

# Injuries to the kidneys, ureter, ureter, testicles

Urological injuries account for about 1-5% of all injuries and are 3 times more common in men than in women.

## Kidney injuries

The kidney is the most frequently injured urogenital organ and its injury is **associated with injuries to other abdominal organs** in up to 10% of cases. Injuries can be divided into blunt and penetrating injuries.

**Blunt injuries** (80-95%) include **car accidents** (up to half of all blunt injuries, half of which are motorcycle accidents), including injuries to cyclists and pedestrians, falls, sports injuries, and violent injuries. In car accidents, the kidney is most often injured by frontal impact with the steering wheel or seat belts. Airbags reduce injuries in up to half of the cases. The main mechanism in crashes is **deceleration** (sudden reduction of speed), where blunt damage to the hilar vessels and occlusion of the renal artery can occur.<sup>[1][2]</sup>

**Penetrating injuries** (5-20%) are most often caused by **gunshot or stab wounds**. Gunshot wounds are unpredictable and often result in total destruction of tissues and surroundings. In war, kidney injuries are one of the most common injuries to the uropoietic system. In contrast, stab wounds can now often be treated by reconstruction.<sup>[1][2]</sup>

## Classification

Currently, AAST-defined criteria based on CT scanning are used because they best reflect the prediction of postoperative mortality and morbidity. Based on this score, a decision is made about possible nephrectomy.<sup>[1]</sup>

Degree	criteria
1.	Contusion or non-expanding subcapsular hematoma, without laceration
2.	Non-expanding perirenal hematoma, cortical laceration < 1 cm, no urine extravasation
3.	Cortical laceration > 1 cm, without urine extravasation
4.	Corticomedullary laceration with KPS damage, segmental vessel damage, partial vessel laceration, thrombosis
5.	Shattered kidney, vascular hilum avulsion

## Diagnostic

**A good history taking from the patient**, witnesses or the ambulance crew is essential for further diagnosis. Data on **haematuria**, records of loss of consciousness and the circumstances or mechanism of injury are important. The speed of the decision-making process is significantly affected by the presence of a solitary kidney (functionally or anatomically), instability of the cardiovascular circulation.<sup>[1][2]</sup>

On physical examination we mainly note **haematuria**, lumbalgia, changes in temperature, blood pressure and respiratory rate - **signs of circulatory instability**. While penetrating trauma may be apparent at first glance, indirect signs such as rib fractures, abdominal resistance (défense) or hematoma in the genital and perineal areas (pelvic injuries should also be considered) **may point to a covered injury**.<sup>[1][2]</sup>

The most important laboratory tests are **hemoglobin level**, **creatinine**, urine chemistry, urinary sediment. The creatinine level is important for forensic reasons - it corresponds to renal functions at the time before the injury occurred.<sup>[1][2]</sup>

**Ultrasound examination** is the first choice method as it is cheap, accessible and allows assessment of the surrounding organs. However, **it does not provide a good assessment of the depth and severity of the laceration**. Macroscopic haematuria and the deceleration mechanism of injury are absolute indications for **CT scanning**, which is always performed with intravenous administration of contrast medium. Imaging is performed in three phases (arterial, venous, excretory). **CT scanning is an essential part of staging** according to AAST. Intravenous excretory urography is replaced by CT scanning, but can be performed perioperatively in acute surgery of unstable patients to assess the vitality of the contralateral kidney (i.e., where a CT scan cannot be performed directly). MRI is a lengthy examination and only indicated in a patient with a known prior allergy to the contrast agent.<sup>[1][2]</sup>

## Treatment

Treatment decisions depend on several factors:<sup>[2]</sup>

- type, mechanism and classification of injuries
- circulatory stability of the patient
- presence of shock
- palpable pulsating hematoma

- Associated sepsis

### Conservative treatment

Blunt injuries (1st and 2nd degree) are usually treated conservatively. Patients with findings of micro/macrohematuria are usually admitted to the ICU. In addition to vital signs, hemoglobin and creatinine levels are monitored. ATB therapy and permanent catheter are introduced. <sup>[1]</sup>

The assessment of gunshot and stab wounds is strictly **individual**; if they are not indicated for surgical revision, they can be treated endoscopically by inserting a ureteral stent and a permanent catheter. <sup>[1]</sup>

### Angiography with embolisation

The development of interventional radiology makes it possible to guide **selective embolization** in hemodynamically stable patients with AAST grade 3 or higher. This procedure is an alternative to open revision. It is possible to perform angiography followed by closure of the bleeding vessels. Embolization can also be performed perioperatively in the management of an expanding perirenal hematoma. The renal artery can also be embolized in unstable patients prior to indicated nephrectomy. <sup>[1]</sup>

### Surgical treatment

Indication for surgery is **hemodynamic instability**, suspected injury of other abdominal/thoracic organs, expanding pulsating hematoma, AAST grade 5. <sup>[1]</sup>

The approach is virtually always transperitoneal and the goal should be a **salvage procedure**. The operative revision consists of hilar vessel control, intersection of Gerota's fascia, emptying of the perirenal hematoma (unless it is an incidental finding), aspiration and suture, and parenchymal control with drainage of the operative field. <sup>[1]</sup>

Kidney reconstruction is feasible in 90% of cases. With multiple lacerations, a special stabilization mesh (PDS mesh) can be used. Nephrectomy is the method of choice especially in cases of devastating injuries, which are not so common - firearms, stab wounds, severe car accidents. Most stab wounds can now be treated with reconstruction instead of nephrectomy. <sup>[1]</sup>

## Complications

The risk of complications increases with the degree of kidney injury. Scintigraphic examination can be performed to assess renal function (e.g. to assess the success of reconstruction). If bleeding is suspected (decreasing haemoglobin level), in patients with temperature or significant pain, a repeat CT scan is necessary. The outpatient examination consists of urine and sediment collection and chemical examination, measurement of BP and creatinine values.. <sup>[1]</sup>

- **early complications** - continued bleeding, urinoma, retroperitoneal abscess, sepsis
- **late complications** - hypertension, hydronephrosis, concrements, A-V fistulas <sup>[2]</sup>

## Injury to the ureter

Ureteral injuries are relatively rare and constitute only a minor part of uropoietic tract injuries. The ureters are relatively mobile and are located in the retroperitoneum, where they are protected. They are most often damaged **iatrogenically** - during gynaecological procedures (close relation of the ureter to the a. uterina, parametrium), radiotherapy, procedures in the small pelvis and urological endoscopic procedures. In such cases, the distal part of the ureter is usually damaged. Other causes include less common gunshot wounds and blunt trauma after car accidents. Here, injuries to the proximal parts of the ureters tend to dominate. Risk factors include neoplastic processes, previous ureteral surgery, diverticulitis, endometriosis or anatomical abnormalities. Injury may range from a simple contusion or traumatic angulation to partial to complete laceration, excision or poorly placed ligature. Prevention can be the insertion of a catheter before surgery for better perioperative protection and orientation of the surgeon, or cystoscopic control before/after gynecological surgery. <sup>[1]</sup>

## Diagnostic

If detection does not occur during the operation, **detection may be difficult**. Hematuria occurs in only 50-75% of cases. Perioperatively, ureteral injury can be verified by intravenous application of a dye (indocarmine). Late signs include lumbalgia, hematuria, temperature, creatinine elevation, sepsis. Sonography may indicate a possible injury. Definitive evidence of injury can be demonstrated on CT scan in the excretory phase using a contrast agent. Ascending uretero(pyelo)graphy can be added to complete the information about the site of injury.. <sup>[1][2]</sup>

## Classification

Classification according to AAST: <sup>[2]</sup>

degree	criteria
1.	hematoma
2.	laceration < 50% of the circumference
3.	laceration > 50% of the circumference
4,	avulsions, < 2 cm devascularization
5.	avulsions, > 2 cm devascularization

## Treatment

For grades 1-3 of the AAST classification, it can be solved by simple urinary diversion with a stent or nephrostomy (more complicated injuries). If the problem is detected peroperatively, it can be solved with a stent immediately. Similarly, it is possible to dissolve a poorly established ligature. For grades 4-5 of the AAST classification, reconstructive procedures are preferred, either peroperatively or in the second period after the temporary nephrostomy is established. Proximal injuries can be addressed with a watertight end-to-end anastomosis (ureterorrhaphy). Distal injuries are usually managed by reimplantation. Reimplantation can be created either by tubularization of the bladder mucosa (**Boariplasty**) or by pulling the bladder and fixation to the ipsilateral m. psoas (tutuprost anastomosis) called **psoas hitch**. Losses can be replaced with an intestinal segment or renal autotransplantation. <sup>[1][2]</sup>

## Injuries of the scrotum, testicles

Injuries to the soft structures of the scrotum occur most often after accidents, falls, kicks, being hit by an object, car accidents and being caught by another object (machine, clothing). They account for 30-60% of urological traumas. Injuries can be **closed** or **open**. <sup>[1]</sup>

### Soft tissue injuries of the scrotum

The severity of injuries can range from **contusions to open injuries**. Regardless of the condition, severe **injury to intrascrotal contents** may be present. On physical examination, varying degrees of pain are usually present but may not correlate with the severity of the situation. The tissue may be swollen with the presence of a **hematoma**. If the hematoma is confined to the penis, without spreading to the thighs or lower abdomen, it is localized within Buck's fascia. Otherwise, it is confined to the Colles fascia - spreading to the perineum, scrotum, abdomen. Sometimes hematoma from the lower abdomen may pass to the scrotum and penis secondarily. **The absence of hematoma, swelling and tenderness does not exclude a serious injury**, but it is very unlikely in such a case. In open injury, the presence of blood in the surrounding area often dominates. Urethrorrhagia indicates injury to the urethra. <sup>[1]</sup>

In the diagnosis, we rely on the history of the mechanism of injury. The presence of blood, hematoma, swelling, laterality of disability or pain is suspicious. Urinalysis rules out microhematuria. **A sonographic examination** of the scrotum to assess its contents (to exclude testicular rupture or torsion) is appropriate. If foreign body intrusion is suspected, a CT scan may be necessary. <sup>[1]</sup>

Concussion is treated by resting, padding and local cooling. If necessary, analgesics can be administered. In open wounds, revision is necessary, exclusion of injuries to deeper structures and, depending on the state of contamination, suturing under local anaesthesia with drainage. In case of large loss wounds, a plastic surgeon may be invited. **ATB therapy is always necessary** and it is not a bad idea to check the validity of the tetanus vaccination or to apply the antitoxin straight away.. <sup>[1]</sup>

### Injuries of the testicle and epididymis

Contusion, bleeding into the parenchyma without rupture of the tunica albuginea or rupture of the testicle/epididymis and rarely torsion may occur. The severity of these injuries lies in **the possible loss of the reproductive organ**. Injuries caused by high impact energy - car accidents and gunshot wounds - have the worst prognosis. In particular, the patient reports significant pain, with signs of contusion or penetration at the scrotum. A varying degree of swelling and haematoma is usually present. <sup>[1]</sup>

Diagnosis is again based on the history of the mechanism of injury, clinical manifestations, physical examination and ultrasound. During sonography, it is necessary to assess the integrity of the testicle (violation of the tunica albuginea), the presence of bleeding and exclude rupture. The testicle may bleed into the parenchyma or scrotum (hematocele). In the case of bleeding into the cavum serosum scroti, a blue colouration of the scrotum may be visible at first sight - a translucent haematotheca. A characteristic image is then seen on ultrasound. In the case of a hematocele, it is always necessary to exclude a **testicular rupture**, as this is indicated for surgical revision. <sup>[1]</sup>

**Testicular contusion** (without signs of hematocele) can be treated with rest, cooling, padding, and analgesics. If testicular rupture and haematocoele are suspected, surgical revision and subsequent suture of the vital testis is indicated. In children and adolescents, post-traumatic testicular torsion must be excluded. With devastating injury, orchiectomy may be the only solution. In penetrating injuries, initiation of antibiotic/antibiotic therapy is necessary. Sterile wound coverage is essential. If worsening of the condition can be expected, it is a good idea to have peripheral venous access and monitor vital signs. <sup>[1][2]</sup>

## References

### Related articles

- Injuries of the bladder, urethra

### References

1. HANUŠ, Tomáš a Petr MACEK. *Urologie pro mediky*. V Praze: Univerzita Karlova, nakladatelství Karolinum, 2015. ISBN 978-80-246-3008-3. Str. 33-38, 40-43
2. Prezentace Traumatologie v urologii <https://portal.lf1.cuni.cz/clanek-996-vzdelavaci-program-urologie-1-lf-uk>