



# Management of blunt renal trauma on pre-existing diseased kidneys: a cross-sectional study

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**Introduction:** Pathological kidney trauma is a special entity. Congenital or acquired lesions may interfere with clinical presentation, radiological imaging, and the therapeutic approach.

**Objective:** Our objective was to determine the clinical, radiological, and therapeutic features of this entity.

**Materials and methods:** The medical records of 37 observations were retrospectively collected from January 1992 to February 2022. All cases were explored by a kidney ultrasound and/or a computed tomography scan, and classified according to the American Association of Surgery of Trauma. Pre-existing renal abnormalities were found in 37 patients among 203 (18.2%). The most common underlying lesion were urolithiasis (37.8%) followed by pyelo-ureteral junction syndrome (32.4%). Surgical abstention was decided in 11 cases, four nephrectomies were performed as a matter of urgency, and seven nephrectomies were performed remotely. The cure of uropathy was performed after an average delay of 3 months.

**Conclusion:** Kidneys with underlying pathology are habitually more susceptible to trauma. Contusions are often benign contrasting with a high nephrectomy rate.

**Keywords:** kidney, nephrectomy, trauma, uropathy

## Introduction

Kidney injuries are common, occurring in 10% of all abdominal injuries<sup>[1]</sup>. Pre-existing renal lesions (PERL) associated with traumatic injuries increase the risk of renal injury, and these abnormal kidneys are easily injured, even with relatively minor blunt trauma<sup>[1]</sup>. The aim of this study was to evaluate the PERL found incidentally during the diagnosis for blunt renal trauma, and determine the clinical, radiological, and therapeutic specificities of this entity.

## Materials and methods

It was a retrospective, descriptive study conducted in a single tertiary care center. Institutional Review Board approval was

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## HIGHLIGHTS

- Pathological kidney trauma is a special entity. Congenital or acquired lesions may alter the clinical presentation and management causing misdiagnosis.
- The rate of success of the nonoperative approach with blunt trauma on pathological kidneys is more important, considering the underlying uropathy.
- Blunt trauma on pathological kidneys may raise a medico-legal issue, about the causality of renal function alteration, trauma, and pre-existing uropathy.

obtained (CEBM.EPS.HR/07/2023). Our data has been reported in line with the strengthening the reporting of cohort, cross-sectional and case-control studies in Surgery (STROCSS) Criteria<sup>[2]</sup>. In this study, the authors confirmed that all methods were carried out under the relevant guidelines and regulations (Helsinki Declaration) under the research registry number 8035.

Medical records of 37 observations were retrospectively collected over a 29-year period from January 1992 to February 2022. The diagnosis of renal injury was confirmed in all the patients by an ultrasound examination followed by an abdominal computed tomography (CT) scan with intravenous contrast. The severity of renal injury was classified according to the kidney injury scale of the American Association for the Surgery of Trauma<sup>[3]</sup>.

The management of renal trauma was adapted to the clinical presentation and severity of kidney damage. Patients with hemodynamic instability refractory to blood transfusion and resuscitative measures underwent emergent nephrectomy. Those with persistent bleeding (hematuria and/or increasing hematoma size) underwent embolization. In case of rupture of the urinary tract, urine drainage was performed with a JJ stent or

nephrostomy. Nonoperative treatment was performed for patients with minor trauma, stable, or stabilized. A delayed CT scan was performed for all patients, at an average of 3 months, in order to assess the evolution of kidney damage and plan the cure of the underlying uropathy.

## Results

Out of 203 patients, pre-existing kidney abnormalities were found in 37 (18.2%). There were 29 men (78.3%) and 8 women who sustained blunt renal trauma in an almost 3.6:1 sex ratio. The mean patient age was 30 years (11–80). The most common cause of blunt renal injuries was falls (14 cases) and sports (13 cases), followed by motor vehicle accidents (5 cases) and abuse or assault (4 cases). According to the classification of the American Association for the Surgery of Trauma (AAST), the lesions grade I (40.5%), were the most frequent (Fig. 1).

The most common underlying lesions were in order of frequency (shown in Table 1): non obstructive urolithiasis (37.8%) (shown in Fig. 2), ureteropelvic junction syndrome (32.4%), renal ectopia (13.5%) (shown in Fig. 3), an isolated case of renal tumor, transplanted kidney, cystic kidney, megaureter, renal aneurysm, and bilateral hydronephrosis on a neurological bladder.

Four patients had an acute hemorrhagic shock that was resistant to intensive care and transfusion, two of them had a grade IV renal trauma, the other two patients had grade V trauma with complete avulsion of the renal pedicle. Those four patients had nephrectomy emergently. Embolization was performed for a patient with a renal aneurysm revealed by an arteriography for persistent hematuria with deglobalization on a renal trauma grade IV.

Furthermore, four patients presented with a rupture of the urinary tract upon an ureteropelvic junction syndrome in two cases, requiring a nephrostomy tube, the other two patients had urolithiasis with hydronephrosis, requiring a double J stenting.

After discharge from the first hospitalization, a delayed CT scan was performed for all patients at an average of 12 weeks in order to assess the evolution of post-traumatic disorders and to

plan the management of the underlying injuries and uropathy. Twenty-two patients were operated on after an average delay of 3 months with extremes ranging from 7 days to 6 months. Patients who underwent delayed surgery, in our department, had: seven nephrectomies (an enlarged total nephrectomy for kidney cancer and six for kidney destroyed on lithiasis or the ureteropelvic junction), a pyeloplasty was performed in eight cases, pyelolithotomy in three cases, percutaneous nephrolithotomy in two cases and a ureteroscopy in two cases. Stones were also treated with extracorporeal shock wave lithotripsy in two cases.

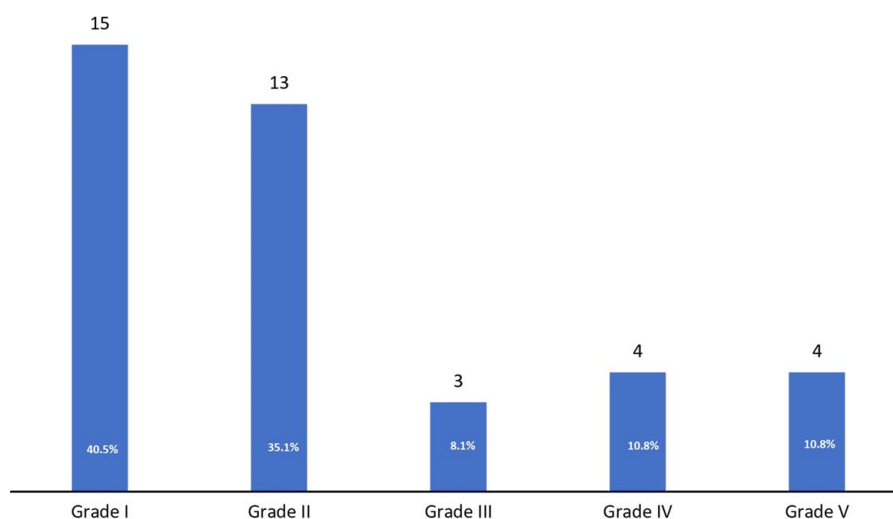
In two cases, renal trauma revealed a left pelvic ectopic kidney with spontaneous restitutio ad integrum after nonoperative treatment. However, 11 patients were successfully managed nonoperatively with no active intervention for the trauma.

At last follow-up, all patients were normotensive with a normal urinalysis and serum creatinine levels. The traumatized kidney was preserved in 26 of 37 (70.2%) patients.

## Discussion

The blunt trauma of pathological kidneys represents a particular clinical form. It occurs in ~1–5% of all trauma cases<sup>[3]</sup>. Its incidence is ~4.9 per 100 000<sup>[4]</sup>. The affected population is most often young (median age between 20 and 30 years) and male sex<sup>[4]</sup>. Children have an increased risk of renal injuries from blunt trauma owing to the relatively increased renal size (beyond the rib cage), its mobility, and its lower position, which means that the kidney in children is less protected compared to the adult<sup>[5]</sup>. Furthermore, the relatively high rate of renal trauma with pre-existing kidney disease in the pediatric population could be explained by the increased frequency of malformative uropathies at this age<sup>[5]</sup>.

When trauma occurs in the pathological kidney, obstructive cause is mostly found. The two most frequent diagnoses reported in the literature are urolithiasis and the ureteropelvic junction syndrome<sup>[3]</sup>, they alone account for 70.2% of patients in our series.



**Figure 1.** Repartition of American Association of Surgery of Trauma grades in our study.

**Table 1**  
**Renal abnormalities of the 37 patients**

Condition	Number of cases
Renal stones	14
Ureteropelvic junction syndrome	12
Ectopic kidney	5
Renal cyst	1
Megaureter	1
Renal cancer	1
Renal graft	1
Renal aneurysm	1
Neurologic bladder with bilateral hydronephrosis	1

Blunt kidney trauma results, in order of decreasing frequency, from motor or vehicle accidents, contact sports, falls, occupational accidents, or assaults<sup>[4]</sup>.

A CT scan of the abdomen is the most sensitive radiological staging technique that assesses injuries of the kidney, the excretory system, and the other abdominal organs. It has therefore become the gold standard in the workup of blunt renal trauma<sup>[6]</sup>. If a CT scan is not available, intravenous urography may be used. However, it will accurately stage only 60–85% of renal injuries, and provide no information on other possibly injured abdominal organs<sup>[6]</sup>. Nevertheless, trauma to a kidney with a pre-existing lesion often presents with complex and confusing imaging features<sup>[7]</sup>.

Bahloul<sup>[8]</sup> reported that the frequency of PERL on blunt renal trauma was 22% (34 patients out of 156) with an underlying uropathy dominated by renal lithiasis (44%), and ureteropelvic junction syndrome (29%). Giannopoulos<sup>[9]</sup>, out of 675 kidney contusions, has found 24 patients (3.5%) with PERL (dominated by urolithiasis, 12 cases). Prieto Chaparro reported 13 PERL out of 112 renal trauma (11.6%).

In our study, blunt renal trauma revealed a significant incidence of kidneys having a pre-existing pathology (18.2%) (shown in Table 2).

The AAST has developed a classification including V grades based on CT scan findings<sup>[2]</sup>. This classification has become the best predictor of surgical exploration. Thus, the V grades have a nephrectomy rate of around 80% according to studies<sup>[2]</sup>.

Bahloul<sup>[8]</sup> reported that minor injuries on pathological kidney, occurred during low violent shocks such as home or work falls; it was for most of grades I and II (88%). Shariat<sup>[3]</sup> reported that minor injuries (grades I, II, and III of the AAST classification) account for 70–90% of all closed kidney injuries. Our study did not present a different conclusion (75.6% of Grade I and II).

The etiology of the increased trauma susceptibility of abnormal kidneys may be explained by several factors. For ectopic kidneys, an explanation may be that they lie in a less well-protected anatomical position than in the retroperitoneum<sup>[10]</sup>. For renal tumors, decreased tissue resistance may be implicated. Schmidlin has found that 6 out of 10 abnormal kidneys contained a liquid-filled, incompressible compartment, such as renal cysts or hydronephrosis<sup>[10]</sup>.

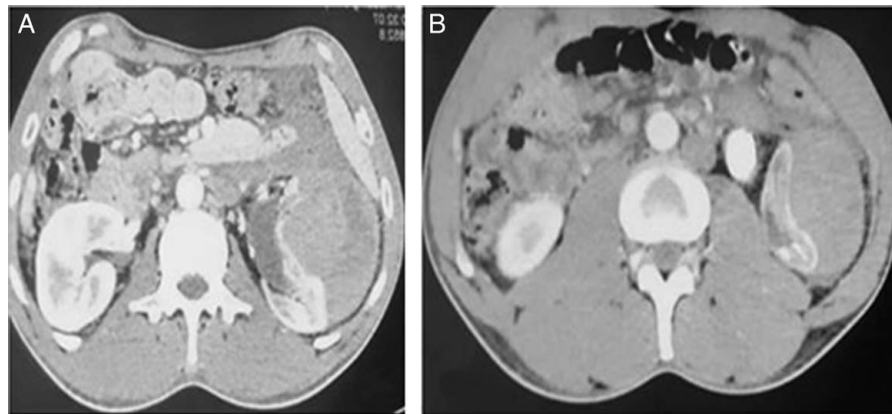
Kidney transplants are more prone to direct trauma due to their positioning in an iliac fossa<sup>[11]</sup>. On the other hand, lesions associated with sudden decelerations are much rarer than on the native kidneys, because grafts are less mobile due to the development of a fibrous shell<sup>[11]</sup>.

Obstructive uropathies, cystic kidneys, and tumor kidneys are at greater risk of traumatic injury, as the presence of a liquid structure in the parenchyma or increased pressure in the excretory cavities increases the force back in response to direct shock<sup>[12]</sup>. The elevation of the pelvic pressure, as described by Schmidlin in a computer model, weakens the kidney by distension and makes it more vulnerable to shocks of low intensity<sup>[12]</sup>.

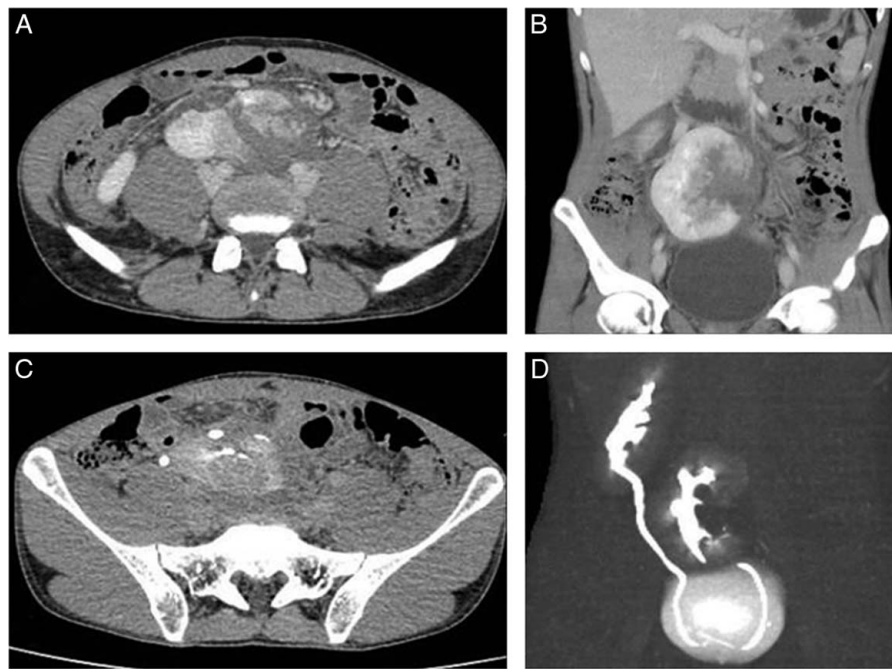
Renal traumas on the pathological kidney can have two consequences: make the diagnosis wander, taking a hydronephrosis or renal polycystosis, or a ureteropelvic junction syndrome for a hematoma, or a tumor for a contusion<sup>[6]</sup>. The pathological kidney is more fragile and therefore more easily harmed during a minimal trauma that can reveal and decompensate a previously unknown uropathy<sup>[10]</sup>.

It is also important to think about the existence of an underlying tumor injury, benign or malignant, for example, in the case of major retroperitoneal hematoma in the presence of minor trauma. Finally, the pelvic kidneys or the ‘horseshoe’ kidneys may be more vulnerable because they are not protected by ribs, and may be harmed by anteroposterior trauma.

Therapeutic management depends on the nature of the pre-existing renal abnormalities and the degree of renal trauma itself.



**Figure 2.** Computed tomography scan with contrast showing a Left Subcapsular renal hematoma (A) measuring a 130 mm upon a 30 mm obstructive proximal ureteral stone (B).



**Figure 3.** Computed tomography scan with contrast showing an ectopic right pelvic kidney trauma with 3 cm cortical laceration (A), urinary extravasation (C, D) and urinoma (B).

Nowadays, surgical abstention with surveillance is the standard for treatment of blunt renal trauma, as it is now well recognized that even major renal trauma may spontaneously heal without surgery<sup>[12,13]</sup>. Therefore, the proportion of blunt renal trauma patients with normal kidneys who need intervention is low (less than 10%)<sup>[14]</sup>, as hemodynamic instability remains the single undeniable indication<sup>[15]</sup>. The indication for surgery is often based on the presence of an underlying pathology. If there is an urgent surgical indication, the best approach is to repair the trauma lesions and the uropathy at the same time<sup>[15,16]</sup>. However, the situation is markedly different in patients harboring abnormal kidneys, as, in this study, the presence of renal pathologies had a significant impact on their trauma management.

In the context of legal redress of physical harm, the experts are faced with a dilemma in assessing traumatic sequelae. Establishing an accountability link between the trauma of the kidney with PERLS and the damage is not always clear. The verification of the accountability criteria encounters some peculiarities: the intensity of the trauma is not mandatory because a minimal trauma can cause kidney damage. Also, the assessment of permanent partial disability rate requires determining the part

of responsibility by only the trauma in the genesis of the sequelae because only the disability attributable to the trauma is compensable. Permanent partial disability rate is still difficult to evaluate since some victims try to hide, or minimize their previous state in order to link all the sequels to the trauma.

At the end of our work, we can mention some deficiencies. The main limitation of our study is its retrospective character. On the other hand, the collection of data was not without difficulties. Indeed, the information found in the medical records had sometimes lacked precision. A few patients were lost in sight and could not be reached, which further hampered long-term follow-up.

**Conclusion**

Blunt renal trauma on pre-existing renal pathology present some specificities to take into consideration. Starting with the increased risk to injury even with minor trauma, considering the frequent existence of obstructive cause, that may increase renal size. Ectopic kidneys are more exposed to trauma, as tumoral kidneys considering the decreased amount of peri-renal fat. An unequivocal radiological diagnosis is also delicate to establish, considering the pre-existing lesions. Other markable feature is that PER may alter the treatment plan or even prohibit nonoperative management, which may explain the relatively high nephrectomy rate, due in most cases to the underlying uropathy. The medico-legal aspect of this entity is to keep in mind, since the partial permanent disability depends on the pre-existing lesion and the renal injuries severity.

**Ethical approval**

The approval of the current study has been granted by the medical committee of research ethics of Charles Nicolle Hospital. It is

**Table 2**

**Frequency of pathological kidney contusions**

Authors	Number of blunt renal trauma	Number of PERL	Percentage (%)
Bahloul <sup>[8]</sup>	156	34	22
Giannopoulos <sup>[9]</sup>	675	24	3.5
Prieto	112	13	11.6
Chaparro <sup>[10]</sup>			
This study	203	37	18.22

available for review by the Editor-in-Chief of this journal on request.

### Consent

Written informed consent was obtained from the patients for publication of this study. A copy of the written consent is available for review by the Editor on request.

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We have any financial sources for our research.

### Conflicts of interest disclosure

All authors disclose any conflicts of interest.

### Provenance and peer review

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