



American
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Association

Urologic Procedures and Antimicrobial Prophylaxis

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The potential benefit of **antimicrobial prophylaxis** should be considered with assessment of **five** points:

1. the patient's ability to respond to an infection,
2. the procedure being performed,
3. procedural factors that increase the likelihood of bacterial invasion at the operative site,
4. the virulence of the bacterial pathogen,
5. the potential morbidity of any subsequent infection.

Host-related factors affecting SSI risk

- Ability to function independently, not age specifically
 - Diabetes mellitus
 - COPD or recent pneumonia, significant cardiovascular disease including stents, angina and MI, HT, PVD, impaired sensorium, TIA or CVA.
 - Anatomic anomalies of the urinary tract associated with risks of obstruction, poor drainage or abnormal storage pressures
 - Poor nutritional status: patient reported nutritional symptoms, poor appetite, nausea, abnormalities of taste and smell
 - Tobacco abuse
 - Chronic corticosteroid use
 - Immunodeficiency
 - Recent systemic chemotherapy
 - Externalized catheters
 - Distant coexistent infection
 - Prolonged preoperative hospitalization, likely a surrogate for the severity for underlying comorbidities
 - Scrotal, inguinal or perineal incision planned
 - Pregnancy (in the setting of ASB)
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- Other host-specific factors such as **drug allergy, intolerance, or a history of C. difficile infection** may influence the selection.
 - **Recent or current antimicrobial therapy** for another indication would also need to be considered.

Wound Classifications

Class I/clean	Uninfected operative wound without entry into pulmonary, GI or GU systems.	Inguinal and scrotal procedures for noninfectious indications, RPLND.
Class II/clean-contaminated	Entry into pulmonary, GI or GU under controlled conditions; no other contamination	Opening into urinary tract, as in nephrectomy, cystectomy, prostatectomy, endoscopic procedures.
Class III/contaminated	Infected stone procedures, Use of bowel segments	PCNL on struvite stones, infected stones. TRUS prostate biopsy.
Class IV/dirty	Open trauma, abscesses	Debridement; implication that the offending organisms were present prior to the index procedure.
Prosthesis Implantation	IPP, AUS	Antibiotic prophylaxis should cover likely skin organisms; increasing resistance, MRSA colonization has led many surgeons to use vancomycin perioperatively.

Proposed Procedure-associated Risk Probability of SSI

LOW RISK	INTERMEDIATE RISK	HIGH RISK	AS YET UNDETERMINED
Most Class I/clean procedures in low risk patients, including SWL	Class I procedures in high risk patients (includes placement of GU prostheses)	All Class IV procedures	Urethral dilation, urethrotomy (likely low risk)
Certain Class II/ clean-contaminated procedures	Minimal to no violation of urinary spaces; adrenalectomy; nephrectomy; lymphadenectomy	Most Class III and certain Class II procedures	Partial cystectomy (likely intermediate risk)
Cystoscopy, biopsy and fulguration	Certain Class II and III procedures	TURP; Laser ablative or enucleation procedures of the prostate	Ureteral reimplant (likely intermediate risk)
Diagnostic cystoscopy	Ureteroscopy with or without lithotripsy	Transrectal ultrasound with prostate biopsy	Scrotal cases: vasectomy, vasovasotomy, varicocelectomy, hydrocelectomy etc. (likely low risk)
Urodynamic studies	Vaginal surgery; including urethral sling procedures, vesicovaginal fistula closure, diverticulectomy	Percutaneous Nephrolithotomy	Inguinal cases: radical orchiectomy, inguinal lymph node dissection (likely intermediate risk)
Ureteral stent exchange	Entry into the genitourinary tract under controlled circumstances (radical prostatectomy)	Urinary diversion involving large bowel	

Proposed Procedure-associated Risk Probability of SSI

LOW RISK	INTERMEDIATE RISK	HIGH RISK	AS YET UNDETERMINED
Transrectal ultrasound without biopsy	Prostate brachytherapy	Colovesical, colovaginal or coloureteral fistula closure	
VCUG; Retrograde urethrography	Implantation of prosthetic materials and devices, including sacral neuromodulation	Major break in sterile technique with purulence, or gross contamination	
Catheter removal, drain removal	Class III cases, urinary diversion involving unobstructed, healthy small bowel including continent diversion, and not involving large bowel	All Class IV procedures, i.e. "dirty, infected" whether determined pre-procedurally or intraoperatively, including ureteroscopy for obstruction	
Incision and drainage; foreign body removal	Litholapaxy, TURBT		
Diagnostic laparoscopy	Urethral reconstruction, urethroplasty, urethrectomy		
	Renal transplant, donor nephrectomy		
	Major break in sterile technique without purulence, or gross contamination		

Procedural Factors...

- There are modifiable perioperative factors affecting SSI risk, which include the avoidance of hypothermia, blood glucose control, preoperative bathing and skin preparation, and sterile technique.
- The degree of mucosal injury and the duration of the procedure impact risk of a periprocedural infection.
- While wound closure techniques, timing of showers, and dressing removal do **not** appear to impact the risk of SSI, the urgency and complexity of the surgical procedure and any associated breaks in infection-control protocols **do** change the risk.
- Periprocedural infections are not limited to the surgical site, and other **healthcare-associated infections (HAI)** may occur, such as periprocedural pneumonia and CAUTI.

Single-dose antimicrobial prophylaxis is appropriate in the majority of uncomplicated urologic cases.

- The current era of increasing healthcare-related costs, adverse events, and growing MDR calls for use of antimicrobials only when medically necessary and with the narrowest spectrum of activity with the shortest duration possible. This ensures the best care for both the patient as well as the greater health of the public.
- There is no high-level evidence to support the use of multiple doses of antimicrobials in the absence of preoperative symptomatic infection.
- There is moderate-quality evidence from multiple RCTs that do not show a benefit of prolonging AP beyond the case completion, and, according to a WHO systematic review, the benefit of intraoperative coverage is undetermined at this time.
- Recent guidelines recommend that only a single dose of preoperative AP be used and that there be no postoperative continuation without exceptions for surgical procedure type.
- The concerns regarding limiting AP doses beyond wound closure is not unique to urologic practice.

Single-dose antimicrobial prophylaxis coverage for usual skin flora may not be necessary for skin incisions Class I/clean procedures (uninfected, no inflammation, closed primarily without entrance into the gastrointestinal or genitourinary tracts).

- A single dose of an antimicrobial, which may reduce the risk of SSI, may be considered for incisions in the skin. Simple outpatient diagnostic tests, which do not normally break either the mucosal or skin barrier, likely do not require AP in the healthy individual (both adult and pediatric).
- Recent studies of Class I/clean outpatient urologic procedures including minimally invasive surgery, as well as some Class II/clean contaminated procedures, such as ureteroscopy, have not demonstrated a significant benefit of AP.
- Selective use of AP for higher-risk individuals is encouraged.

Exceptions are appropriate for **prosthetic device** implantation and may be considered for **groin and perineal incisions** where the surgical site infection risk may be increased.

- Recent modifications to the NNIS risk index include a history of preoperative chemotherapy (OR=1.94), or **groin incisions** (OR=4.65). As groin, and presumably perineal incisions, may confer an increased risk of SSI, single-dose AP may be considered for these cases.
- For **prosthetic device implantation**, AP coverage for **skin flora**, specifically coagulase negative staphylococci and also gram-negative bacilli, including Pseudomonas species, has been recommended (<24 hours).
- Recent studies have demonstrated **decreasing overall incidence of prosthetic infection**; however, relatively higher rates of **anaerobic, MRSA, and fungal infections** are potentially being identified when infections do occur.
- Clearly need to assess the **organisms grown at explant of infected prostheses** to direct **future guidelines** in this critical area.

Single-dose periprocedural antimicrobial prophylaxis is currently recommended for patients undergoing **specific Class II/clean-contaminated** genitourinary procedures as the risk reduction of a serious surgical site infection or systemic infection exceeds the anticipated risks of increasing antimicrobial resistance and other adverse events.

- Class II procedures include any opening into the GU tract, nephrectomy, cystectomy, endoscopic, and vaginal cases. The reported risks of a periprocedural infectious complication for Class II/clean-contaminated GU procedures range considerably even with appropriate AP covering the most likely pathogens, and underscore the variability of procedural-specific risk of SSI.
- As the urologic procedure-associated risks of an SSI do not align with these traditional wound classifications, these classifications should not be used to determine the need for AP (cystoscopy vs. TURP).
- AP for Class II/clean-contaminated urologic procedures needs to be tailored to the specific procedure-associated risk. While the need for AP for urologic Class II procedures is based on the specific procedure, the AP agent choice requires knowledge of the prior urine culture results, the local antibiogram, and the patient's associated risks.

Routine cystoscopy and urodynamic studies do NOT require antimicrobial prophylaxis in healthy adults in the absence of infectious signs and symptoms.

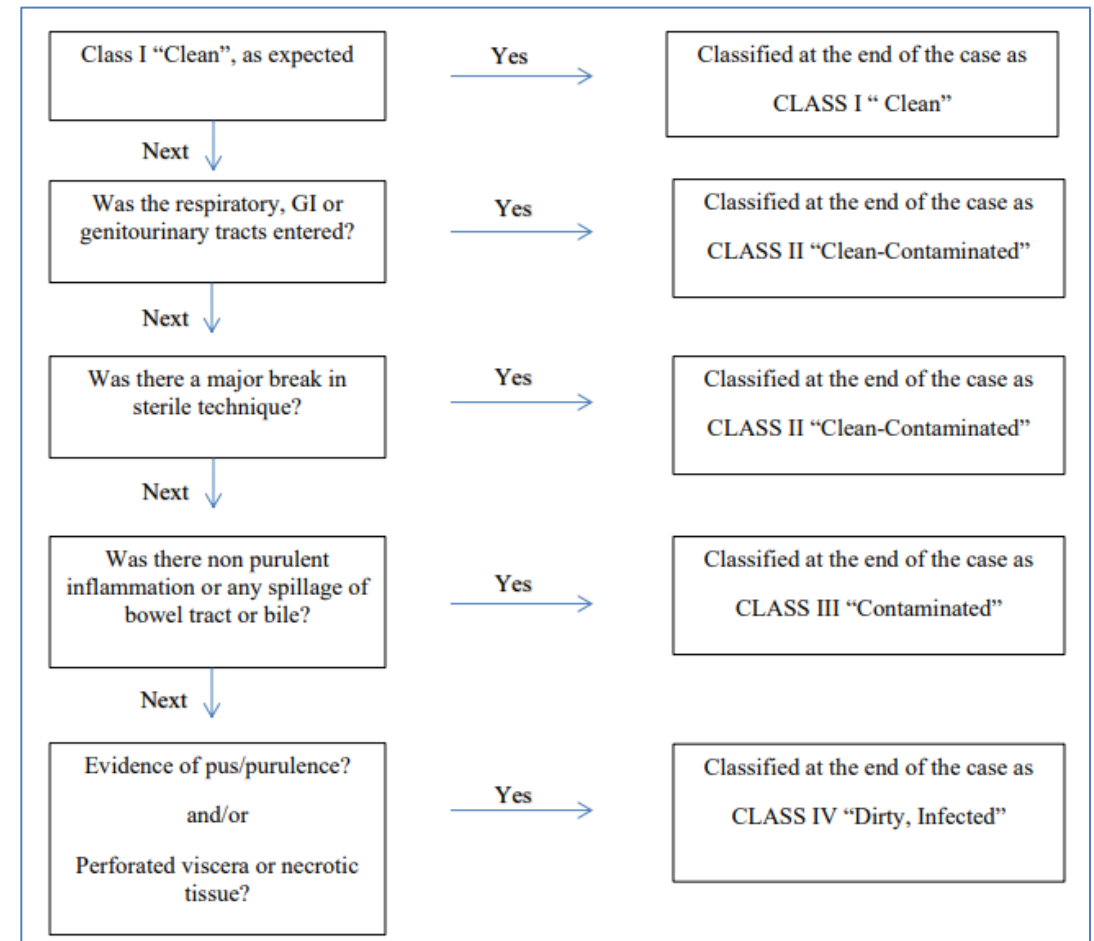
- Single-dose AP is recommended prior to all procedures for the treatment of BPH, transurethral bladder tumor resections, vaginal procedures (excluding mucosal biopsy), stone intervention for URSL, PCNL, and open and laparoscopic/robotic stone surgery. These more invasive procedures entail higher SSI risk.
- Emerging data suggest that antibiotics **may not** be medically necessary for simple **bladder biopsies** performed with periprocedural uninfected urine.
- Future investigations are encouraged that would allow **sub-classification within specific Class II** procedures by patient and periprocedural risk characteristics, and inclusive of SSI and remote infections.

Single-dose antimicrobial prophylaxis agents are recommended for patients undergoing Class III/contaminated procedures as the risk of a serious surgical site infection or systemic infection is high. Specific Class III/contaminated procedures requiring antimicrobial prophylaxis include transrectal prostate biopsy.

- Similar to Class II procedures, there is emerging data that Class III wounds vary in the associated SSI risk. Single-dose AP may not be required for surgical incision and drainage.
- For surgical procedures including unobstructed small bowel, patients should receive a first-generation cephalosporin as the upper GI tract flora is relatively sparse and intense colonization unusual in the healthy individual.
- Preoperative mechanical bowel preparation and oral antibiotics for colorectal procedures is recommended by the WHO, consistent with most urologic practices using colorectal segments and associated with reduced complication rates. The use of small bowel segments for diversion does not necessitate a bowel prep.

Class IV wounds are by **definition infected**. Antimicrobial prophylaxis guidelines may help choose the most appropriate **empiric** antimicrobial agent(s) for the most common offending pathogens until **cultures** inform targeted therapy.

- If intraoperative circumstances change and a wound becomes or is recognized as, contaminated, a **shift up in AP coverage** should occur. Wound classification is best considered a flexible designation throughout the case. If contamination occurs, then the wound class changes and the AP agent(s) should be reconsidered.



Recommended antimicrobial prophylaxis for urologic procedures

Procedure	Likely Organisms	Prophylaxis Indicated	Antimicrobial(s) of Choice	Alternative Antimicrobial(s), if required	Duration of Therapy
Lower Tract Instrumentation					
Cystourethroscopy with minor manipulation, break in mucosal barriers, biopsy, fulguration, etc.; clean-contaminated	GNR, rarely enterococci	Uncertain; consider host-related risk factors Increasing invasiveness increases risk of SSI	TMP-SMX or Amoxicillin/Clavulanate	1st/2nd generation Cephalosporin or Aminoglycoside +/- Ampicillin or Aztreonam +/- Ampicillin	Single dose
Transurethral Cases: e.g., TURP, TURBT, laser enucleative and ablative procedures, etc.; clean-contaminated	GNR, rarely enterococci	All cases	Cefazolin or TMP-SMX	Amoxicillin/Clavulanate or Aminoglycoside +/- Ampicillin or Aztreonam +/- Ampicillin	Single dose
Prostate brachytherapy or cryotherapy; clean-contaminated	S. aureus, skin; GNR	All cases	Cefazolin	Clindamycin	Single dose
Transrectal prostate biopsy; contaminated	GNR, anaerobes; consider multi-drug resistance coverage, if risks of systemic antibiotics within six months, international travel, healthcare worker	All cases	Fluoroquinolone or 1st/2nd gen. Cephalosporin +/- Aminoglycoside or 3rd gen. Cephalosporin	Aztreonam May need to consider infectious disease consultation	Single dose

Recommended antimicrobial prophylaxis for urologic procedures					
Procedure	Likely Organisms	Prophylaxis Indicated	Antimicrobial(s) of Choice	Alternative Antimicrobial(s), if required	Duration of Therapy
Upper Tract Instrumentation					
Percutaneous renal surgery, e.g., PCNL; clean-contaminated	GNR, rarely enterococci, and skin, <i>S. aureus</i>	All cases	1st/2nd gen. Cephalosporin or Aminoglycoside and Metronidazole or Aztreonam and Metronidazole or Aminoglycoside and Clindamycin or Aztreonam and Clindamycin	Ampicillin/Sulbactam	<24 hours
Ureteroscopy, all indications; clean-contaminated	GNR, rarely enterococci,	All cases; of undetermined benefit for uncomplicated diagnostic only procedures.	TMP-SMX or 1st/2nd gen. Cephalosporin	Aminoglycoside +/- Ampicillin or Aztreonam¥ +/- Ampicillin or Amoxicillin/Clavulanate	Single dose
Open, Laparoscopic or Robotic Surgery					
Without entering urinary tract, e.g., adrenalectomy, lymphadenectomy, retroperitoneal or pelvic; clean	<i>S. aureus</i> , skin	Consider in all cases; may not be required	Cefazolin	Clindamycin	Single dose
Penile surgery, e.g. circumcision, penile biopsy, etc.; clean-contaminated	<i>S. aureus</i>	Likely not required			

Recommended antimicrobial prophylaxis for urologic procedures

Procedure	Likely Organisms	Prophylaxis Indicated	Antimicrobial(s) of Choice	Alternative Antimicrobial(s), if required	Duration of Therapy
Urethroplasty; reconstruction anterior urethra, stricture repair, including urethrectomy; clean; contaminated; controlled entry into the urinary tract	GNR, rarely enterococci, S. aureus	Likely required	Cefazolin	Cefoxitin or Cefotetan or Ampicillin/Sulbactam	Single dose
Involving controlled entry into urinary tract e.g. renal surgery, nephrectomy, partial or otherwise, ureterectomy pyeloplasty, radical prostatectomy; partial cystectomy, etc.; clean-contaminated	GNR (E. coli), rarely enterococci	All cases	Cefazolin or TMP-SMX	Ampicillin/Sulbactam or Aminoglycoside and Metronidazole or Aztreonam [‡] and Metronidazole or Aminoglycoside and Clindamycin or Aztreonam [‡] and Clindamycin	Single dose
Involving small bowel (i.e., 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 or Cefuroxime (2nd generation cephalosporin) or Aminopenicillin combined with a β -lactamase inhibitor and Metronidazole (optional)	Single dose

Recommended antimicrobial prophylaxis for urologic procedures

Procedure	Likely Organisms	Prophylaxis Indicated	Antimicrobial(s) of Choice	Alternative Antimicrobial(s), if required	Duration of Therapy
Involving large bowel; colon conduits; clean-contaminated	GNR, anaerobes	All cases	Cefazolin and Metronidazole or Cefoxitin and Metronidazole or Cefotetan and Metronidazole or Ceftriaxone and Metronidazole or Ertapenem NB: these IV agents are used along with mechanical bowel preparation and oral antimicrobial (neomycin sulfate + erythromycin base or neomycin sulfate + metronidazole)	Ampicillin/Sulbactam or Ticarcillin/Clavulanate or Piperacillin/Tazobactam	Single parenteral dose
Implanted prosthetic devices: AUS, IPP, sacral neuromodulators; clean	GNR, S. aureus, with increasing reports of anaerobic, and fungal organisms	All cases	Aminoglycoside and 1st/2nd gen. Cephalosporin or Aztreonam and 1st/2nd gen. Cephalosporin or Aminoglycoside and Vancomycin or Aztreonam and Vancomycin	Aminopenicillin or β -lactamase inhibitor (including Ampicillin/Sulbactam Ticarcillin, Tazobactam)	<24 hours

Recommended antimicrobial prophylaxis for urologic procedures

Procedure	Likely Organisms	Prophylaxis Indicated	Antimicrobial(s) of Choice	Alternative Antimicrobial(s), if required	Duration of Therapy
Inguinal and scrotal cases; e.g. radical orchiectomy, vasectomy, reversals, varicocelectomy, hydrocelectomy, etc.; clean	GNR, <i>S. aureus</i>	Of increased risk; all cases (likely intermediate risk)	Cefazolin	Ampicillin/Sulbactam	Single dose
Vaginal surgery, female incontinence, e.g. urethral sling procedures, fistulae repair, urethral diverticulectomy, etc.; clean-contaminated	<i>S. aureus</i> , streptococci, enterococci, vaginal anaerobes; skin	All	2nd gen. Cephalosporin (e.g., Cefoxitin, Cefotetan) provides better anaerobic coverage than 1st gen. cephalosporins; however, Cefazolin is equivalent coverage for the vaginal anaerobes in sling procedures	Ampicillin/Sulbactam and Aminoglycoside or Aztreonam [‡] and Metronidazole or Aztreonam [‡] and Clindamycin or Clindamycin	Single dose
Other:					
Shock-wave lithotripsy; clean	GNR, rarely enterococci; GU pathogens	Only if risk factors	If risks, consider TMP-SMX or 1st gen. Cephalosporin (Cefazolin) or 2nd gen. Cephalosporin (Cefuroxime) or Aminopenicillin combined with a β - lactamase inhibitor and Metronidazole	1st/2nd gen. Cephalosporin or Amoxicillin/Clavulanate or Ampicillin and Aminoglycoside or Ampicillin and Aztreonam or Clindamycin	Single dose

Recent instrumentation, nephrostomy tubes, positive urine culture, or history of recent UTI/sepsis, repeated ESWL, infected stones, and stones with a size of ≥ 2 cm, etc.

Antimicrobial prophylaxis should target the likely local organisms. For example, incisions into the urinary system should be covered by antimicrobials whose profile covers the **most recent local antibiogram for genitourinary organisms**. **Cost, convenience, and safety** of the agent as well as **impact on emerging resistant organisms** should be considered.

- The **more invasive** the procedure, the **more contaminated** the operating field, the **longer** the procedure, the greater the risk of a post-procedural infection.
- Surgeons should consider **reclassifying** the wound at the conclusion of the case, noting breaks in sterile technique or any **inadvertent** entry into bowel, urinary or vaginal tract that may have occurred.
- Surgical antimicrobial prophylaxis may require **re-dosing, weight-adjustment, or renal adjustment** to ensure desired antimicrobial tissue levels during a procedure.

Antimicrobial prophylaxis should be **stopped** after **wound closure** and case completion, even in the presence of a **drain**.

Antimicrobials are **not** indicated for the duration of **indwelling catheterization** in the postoperative period for the reduction of SSI as they do not reduce the risk of a CAUTI.

Antimicrobial prophylaxis is **not** the use of antibiotics for treatment of a **suspected infection**; clinicians may determine that the **continuation** of antibiotics is **indicated where treatment, not prevention**, of an infection is the goal of therapy.

Prior to any urologic procedure, evaluation of a patient's urinary tract symptoms suggestive of a UTI should include a simple dipstick, laboratory performed microscopy, and/or formal culture, with assessed risks requiring higher levels of antimicrobial specificity and sensitivity

- Positive microscopy findings should be confirmed with a culture for antimicrobial sensitivities in the perioperative setting where the risk of an SSI is high and targeted antimicrobial treatment may be required.
- Elective procedures should be deferred in the presence of symptoms consistent with an active infection until an antimicrobial course is complete and associated symptoms have improved. In particular, instrumentation of the GU tract in the setting of an active infection should be delayed, if possible and clinically appropriate, until the results of cultures and sensitivities are available. **Vs.** Operative delay is often unsafe and places these patients at higher risk for periprocedural infectious complications.

Asymptomatic bacteriuria and/or funguria may not require antimicrobial prophylaxis prior to a low-risk urologic surgical procedure in otherwise low-risk patients, with the exception of pregnant females.

- Single-dose treatment of ASB is recommended in pregnant females since they are a high-risk population. The identification of ASB, which normally occurs in 3% to 5% of women, has been associated with a 40% risk of pyelonephritis during pregnancy, and has led to treatment of ASB in this cohort.
- ASB need not be managed any differently prior to intermediate- or higher-risk procedures as single-dose AP, the standard practice prior to GU procedures where a mucosal barrier will be broken, should be administered regardless of the presence of ASB.
- ASB do not require treatment prior to an elective surgical procedure not entering the genitourinary system.

Antimicrobial prophylaxis, when indicated, is to be accompanied by best surgical practices for surgical site infection reduction, and is **never a substitute for these best practices !!**

- Minimizing the risk of a SSI begins with creating an **environment that minimizes the risk** of introducing pathogens into the operative site.
- As the patient's skin flora, gram-positive organisms and staphylococcal species in particular, is a major source of SSI procedures involving skin incision, patients should **shower or bathe (full body) with soap (antimicrobial or non-antimicrobial) or an antiseptic agent on at least the night before the operative day.**
- **Mechanical bowel preparation and oral antimicrobials prior to colorectal procedures,** consistent with most urologic practices using colorectal segments.
- Level I evidence recommends **skin preparation with chlorhexidine and alcohol** over betadine for non-mucosal surfaces.

- Intact **sterile drapes** placed around the prepared skin defines the procedural field and are **broad enough in coverage to avoid contamination** of the proceduralist or the instruments by touching non-sterile areas in the operating room.
- While reducing contamination through either microperforations or frank perforations, **double-gloving** does **not** appear to confer a reduction in SSI.
- Hair removal has been traditionally performed to better visualize the operative area and potentially decrease infection. Data to date do **not** show that **hair removal prior to surgery** decreases risk of infection.
- **Transfusion** of blood products **should not be withheld** from surgical patients as a means to prevent SSI.
- Antimicrobial agents (i.e., ointments, solutions, powders) need **not** be applied to the surgical incision for the prevention of SSI. **Antibiotic impregnated suture material** appears to be useful in **reduction of SSI and cost reduction across most** but not all studies.

Summary

- **Single-dose** antimicrobial prophylaxis is appropriate in the majority of uncomplicated urologic cases.
- Antimicrobial prophylaxis is not the use of antibiotics for treatment of a suspected infection; clinicians may determine that the **continuation of antibiotics is indicated where treatment**, not prevention, of an infection is the goal of therapy.
- Antimicrobial prophylaxis, when indicated, is to be accompanied by best surgical practices for surgical site infection reduction, and is **never a substitute for these best practices**.