Urotrauma: AUA Guideline

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Purpose: The authors of this guideline reviewed the urologic trauma literature to guide clinicians in the appropriate methods of evaluation and management of genitourinary injuries.

Materials and Methods: A systematic review of the literature using the MEDLINE® and EMBASE databases (search dates 1/1/90-9/19/12) was conducted to identify peer-reviewed publications relevant to urotrauma. The review yielded an evidence base of 372 studies after application of inclusion/exclusion criteria. These publications were used to inform the statements presented in the guideline as Standards, Recommendations or Options. When sufficient evidence existed, the body of evidence for a particular treatment was assigned a strength rating of A (high), B (moderate) or C (low). In the absence of sufficient evidence, additional information is provided as Clinical Principles and Expert Opinions.

Results: Guideline statements were created to inform clinicians on the initial observation, evaluation and subsequent management of renal, ureteral, bladder, urethral and genital traumatic injuries.

Conclusions: Genitourinary organ salvage has become increasingly possible as a result of advances in imaging, minimally invasive techniques, and reconstructive surgery. As the field of genitourinary reconstruction continues to evolve, clinicians must strive to approach clinical problems in a creative, multidisciplinary, evidence-based manner to ensure optimal outcomes.

Key Words: urotrauma, injury

Abbreviations and Acronyms

AAST = American Association for the Surgery of Trauma
CT = computerized tomography
ICU = intensive care unit
IV = intravenous
IVP = intravenous pyelogram
MRI = magnetic resonance imaging
ORIF = open reduction internal fixation
PFUI = pelvic fracture urethral injury
PR = primary realignment
SP = suprapubic
SPT = suprapubic tube

The complete guideline is available at http://www.auanet.org/education/guidelines/urotrauma.cfm.

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THE Panel's purpose is to review the existing literature pertaining to the acute care of urologic injuries in an effort to develop effective guidelines for appropriate diagnosis and intervention strategies in the setting of urotrauma.

METHODOLOGY

A comprehensive search of the literature targeted the five main urotrauma topics within the scope of this guideline: renal, ureteral, bladder, urethral, and genital trauma. Guideline statements were formed based on this literature review.

The AUA nomenclature system explicitly links statement type to body of evidence strength and the Panel's judgment regarding the balance between benefits and risks/burdens.[1] For a complete discussion of the methodology and evidence grading, please refer to the unabridged guideline available at http://www.auanet.org/education/guidelines/urotrauma.cfm.

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BACKGROUND

Definition

Trauma refers to injury caused by external force from a variety of mechanisms, including traffic- or transportation-related injuries, falls, assault (e.g., blunt weapon, stabbing, gunshot), explosions, etc.

Prevalence

Traumatic injuries are the leading cause of death in the United States for people ages 1-44 years, and a significant cause of morbidity and loss of productive life across all ages.[2] Worldwide, traumatic injuries are the sixth leading cause of death and the fifth leading cause of moderate and severe disability.[3] The kidneys are the most commonly injured genitourinary organ. Civilian renal injury occurs in up to 5% of trauma victims,[4,5] and accounts for 24% of traumatic abdominal solid organ injuries.[6]

GUIDELINE STATEMENTS

Renal Trauma

1. Clinicians should perform diagnostic imaging with intravenous contrast enhanced computerized tomography in stable blunt trauma patients with gross hematuria or microscopic hematuria and systolic blood pressure < 90 mm HG. (*Standard; Evidence Strength: Grade B*)

These criteria should allow early and accurate detection and staging of significant renal injuries. Advantages of CT outweigh the risks, which include contrast related complications, radiation exposure, and the dangers of transporting a patient away from the resuscitation environment.

2. Clinicians should perform diagnostic imaging with IV contrast enhanced CT in stable trauma patients with mechanism of injury or physical exam findings concerning for renal injury (e.g., rapid deceleration, significant blow to flank, rib fracture, significant flank ecchymosis, penetrating injury of abdomen, flank, or lower chest). (*Recommendation; Evidence Strength: Grade C*)

Up to 34% of multisystem trauma patients may have renal injury despite absence of hematuria or hemodynamic instability.[7] A lack of these findings should not preclude imaging if clinicians suspect renal injury based on physical findings, associated abdominal injuries, or mechanism of injury.

3. Clinicians should perform IV contrast enhanced abdominal/pelvic CT with immediate and delayed images when there is suspicion of renal injury. (*Clinical Principle*)

CT scan of the abdomen and pelvis, using IV contrast with immediate and delayed (10 minute) phases is preferred in order to elucidate both the location of renal lacerations and the presence of contrast extravasation from collecting system injuries. Standard intravenous pyelogram may be used in rare cases where CT is not available, but is inferior. Ultrasound may be used in children, although CT is preferred. An intraoperative one-shot IVP may be used to confirm that a contralateral functioning kidney is present in rare cases where the patient is taken to the operating room without a CT scan.

4. Clinicians should use non-invasive management strategies in hemodynamically stable patients with renal injury. (*Standard; Evidence Strength: Grade B*)

Stable patients are defined as those who do not have vital signs consistent with shock and show stable serial hematocrit values over time. Noninvasive management of renal injury, which may consist of close hemodynamic monitoring, bed rest, ICU admission and blood transfusion, avoids unnecessary surgery, decreases unnecessary nephrectomy, and preserves renal function.

5. The surgical team must perform immediate intervention (surgery or angioembolization in selected situations) in hemodynamically unstable patients with no or transient response to resuscitation. (*Standard; Evidence Strength: Grade B*)

Hemodynamic instability despite resuscitation suggests uncontrolled and ongoing bleeding. Immediate intervention (either open surgery or angioembolization) is warranted for unstable patients to limit the need for future transfusion and prevent life-threatening complications. The goal of operative exploration is to control bleeding first, repair the kidney (when possible), and establish perirenal drainage. Nephrectomy is a frequent result when hemodynamically unstable patients undergo surgical exploration.

Selected patients with bleeding from segmental renal vessels may benefit from angioembolization as a minimally invasive treatment to control bleeding. Patients who are hemodynamically unstable despite active resuscitation should be taken to the operating room rather than angiography.

6. Clinicians may initially observe patients with renal parenchymal injury and urinary extravasation. (*Clinical Principle*)

Parenchymal collecting system injuries often resolve spontaneously. A period of observation without intervention is advocated in stable patients where renal pelvis or proximal ureteral injury is not suspected. When renal pelvis or proximal ureteral avulsion is suspected, prompt intervention is warranted.

7. Clinicians should perform follow-up CT imaging for renal trauma patients having

either (a) deep lacerations (AAST Grade IV-V) or (b) clinical signs of complications (e.g., fever, worsening flank pain, ongoing blood loss, abdominal distention). (*Recommendation; Evidence Strength: Grade C*)

Follow-up CT imaging (after 48 hours) is prudent in patients with deep renal injuries (AAST Grade IV-V) because these are prone to developing troublesome complications, such as urinoma or hemorrhage. AAST Grade I-III injuries have a low risk of complications and rarely require intervention;[8] routine follow-up CT imaging is not advised for these injuries.

8. Clinicians should perform urinary drainage in the presence of complications, such as enlarging urinoma, fever, increasing pain, ileus, fistula or infection. (*Recommendation; Evidence Strength: Grade C*) Drainage should be achieved via ureteral stent and may be augmented by percutaneous urinoma drain, percutaneous nephrostomy or both. (*Expert Opinion*)

A ureteral stent is minimally invasive and alone may provide adequate drainage of the injured kidney. Clinicians must make adequate provision to ensure removal of stent in follow-up. A period of concomitant Foley catheter drainage may minimize pressure within the collecting system and enhance urinoma drainage. If follow-up imaging demonstrates a urinoma increasing in size, purulence, or complexity, a percutaneous drain may also be necessary.

Ureteral Trauma

9a. Clinicians should perform IV contrast enhanced abdominal/pelvic CT with delayed imaging (urogram) for stable trauma patients with suspected ureteral injuries. (*Recommendation; Evidence Strength: Grade C*)

Ureteral injuries should be suspected in complex, multisystem abdominopelvic trauma patients, such as those with bowel, bladder, or vascular injuries; in those with complex pelvic/vertebral fractures; after rapid deceleration injuries; and when the trajectory of the penetrating injury is near the ureter, especially with high velocity gunshot wounds.[9] Absence of hematuria cannot be relied upon to exclude ureteral injury.[10] In stable patients not proceeding directly to exploratory laparotomy, IV enhanced abdominal/pelvic CT with 10 minute delayed images should be obtained to evaluate for ureteral injury.

9b. Clinicians should directly inspect the ureters during laparotomy in patients with suspected ureteral injury who have not had preoperative imaging. (*Clinical Principle*)

Direct ureteral inspection is necessary in patients suspected to have ureteral injury who proceed directly to laparotomy without adequate radiographic staging. Adjunctive maneuvers to identify ureteral injuries include careful ipsilateral ureteral mobilization and/or IV or intraureteral injectable dyes, such as methylene blue or indigo carmine. Retrograde pyelography may be performed in equivocal cases when possible.

10a. Surgeons should repair traumatic ureteral lacerations at the time of laparotomy in stable patients. (*Recommendation; Evidence Strength: Grade C*)

Ureteral repair should be performed at the time of initial laparotomy, when possible, though immediate repair may not be appropriate in unstable, complex polytrauma patients.

10b. Surgeons may manage ureteral injuries in unstable patients with temporary urinary drainage followed by delayed definitive management. (*Clinical Principle*)

In damage control settings when immediate ureteral repair is not possible, urinary extravasation can be prevented with ureteral ligation followed by percutaneous nephrostomy tube placement or with an externalized ureteral catheter secured to the proximal end of the ureteral defect. Definitive repair of the injury should be performed when the patient's clinical situation has improved/stabilized.

10c. Surgeons should manage traumatic ureteral contusions at the time of laparotomy with ureteral stenting or resection and primary repair depending on ureteral viability and clinical scenario. (*Expert Opinion*)

Ureteral contusion is not uncommon in the context of a gunshot wound with blast injury; complications may include delayed ureteral stricture and/or overt ureteral necrosis with urinary extravasation. Thus, when identified during laparotomy, intact but contused ureters should be primarily managed with ureteral stenting; resection with primary repair may be performed in selected instances, depending on the severity of the contusion and the viability of local tissues.

11a. Surgeons should attempt ureteral stent placement in patients with incomplete ureteral injuries diagnosed postoperatively or in a delayed setting. (*Recommendation; Evidence Strength: Grade C*)

When an incomplete ureteral injury is first unrecognized or presents in a delayed fashion, retrograde ureteral imaging with ureteral stent placement should be performed initially.[11–13] Immediate repair can be considered in certain situations if the injury is recognized within one week (e.g., injury located near a surgically closed viscus, such as bowel or vagina, or if the patient is being re-explored for other reasons).

11b. Surgeons should perform percutaneous nephrostomy with delayed repair as needed in patients when stent placement is unsuccessful or not possible. (*Recommendation; Evidence Strength: Grade C*)

When the ureter is completely transected or otherwise cannot be cannulated in a retrograde fashion or if patient instability precludes attempts at retrograde treatment, a percutaneous nephrostomy tube should be placed. If nephrostomy alone does not adequately control the urine leak, options then include placement of a periureteral drain or immediate open ureteral repair.[11–14]

12a. Surgeons should repair ureteral injuries located proximal to the iliac vessels with primary repair over a ureteral stent, when possible. (*Recommendation; Evidence Strength: Grade C*)

When the ureter is transected above the iliac vessels, a spatulated, tension-free primary ureteral repair over a ureteral stent is advisable after all non-viable ureteral tissue has been judiciously debrided. In situations where the anastomosis cannot be performed without tension, mobilization of the ureter should be performed in a manner that preserves maximal ureteral blood supply. If an anastomosis can still not be performed after mobilization, a ureteral reimplantation can be attempted incorporating ancillary maneuvers such as a downward nephropexy, bladder psoas hitch and/or Boari bladder flap.

12b. Surgeons should repair ureteral injuries located distal to the iliac vessels with ureteral reimplantation or primary repair over a ureteral stent, when possible. (*Recommendation; Evidence Strength: Grade C*)

When the ureter is injured below the iliac vessels, the distal ureter may be healthy enough to perform a simple ureteroureterostomy in select situations, although the surgeon should defer to direct ureteral reimplantation if there is any doubt about the segment's viability. Tension-free reimplantation may require ancillary maneuvers, such as a bladder mobilization with psoas hitch or flap.

13a. Surgeons should manage endoscopic ureteral injuries with a ureteral stent and/or percutaneous nephrostomy tube, when possible. (*Recommendation; Evidence Strength: Grade C*)

When a ureteral injury occurs during ureteral endoscopy, a ureteral stent should be placed. If placement of a ureteral stent is not possible or if stent placement fails to adequately divert the urine, then a percutaneous nephrostomy tube should be placed with or without a periureteral drain. Delayed ureteral reconstruction is often necessary.[12]

13b. Surgeons may manage endoscopic ureteral injuries with open repair when endoscopic or percutaneous procedures are not possible or fail to adequately divert the urine. (*Expert Opinion*)

Open or laparoscopic repair of endoscopic ureteral injuries, using techniques and principles mentioned above, is necessary when endoscopic attempts at diverting the urine fail.[11,14]

Bladder Trauma

14a. Clinicians must perform retrograde cystography (plain film or CT) in stable patients with gross hematuria and pelvic fracture. (*Standard; Evidence Strength: Grade B*)

Gross hematuria is the most common indicator of bladder injury.[15–18] Pelvic fracture is the most common associated injury with bladder rupture;[15,19] however, pelvic fracture alone does not warrant radiologic evaluation of the bladder.[18] Bladder injury is present in 29% of the patients presenting with the combination of gross hematuria and pelvic fracture; therefore, gross hematuria occurring with pelvic fracture is considered an absolute indication for retrograde cystography to evaluate for the presence of bladder injury.[15]

14b. Clinicians should perform retrograde cystography in stable patients with gross hematuria and a mechanism concerning for bladder injury, or in those with pelvic ring fractures and clinical indicators of bladder rupture. (*Recommendation; Evidence Strength: Grade C*)

Although the majority of bladder ruptures ($\geq$90%) will present with gross hematuria in the setting of a pelvic ring fracture, a number of other clinical scenarios should warrant retrograde cystography to evaluate for bladder injury.[15] A limited number of pelvic fracture patients with bladder injuries will present with microscopic hematuria (0.6-5.0%).[15,20] In general, microscopic hematuria combined with pelvic fracture is not an indication for radiologic evaluation, but may be warranted in select cases with other clinical indicators of bladder rupture, such as low urine output, abdominal distension, inability to void, suprapubic (SP) pain, or altered mental status.[15,19,20]

15. Surgeons must perform surgical repair of intraperitoneal bladder rupture in the setting of blunt or penetrating external trauma. (*Standard; Evidence Strength: Grade B*)

Intraperitoneal bladder ruptures must be surgically repaired.[15–18,21] Intraperitoneal ruptures caused by blunt external trauma tend to be large "blow-out" injuries located in the dome of the bladder and are unlikely to heal spontaneously with catheter drainage alone. Penetrating injuries with intraperitoneal components have smaller

injuries but must be repaired as well. Failure to repair intraperitoneal bladder injuries can result in translocation of bacteria from the bladder to the abdominal cavity resulting in peritonitis, sepsis, and other serious complications.

16. Clinicians should perform catheter drainage as treatment for patients with uncomplicated extraperitoneal bladder injuries. (*Recommendation; Evidence Strength: Grade C*)

Uncomplicated extraperitoneal bladder injuries can be managed using urethral Foley catheter drainage with the expectation that the injury will heal with conservative management.[17,18,21] Leaving the Foley catheter in place two to three weeks is standard, although it is acceptable to leave the Foley catheter in longer. Cystography is advised to confirm complete bladder healing prior to catheter removal.

17. Surgeons should perform surgical repair in patients with complicated extraperitoneal bladder injury. (*Recommendation; Evidence Strength: Grade C*)

Complicated extraperitoneal bladder ruptures should be surgically repaired in the standard fashion to avoid prolonged sequelae from the injury. Pelvic fractures that result in exposed bone spicules in the bladder lumen should be repaired with removal of the exposed bone and closure of the bladder. Concurrent rectal or vaginal lacerations may lead to fistula formation to the ruptured bladder, and in this setting the extraperitoneal bladder rupture should be fixed. Bladder neck injuries may not heal with catheter drainage alone and repair should be considered. Bladder repair is advised in pelvic fracture patients having open reduction internal fixation procedures.

18. Clinicians should perform urethral catheter drainage without suprapubic (SP) cystostomy in patients following surgical repair of bladder injuries. (*Standard; Evidence Strength: Grade B*)

A number of studies have shown no advantage of combined SP and urethral catheterization over urethral catheterization alone after repair of bladder injuries. Urethral catheters have been shown to adequately drain the repaired bladder and result in shorter hospital stay and lower morbidity.[15]

There are clinical exceptions in which suprapubic tubes may be considered (e.g., patients requiring long-term catheterization, those immobilized due to orthopedic injuries, and complex bladder repairs with tenuous closures or significant hematuria).

Urethral Trauma

19. Clinicians should perform retrograde urethrography in patients with blood at the urethral meatus after pelvic trauma. (*Recommendation; Evidence Strength: Grade C*)

Given concerns for urethral injury, clinicians should perform retrograde urethrography after pelvic or genital trauma when blood is seen at the urethral meatus.[22] The retrograde urethrogram may demonstrate partial or complete urethral disruption, providing guidance for how to best manage bladder drainage in the acute setting. Blind catheter passage prior to retrograde urethrogram should be avoided.

20. Clinicians should establish prompt urinary drainage in patients with pelvic fracture associated urethral injury. (*Recommendation; Evidence Strength: Grade C*)

Patients with pelvic fracture urethral injury are often unable to urinate due to their injuries.[23] Because trauma resuscitations typically involve aggressive hydration and a critical need to closely monitor patient volume status, clinicians should establish efficient and prompt urinary drainage in the acute setting. For polytrauma patients with complete urethral injuries, immediate SPT placement (percutaneously or via open technique) is advised.

21. Surgeons may place suprapubic tubes in patients undergoing open reduction internal fixation for pelvic fracture. (*Expert Opinion*)

The management of PFUI requires close coordination with orthopedic surgeons to optimize timing of interventions. In such cases, concerns regarding the use of SPT in patients undergoing open reduction and internal fixation of the pubic symphysis vary based on individual surgeon and institutional practice patterns. No evidence exists to indicate that SPT insertion increases the risk of orthopedic hardware infection.[24] Thus considerations of the urethral injury and its management should dictate the use of SPT.

22. Clinicians may perform primary realignment (PR) in hemodynamically stable patients with pelvic fracture associated urethral injury. *(Option; Evidence Strength: Grade C*) Clinicians should not perform prolonged attempts at endoscopic realignment in patients with pelvic fracture associated urethral injury. (*Clinical Principle*)

The first priority in management of PFUI is establishment of urinary drainage. SPT and delayed urethral reconstruction remains the accepted treatment for the vast majority of cases. Patients undergoing PR of PFUI may have less severe urethral strictures when compared to patients undergoing SP diversion alone.[25,26]

Although the indications, benefits, and methods of PR remain debatable, attempts at PR should be reserved for hemodynamically stable patients

within the first few days after injury.[27] The technique may require two urologists to navigate the urethra simultaneously from above and below with multiple flexible or rigid cystoscopes, video monitors, and fluoroscopy. Prolonged attempts at endoscopic realignment must be avoided as the process may increase injury severity and long-term sequelae, delay other medical services the patient requires, and has not been shown to improve long-term outcomes. Whether endoscopic realignment is successfully performed or not, patients with PFUI are at high risk for developing urethral stricture; therefore, after PR it is prudent to maintain SPT drainage concomitantly while awaiting resolution of PFUI.

23. Clinicians should monitor patients for complications (e.g., stricture formation, erectile dysfunction, incontinence) for at least one year following urethral injury. (*Recommendation; Evidence Strength: Grade C*)

PFUI is associated with high rates of urethral stricture formation and erectile dysfunction, while only small numbers of men will report urinary incontinence.[23,28] Rates of stricture after PFUI will vary based on injury severity and management with PR or SPT, but in either scenario, stricture in most cases develops within a year of injury and can be treated by urethroplasty or direct vision internal urethrotomy.[29,30] Thus surveillance strategies with uroflowmetry, retrograde urethrogram, cystoscopy, or some combination of methods are recommended for the first year after injury. Impotence and incontinence are generally considered to be caused by the pelvic fracture itself rather than contemporary interventions for PFUI.[31,32]

24. Surgeons should perform prompt surgical repair in patients with uncomplicated penetrating trauma of the anterior urethra. (*Expert Opinion*)

After a penetrating trauma to the anterior urethra has been appropriately staged, surgical repair should be performed. It is expert opinion that spatulated primary repair of uncomplicated injuries in the acute setting offers excellent outcomes superior to delayed reconstruction. Primary repair should not be undertaken if the patient is unstable, the surgeon lacks expertise in urethral surgery or in the setting of extensive tissue destruction or loss.

25. Clinicians should establish prompt urinary drainage in patients with straddle injury to the anterior urethra. (*Recommendation; Evidence Strength: Grade C*)

Crush injuries of the bulbar urethra caused by straddle injury require prompt intervention to avoid urinary extravasation.[33] Establishing urinary drainage by SPT, or PR in less severe cases, requires consideration of associated injuries, severity of the disruption, degree of bladder distension, and availability of urological expertise and endoscopic instrumentation. Immediate operative intervention to repair or debride the injured urethra is contraindicated due to the indistinct nature of the injury border. Stricture formation after straddle injury is likely and all patients undergoing urinary diversion require follow-up surveillance using uroflowmetry, retrograde urethrogram and/or cystoscopy.[34]

Genital Trauma

26. Clinicians must suspect penile fracture when a patient presents with penile ecchymosis, swelling, cracking or snapping sound during intercourse or manipulation and immediate detumescence. (*Standard; Evidence Strength: Grade B*)

Penile swelling and ecchymosis are the most common signs of penile fracture. Most patients report a cracking or snapping sound followed by immediate detumescence. Other symptoms may include penile pain and penile angulation. History and physical examination alone are often diagnostic in these patients.

27. Surgeons should perform prompt surgical exploration and repair in patients with acute signs and symptoms of penile fracture. (*Standard; Evidence Strength: Grade B*)

In patients with history and physical signs consistent with penile fracture, surgical repair should be performed. The repair is performed by exposing the injured corpus cavernosum through either a ventral midline or circumcision incision. Tunical repair is performed with absorbable suture and should be performed at the time of presentation to improve long-term outcomes.[35–38]

28. Clinicians may perform ultrasound in patients with equivocal signs and symptoms of penile fracture. (*Expert Opinion*)

Patients with equivocal signs of penile fracture may undergo imaging as an adjunct study to assist with confirmation or exclusion of the diagnosis of penile fracture.[39] Ultrasound is the most commonly used imaging modality due to wide availability, low cost, and rapid examination times.[38,40,41] If imaging is equivocal or diagnosis remains in doubt, surgical exploration should be performed.

29. Clinicians must perform evaluation for concomitant urethral injury in patients with penile fracture or penetrating trauma who present with blood at the urethral meatus, gross hematuria or inability to void. (*Standard; Evidence Strength: Grade B*)

Patients with penile fracture and gross hematuria, blood at the urethral meatus, or inability to void should undergo evaluation for concomitant urethral injury.[42–44] An additional risk factor is bilateral

corporal body fracture.[35,45,46] Options for evaluation include urethroscopy and retrograde urethrogram.[39,47] Neither method is superior for diagnosis. The choice of retrograde urethrogram or cystoscopy is the decision of the urologist based on equipment availability and procedure timing.

30. Surgeons should perform scrotal exploration and debridement with tunical closure (when possible) or orchiectomy (when non-salvagable) in patients with suspected testicular rupture. (*Standard; Evidence Strength: Grade B*)

Testicular rupture after blunt or penetrating scrotal injuries may be suggested by scrotal ecchymosis and swelling or difficulty in identifying the contours of the testicle on physical exam. The most specific findings on ultrasonography are loss of testicular contour and heterogenous echotexture of parenchyma, which should prompt testicular repair.[48] Repair of the ruptured testis by debriding non-viable tissue and closing the tunica albuginea is preferred when possible.[49,50] Expert opinion is that tunica vaginalis grafts may be used to provide closure when the tunica albuginea cannot be closed primarily. For penetrating scrotal injuries, immediate exploration with debridement and repair is encouraged to prevent complications.

31. Surgeons should perform exploration and limited debridement of non-viable tissue in patients with extensive genital skin loss or injury from infection, shearing injuries, or burns (thermal, chemical, electrical). (*Standard; Evidence Strength: Grade B*)

Initial management in these patients should include operative exploration, irrigation, and limited debridement of clearly non-viable tissue. Typically, these injuries require multiple procedures in the operating room prior to definitive reconstructive procedures. Wound management can include a variety of methods including gauze dressings with frequent changes, silver sulfadiazine or topical antibiotic and occlusive dressing, or negative pressure dressings. Reconstructive techniques for definitive repair include primary closure and advancement flaps, placement of skin grafts, free tissue flaps, and pedicle based skin flaps.

32. Surgeons should perform prompt penile replantation in patients with traumatic penile amputation, with the amputated appendage wrapped in saline-soaked gauze, in a plastic bag and placed on ice during transport. (*Clinical Principle*)

Urologists should perform reanastomosis of macroscopic structures, including the corpora cavernosa, spatulated repair of the urethra, and skin, when the amputated penis is available. A microvascular surgeon should be consulted whenever possible to perform microscopic repair of dorsal arteries, veins, and nerves. The amputated appendage should be transported to the hospital in a two-bag system with the penis wrapped in saline-soaked gauze, placed in a plastic bag, and then placed on ice in a second bag.

Conflict of Interest Disclosures

All panel members completed COI disclosures. Relationships that have expired (more than one year old) since the panel's initial meeting, are listed. Those marked with (C) indicate that compensation was received; relationships designated by (U) indicate no compensation was received. **Consultant or Advisor: Jeffrey M. Holzbeierlein:** Janssen (C); **Allen F. Morey, MD:** American Medical Systems (C); **Meeting Participant or Lecturer**: **Steven B. Brandes, MD:** American Medical Systems (C), Astellas (C); **Jeffrey M. Holzbeierlein, MD:** Janssen (C), Amgen (C); **Allen F. Morey, MD:** American Medical Systems (C), Glaxo Smith Kline (C), Coloplast (C), Pfizer (C) (Expired); **Hunter Wessells, MD:** National Institutes of Health **Scientific Study or Trial: Steven Benjamin Brandes, MD:** Allergan (U); **Joshua A. Broghammer, MD:** Trauma Urologic Reconstructive Network (U), **Hunter Wessells, MD:** National Institutes of Health (U); **Other: Joshua A. Broghammer, MD:** American Medical Systems (C); **Hunter Wessells, MD:** National Institutes of Health (U).

Disclaimer

This document was written by the Urotrauma Guidelines Panel of the American Urological Association Education and Research, Inc., which was created in 2013. The Practice Guidelines Committee (PGC) of the AUA selected the committee chair. Panel members were selected by the chair. Membership of the committee included urologists and other clinicians with specific expertise on this disorder. The mission of the committee was to develop recommendations that are analysis-based or consensus-based, depending on Panel processes and available data, for optimal clinical practices in the treatment kidney stones.

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While these guidelines do not necessarily establish the standard of care, AUA seeks to recommend and to encourage compliance by practitioners with current best practices related to the condition being treated. As medical knowledge expands and technology advances, the guidelines will change. Today

these evidence-based guidelines statements represent not absolute mandates but provisional proposals for treatment under the specific conditions described in each document. For all these reasons, the guidelines do not pre-empt physician judgment in individual cases.

Treating physicians must take into account variations in resources, and patient tolerances, needs, and preferences. Conformance with any clinical guideline does not guarantee a successful outcome. The guideline text may include information or recommendations about certain drug uses ('off label') that are not approved by the Food and Drug Administration (FDA), or about medications or substances not subject to the FDA approval process. AUA urges strict compliance with all government regulations and protocols for prescription and use of these substances. The physician is encouraged to carefully follow all available prescribing information about indications, contraindications, precautions and warnings. These guidelines and best practice statements are not in-tended to provide legal advice about use and misuse of these substances.

Although guidelines are intended to encourage best practices and potentially encompass available technologies with sufficient data as of close of the literature review, they are necessarily time-limited. Guidelines cannot include evaluation of all data on emerging technologies or management, including those that are FDA-approved, which may immediately come to represent accepted clinical practices.

For this reason, the AUA does not regard technologies or management which are too new to be addressed by this guideline as necessarily experimental or investigational.

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