder injuries. A small proportion of cystotomies are missed and devascularization, denervation, or thermal injuries are not identifiable by cystoscopy. The rate of missed diagnoses of clinically important injuries was illustrated in a systematic review of 17 retrospective studies of women who underwent benign gynecologic surgery with routine intraoperative use of cystoscopy, in which women presented with bladder injury postoperatively following 0.8 per 1000 procedures [2].

Evaluating bladder lesions — Bladder biopsy should be performed if lesions are found that are suspicious for a bladder neoplasm or, for patients with potential interstitial cystitis/bladder pain syndrome, lesions that are associated with this condition (eg, Hunner lesions). If the surgeon is not experienced with bladder biopsy or evaluation of bladder tumors, the patient should be referred to a urologist. Characteristics of bladder tumors include a bubble-like appearance to the trigone, bullous edema, frond-like papillary growths, or shaggy, necrotic tissue (picture 5).

If urothelial malignancy is suspected, a bladder barbotage (repeated injection and aspiration of fluid) to obtain urothelial cells for cytology should be performed. An isotonic fluid should be used (eg, isotonic saline) since hypotonic fluids (eg, sterile water) will cause the cells to lyse, yielding inaccurate cytology. Glycine may also be used for barbotage, if glycine is the medium of choice for the procedure. (See 'Distending medium' above.)

Evaluating genitourinary fistula — Cystoscopy with simultaneous vaginal examination may be necessary to find extremely small vesicovaginal fistulas and to assess patients who have failed primary attempts at repair. This is discussed in detail separately. (See "Urogenital tract fistulas in females", section on 'Cystoscopy and imaging studies'.)

Ureteral orifices — The ureteral orifices are located in the bladder trigone, which is directly in front of the urethra and is identified by locating the interureteric ridge. The cystoscope may need to be rotated to visualize the ureteral orifices. Several minutes of observation may be needed to identify the orifices, which are small, slit-like openings that only become apparent when a burst of urine is released.

In women in whom the bladder is distorted by tumor or cystocele, a finger placed in the vagina and pressed upward under the bladder base may facilitate visualization of the ureteral openings. Large cervical tumors can cause distortion of the bladder such that the trigone sits in a valley behind the ridge made by the tumor. It is also important to note that in women who have had prior ureteral surgery, the ureteral orifice may be in an ectopic location. In situations where it is difficult to identify the ureteral orifice, coloring the urine

with phenazopyridine 100 to 200 mg, methylene blue, or sodium fluorescein may be helpful. (See "Urinary tract injury in gynecologic surgery: Identification and management".)

Identifying ureteral injury — Identification of ureteral injury is aided by coloring the urine, thereby allowing visualization of the urine jet as it flows out of the ureteral orifice and confirming ureteral patency. Agents to color the urine include intravenous sodium fluorescein, intravenous methylene blue, and preoperative oral phenazopyridine. Some have also advocated using 10% dextrose as distension media to improve visualization of ureteral jets. The intraoperative evaluation of the bladder and ureters is presented separately. (See "Urinary tract injury in gynecologic surgery: Identification and management".)

Management of operative ureteral injury is discussed in detail separately. (See "Urinary tract injury in gynecologic surgery: Identification and management", section on 'Ureteral injury' and "Surgical repair of an iatrogenic ureteral injury".)

When to call for consultation — Intraoperative or postoperative consultation by a urogynecologist or urologist may be required if a urinary tract injury is discovered that cannot be repaired by the primary surgeon. In addition, if urinary tract malignancy is suspected, consultation may be required for biopsy and follow-up evaluation and management. The authors recommend that urologic or urogynecologic consultation should be obtained anytime there is concern about what is visualized.

COMPLICATIONS

Complications of cystoscopy are rare. This was illustrated in a retrospective study of 101 women who underwent cystoscopy immediately following pelvic surgery, which reported only one complication associated with operative cystoscopy (a thermal injury) [17].

Infection — The reported incidence of bacteriuria following cystoscopy is 5 to 8 percent; the incidence of symptomatic urinary tract infection (UTI) is approximately 2 to 5 percent [18-20]. Bacteremia is possible after cystoscopy, but reports of sepsis following cystoscopy are rare and involve patients with risk factors for UTI [20-22].

For women with postoperative symptoms of UTI, a urine culture should be sent and infection appropriately treated. Asymptomatic women who have findings on cystoscopy suggestive of infection (eg, exudate) should be treated with antibiotics after the procedure.

Urethral or bladder injury — There are no data regarding the incidence of urethral or bladder injury in diagnostic cystoscopy. Minor injuries with a small amount of bleeding can be controlled with electrosurgery. Perforation of the bladder or urethra may require placement of a urinary catheter or surgical repair. Perforation of the bladder could require

abdominal or laparoscopic surgery for repair; however, in the setting of diagnostic cystoscopy, this is extremely rare.

Other complications — Hemorrhage after cystoscopy is rare [23,24].

POSTOPERATIVE CARE

Most patients experience mild postprocedure urinary urgency or dysuria and a small amount of hematuria that should clear within three voids. Patients with persistent dysuria may use phenazopyridine 100 to 200 mg up to three times a day for up to three consecutive days, as needed. The patient may resume most normal activities as soon as anesthetic effects, if used, have resolved. We advise patients to call their surgeon if they have urethral bleeding that is heavy or lasts for more than five days or if they develop persistent suprapubic pain, dysuria, urinary urgency, urinary frequency, or fever.

We review the results with patients immediately after the procedure if only topical or regional anesthetic was used. We see patients for a follow-up visit two weeks postoperatively if they were under sedation or general anesthesia or have biopsy results pending.

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Gynecologic surgery".)

SUMMARY AND RECOMMENDATIONS

- **Description –** Diagnostic cystoscopy is an endoscopic technique for examining the internal aspect of the urethra and bladder and assessing ureteral patency. (See 'Introduction' above.)
- **Procedure indications –** Gynecologic indications for cystoscopy include: evaluation of urogynecologic symptoms, assessment of bladder and ureteral involvement by gynecologic malignancies, and identification of urinary tract injuries during or after gynecologic procedures. (See 'Indications' above.)
- **Role of urethral anesthetic –** For women undergoing cystoscopy who do not receive regional or general anesthesia, we suggest the use of a topical urethral anesthetic prior to the procedure rather than no topical anesthetic (**Grade 2B**). (See 'Anesthesia' above.)

- **Distending media –** An electrolyte-containing irrigation fluid or sterile water is used for diagnostic cystoscopy. If barbotage is done, sterile water is not appropriate. (See 'Distending medium' above.)

- **Injury detection –** Cystoscopy does not detect all bladder or ureteral injuries; approximately 1 injury will be missed for every 1000 procedures, depending on the type of gynecologic procedure performed. (See 'Examining the lower urinary tract' above.)

- **Side effects and complications –** Following cystoscopy, mild postprocedure hematuria and dysuria are normal and should clear within several voids. Potential complications include urinary tract infection and injury to the urethra or bladder. (See 'Postoperative care' above and 'Complications' above.)

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Topic 3288 Version 23.0

GRAPHICS

Recommended antimicrobial prophylaxis for urologic procedures

Procedure	Likely organisms	Prophylaxis indicated	Antimicrobial(s) of choice	Alternativ antimicrobial required
Lower tract instrumentation				
Cystourethroscopy with minor manipulation, break in mucosal barriers, biopsy, fulguration, etc; clean-contaminated	GNR, rarely enterococci[¶]	Uncertain[Δ]; consider host-related risk factors. Increasing invasiveness increases risk of SSI.	TMP-SMX, amoxicillin/clavulanate	First/second-generation cephalosporin + aminoglycoside (aztreonam[◇]) ± ampicillin
Transurethral cases (eg, TURP, TURBT, laser enucleative and ablative procedures, etc); clean-contaminated[§]	GNR, rarely enterococci	All cases	Cefazolin, TMP-SMX	Amoxicillin/clavu aminoglycoside (aztreonam[◇]) ± ampicillin
Prostate brachytherapy or cryotherapy; clean-contaminated	*Staphylococcus aureus*, skin; GNR	All cases	Cefazolin	Clindamycin[¥]
Transrectal prostate biopsy; contaminated	GNR, anaerobes[‡]; consider MDR coverage, if risks of systemic antibiotics within six months, international travel, health care worker	All cases	Fluoroquinolone, first/second/third-generation cephalosporin (ceftriaxone commonly used) + aminoglycoside	Aztreonam May need to cons ID consultation
Upper tract instrumentation				
Percutaneous kidney surgery (eg,	GNR, rarely enterococci,	All cases	First/second-generation cephalosporin,	Ampicillin/sulbac

PCNL); clean-contaminated	and skin[†], *S. aureus*		aminoglycoside (aztreonam[◇]) + metronidazole, or clindamycin	
Ureteroscopy, all indications; clean-contaminated	GNR, rarely enterococci	All cases; of undetermined benefit for uncomplicated, diagnostic-only procedures	TMP-SMX, first/second-generation cephalosporin	Aminoglycoside (aztreonam[◇]) ± ampicillin, first/se generation cephalosporin, amoxicillin/clavul
Open, laparoscopic, or robotic surgery				
Without entering urinary tract (eg, adrenalectomy, lymphadenectomy, retroperitoneal or pelvic); clean	*S. aureus*, skin	Consider in all cases; may not be required	Cefazolin	Clindamycin
Penile surgery (eg, circumcision, penile biopsy, etc); clean-contaminated	*S. aureus*	Likely not required		
Urethroplasty; reconstruction of the anterior urethra; stricture repair, including urethrectomy; clean; contaminated; controlled entry into the urinary tract	GNR, rarely enterococci, *S. aureus*	Likely required	Cefazolin	Cefoxitin, cefotet ampicillin/sulbac
Involving controlled entry into urinary tract (eg, kidney surgery; nephrectomy, partial or otherwise; ureterectomy; pyeloplasty; radical prostatectomy); partial cystectomy,	GNR (*Escherichia coli*), rarely enterococci	All cases	Cefazolin, TMP-SMX	Ampicillin/sulbac aminoglycoside (aztreonam[◇]) + metronidazole, o clindamycin

etc; clean-contaminated				
Involving small bowel (ie, urinary diversions, cystectomy with small bowel conduit, other GU procedures); ureteropelvic junction repair, partial cystectomy, etc; clean-contaminated	Skin, *S. aureus*, GNR, rarely enterococci	All cases	Cefazolin	Clindamycin and aminoglycoside, cefuroxime (seco generation cephalosporin), aminopenicillin combined with a lactamase inhibit metronidazole
Involving large bowel**; colon conduits; clean-contaminated	GNR, anaerobes	All cases	Cefazolin + metronidazole, cefoxitin, cefotetan, or ceftriaxone + metronidazole, ertapenem NB: These IV agents are used along with mechanical bowel preparation and oral antimicrobial (neomycin sulfate + erythromycin base or neomycin sulfate + metronidazole)	Ampicillin/sulbac ticarcillin/clavula piperacillin/tazob
Implanted prosthetic devices: AUS, IPP, sacral neuromodulators; clean	GNR, *S. aureus*, with increasing reports of anaerobic and fungal organisms	All cases	Aminoglycoside (aztreonam◇) + first/second-generation cephalosporin or vancomycin¶¶	Aminopenicillin b lactamase inhibit including ampicillin/sulbac ticarcillin, or tazobactam
Inguinal and scrotal cases (eg, radical orchiectomy, vasectomy, reversals, varicocelectomy, hydrocelectomy, etc); clean	GNR, *S. aureus*	Of increased risk; all cases	Cefazolin	Ampicillin/sulbac
Vaginal surgery, female	*S. aureus*, streptococci,	All	Second-generation cephalosporin	Ampicillin/sulbac aminoglycoside

incontinence (eg, urethral sling procedures, fistulae repair, urethral diverticulectomy, etc); clean-contaminated	enterococci, vaginal anaerobes; skin		(cefoxitin, cefotetan) provides better anaerobic coverage than first-generation cephalosporins; however, cefazolin is equivalent coverage for the vaginal anaerobes in sling procedures	(aztreonam◇) + metronidazole, o clindamycin
Other				
Shock-wave lithotripsy; clean	GNR, rarely enterococci; GU pathogens	Only if risk factors	If risks, consider TMP-SMX, first-generation cephalosporin (cefazolin), second-generation cephalosporin (cefuroxime), aminopenicillin combined with a beta-lactamase inhibitor + metronidazole	First/second-generation cephalosporin, amoxicillin/clavul ampicillin + aminoglycoside (aztreonam◇), clindamycin

GNR: gram-negative rod; SSI: surgical site infection; TMP-SMX: sulfamethoxazole and trimethoprim; TURP: transurethral resection of the prostate; TURBT: transurethral resection of bladder tumor; MDR: multidrug resistant; ID: infectious diseases; PCNL: percutaneous nephrolithotomy; GU: genitourinary; IV: intravenous; AUS: artificial genitourinary sphincter; IPP: implantable penile prosthesis; GPC: gram-positive cocci; AP: antimicrobial prophylaxis.

* Or full course of culture-directed antimicrobials for documented infection (which is treatment, not prophylaxis).

¶ GU GNR: Common urinary tract organisms are *E. coli*, *Proteus* spp, *Klebsiella* spp, and GPC *Enterococcus*.

Δ If urine culture shows no growth prior to the procedure, antimicrobial prophylaxis is not necessary.

◇ Aztreonam can be substituted for aminoglycosides in patients with kidney function impairment.

§ Includes transurethral resection of bladder tumor and prostate and any biopsy, resection, fulguration, foreign body removal, urethral dilation or urethrotomy, or ureteral instrumentation including catheterization or stent placement/removal.

¥ Clindamycin, or aminoglycoside + metronidazole or clindamycin, are general alternatives to penicillins and cephalosporins in patients with penicillin allergy, even when not specifically listed.

‡ Intestine: Common intestinal organisms include aerobes and anaerobes: *E. coli*, *Klebsiella* spp, *Enterobacter*, *Serratia* spp, *Proteus* spp, *Enterococcus*, and *Anaerobes*.

† Skin: Common skin organisms are *S. aureus*, coagulase-negative *Staphylococcus* spp, Group A *Streptococcus* spp.

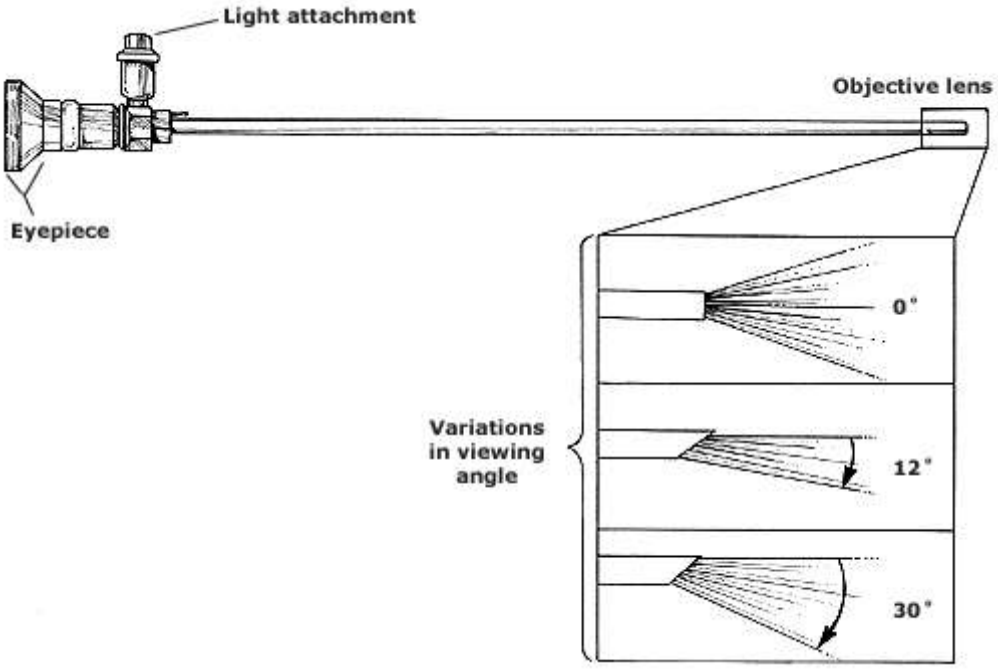
** For surgery involving the colorectum, bowel preparation with oral neomycin plus either erythromycin base or metronidazole is added to systemic agents.

¶¶ Routine administration of vancomycin for AP is not recommended. The antimicrobial spectrum of vancomycin is less effective against methicillin-sensitive strains of *S. aureus*.

From: Lightner DJ, Wymer K, Sanchez J, Kavoussi L. Best practice statement on urologic procedures and antimicrobial prophylaxis. J Urol 2020; 203:351. DOI: 10.1097/JU.0000000000000509.

Graphic 129971 Version 3.0

Hysteroscope with different viewing angles



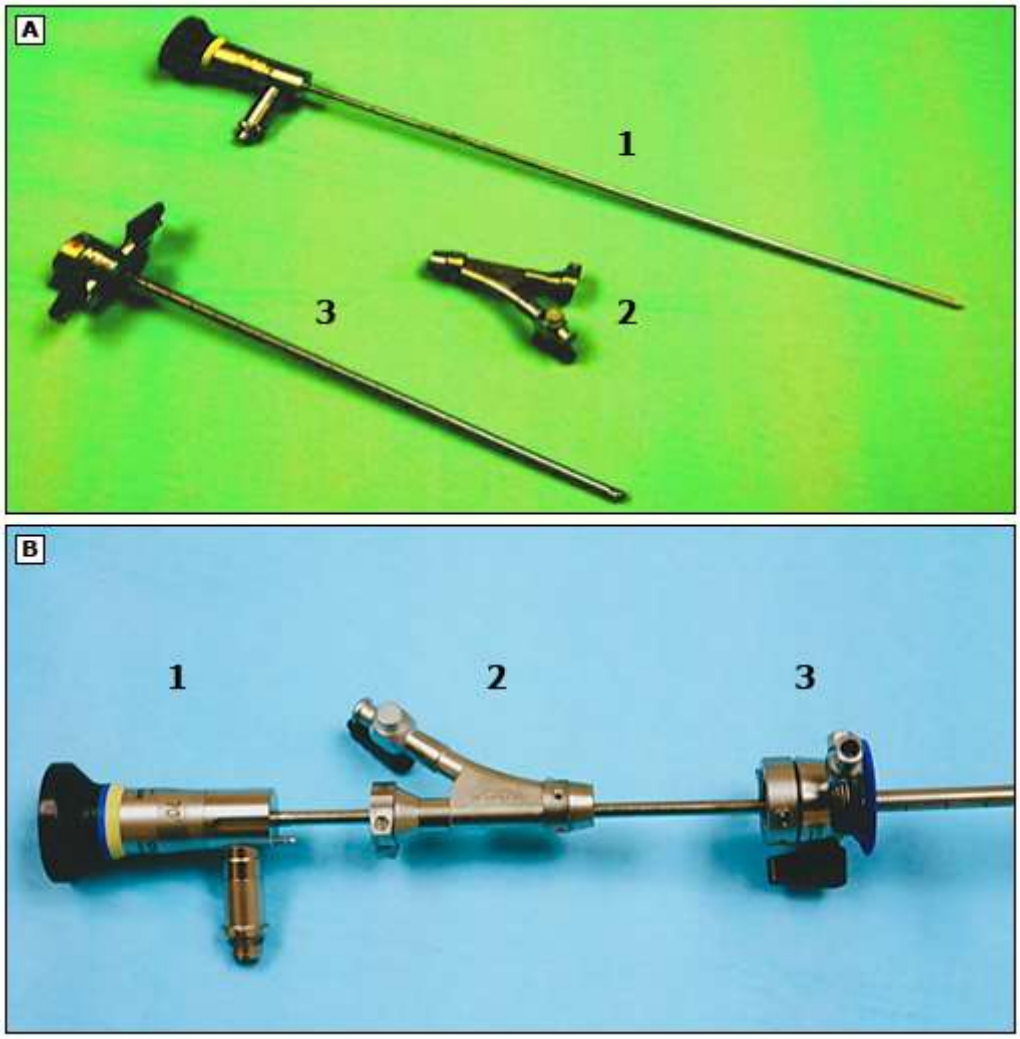
Graphic 58867 Version 1.0

Cystoscopy light source and video monitor

Picture of what a cystoscopy set-up may look like. Note the fluid medium at the upper left corner of the photo, the monitor at the top of the screen, and the inputs for the light source and camera in the middle of the screen. Also note the assembled cystoscope on top of the light box.

Graphic 83049 Version 1.0

Cystoscope components



(A) The parts of a basic cystoscope: 1) lens; 2) bridge; 3) sheath.

(B) Assembly of cystoscope parts.

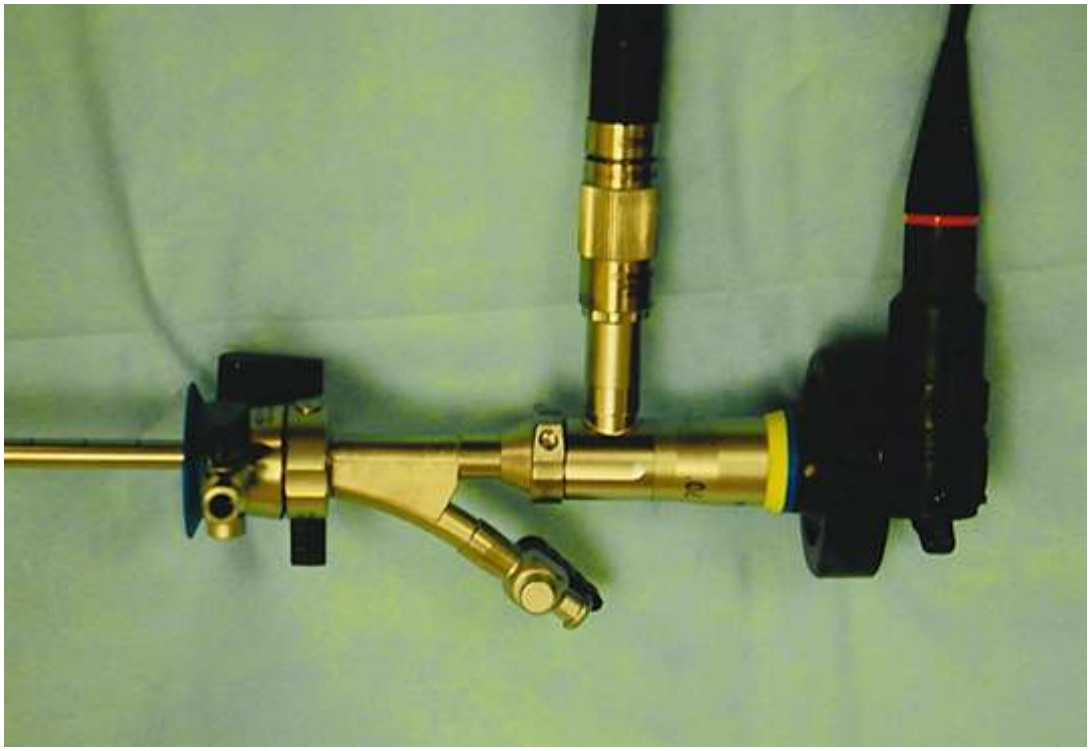
Graphic 83017 Version 1.0

Cystoscope camera and light source

Cystocope (A) camera and (B) light cord.

Graphic 83018 Version 1.0

Cystoscope



A cystoscope with the parts fully assembled.

Graphic 83076 Version 1.0

Distending media for hysteroscopy

Category	Medium	Hysteroscopic procedure	Biochemical properties	Complications or adverse effects	Safety measures[1,2]
Gaseous	Carbon dioxide	Diagnostic	Colorless gas	Gas embolism Shoulder pain	Use hysteroscopic insufflator Safety thresholds: Flow <100 mL/min Intrauterine pressure <100 mmHg
Electrolyte fluid	Saline 0.9 percent	Diagnostic OR Operative: ▪ Bipolar electrocautery ▪ Mechanical morcellation device ▪ Mechanical tissue removal ▪ Laser	Water and sodium chloride Isotonic	Volume overload	Fluid deficit thresholds: 750 mL: Plan completion of procedure 2500 mL: Stop procedure (or earlier in patients who are elderly or have comorbidities)
	Lactated Ringer's solution	Diagnostic OR Operative: ▪ Bipolar electrocautery ▪ Mechanical morcellation device ▪ Mechanical tissue removal ▪ Laser	Water and sodium chloride, lactate, potassium, calcium Isotonic	Volume overload	
Electrolyte-poor fluids	Mannitol 5 percent	Operative: monopolar electrocautery only	Six-carbon sugar Cleared by kidneys; acts	Volume overload Hyponatremia	Fluid deficit thresholds: 750 mL: Plan completion of procedure **OR**

			as its own diuretic Elimination half-life: ≥100 min[3] Isoosmolar		Stop procedure in patients who are elderly or have comorbidities 1000 mL: Stop procedure
	Sorbitol 3 percent	Operative: monopolar electrocautery only	Six-carbon sugar Metabolized in the liver to fructose and glucose Elimination half-life: ≥33 min[3] Hypoosmolar	Volume overload Hyponatremia Hypoosmolality Hyperglycemia Peritonitis[4]	
	Glycine 1.5 percent	Operative: monopolar electrocautery only	Amino acid Metabolized into serine and ammonia Elimination half-life: ≥40 min[3] Hypoosmolar	Volume overload Hyponatremia Hypoosmolality Hyperammonemia	

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Graphic 71692 Version 3.0

Cystoscopic view of a bladder cancer

Cystoscopic view of a bladder tumor. Note the calcification.

Courtesy of Marcus L Quek, MD.

Contributor Disclosures

Cynthia S Fok, MD, MPH Other Financial Interest: Medtronic [one time fee for being a participant in a trial April 2023]; UroCure [one time consulting fee June 2022]. All of the relevant financial relationships listed have been mitigated. **Kimberly Kenton, MD, MS, FACOG, FACS** Grant/Research/Clinical Trial Support: Axonics [Sacral neuromodulation]. Other Financial Interest: Ethicon [Expert witness – Midurethral slings]. All of the relevant financial relationships listed have been mitigated. **Linda Brubaker, MD, FACOG** Grant/Research/Clinical Trial Support: National Institutes of Health [Prevention of lower urinary symptoms]. Other Financial Interest: Editor in Chief for Urogynecology journal [Urogynecology]; Journal of the American Medical Association [Women's health]. All of the relevant financial relationships listed have been mitigated. **Kristen Eckler, MD, FACOG** No relevant financial relationship(s) with ineligible companies to disclose.

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