

Pediatric Blunt Renal Trauma. A Single Institution's 20 Years Experience with Surgically Treated Patients.

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Abstract

Background: Kidney is the most common site of genitourinary trauma. 50% of all urinary injuries is kidney. Kidney is also affected in 8-12% of all blunt and penetrating trauma to abdomen. 80-90% of renal injury is caused by blunt injury GY. Children, compared to adults, have at a higher risk of renal injury from blunt trauma due to a variety of anatomic factors including decreased perirenal fat, weaker abdominal muscles, and a less ossified thoracic cage. While there are strong trends toward non-operative management of blunt renal trauma, there are no explicit guidelines for high grade injuries. Organ preservation in children is always a primary goal with solid organ injury.

Aim of the work: The aim of the retrospective study is to show the specificity of kidney injury in children as well as the specificity of surgical treatment.

Material and Methods: All 19 patients under the age of 18 who were admitted to Clinic for Pediatric surgery in Sarajevo with a diagnosis of renal trauma were retrospectively reviewed. The Echo and CT were used to identify patients with a renal injury. The time period examined was between January 1, 1999- 2019. Inclusion criteria were either a diagnosis of renal trauma or a diagnosis of blunt abdominal trauma and hematuria. Exclusion criterion was death due to an additional traumatic injury. The mechanism of injury (fall, car accident, assault) injury grade (I-V), the presence of hematuria, and demographic data to include age, weight, and sex, were recorded and reviewed. In addition, amount of blood product required, hematocrit nadir prior to transfusion to assist in ascertaining whether transfusion was necessary, surgical interventions performed, and hospital length of stay were also retrospectively analyzed. Due to the low sample size we used descriptive as opposed to inferential statistics in our analysis.

Results: Demographics include male to female ratio of 13:6 and the average age of patients was 11.9 + 4.6 years. Of the nineteen patients who underwent review, eleven (57,89%) children presented with a grade III renal injury, five with a grade IV injury and three with grade V injury. Six patients presented with gross hematuria and 3 with microscopic hematuria. Only four patients (22%) required blood transfusions, with the average hematocrit nadir being 31 + 5.3% (24.8-37.8). One of the two patients transfused had a concomitant grade IV splenic laceration with a hematocrit nadir of 24.8% and clinical symptoms consistent with shock.

Conclusions: The specificity of the child's anatomy is an aggravating prognostic factor (the kidney is larger in relation to the body cavity than in adults, less protected against the ribs, the muscles of the body and the lower abdomen, the less developed peritoneal and retroperitoneal fatty tissue). It is recommended to initiate conservative treatment (leaching, infusion solution, monitoring) and possibly delayed surgical treatment. Indications for early surgical treatment are reserved only for patients with bleeding (absolute) and extravasation (relative). If it is necessary surgical treatment should be maximally preserve kidney tissue.

Keywords: Kidney, pediatric, blunt, trauma

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Full Text

Introduction

Kidney is the most common site of genitourinary trauma. 50% of all urinary injuries is kidney. ¹ Kidney is also affected in 8-12% of all blunt and penetrating trauma to abdomen. ² 80-90% of renal injury is caused by blunt injury. ³ Children, compared to adults, have at a higher risk of renal injury from blunt trauma due to a variety of anatomic factors including decreased perirenal fat, weaker abdominal muscles, and a less ossified thoracic cage. While there are strong trends toward non-operative management of blunt renal trauma, there are no explicit guidelines for high grade injuries. Organ preservation in children is always a primary goal with solid organ injury.

Material and Methods

All patients under the age of 18 who were admitted to Clinic for Pediatric surgery in Sarajevo with a diagnosis of renal trauma were retrospectively

reviewed. The Echo and CT were used to identify patients with a renal injury. The time period examined was between January 1, 1999- 2019. Inclusion criteria were patients with blunt kidney injuries who had to be surgically treated. Exclusion criterion was death due to an additional traumatic injury and patients with blunt kidney injuries who were treated conservatively only. We used the International Classification for blunt trauma of parenchymal organs (kidney) (figure 1) The mechanism of injury (fall, car accident, assault) injury grade (I-V), the presence of hematuria, and demographic data to include age, weight, and sex, were recorded and reviewed. In addition, amount of blood product required, hematocrit nadir prior to transfusion to assist in ascertaining whether transfusion was necessary, surgical interventions performed, and hospital length of stay were also retrospectively analyzed. Due to the low sample size we used descriptive as opposed to inferential statistics in our analysis.

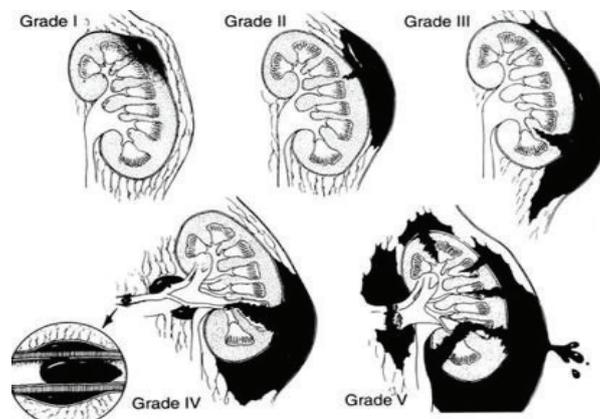
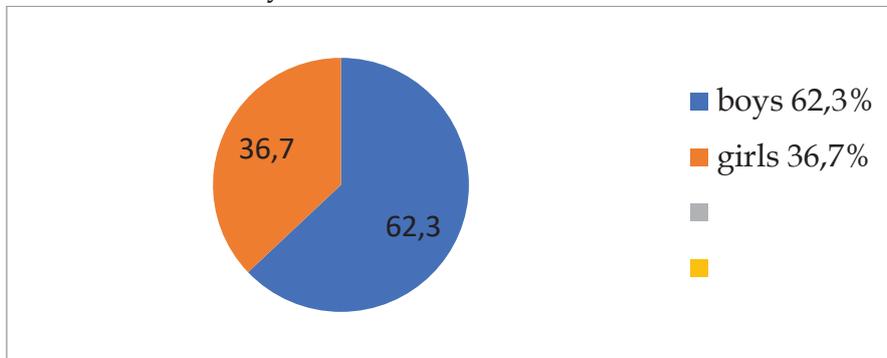


Figure 1: International Classification for blunt trauma of parenchymal organs (kidney)

Results

Demographics include male to female ratio of 13:6 (*figure 2*) and the average age of patients was 11.9 + 4.6 years.



Figures 2: relationship between the number of boys and girls with blunt kidney injury

In our study, we also analyzed the cause of injury. Traffic accidents were reported in 8 (42,11%) patients and a fall

from a height to a hard surface was the cause of the injury in 11 (57,89%) patients. (*figure 3*)

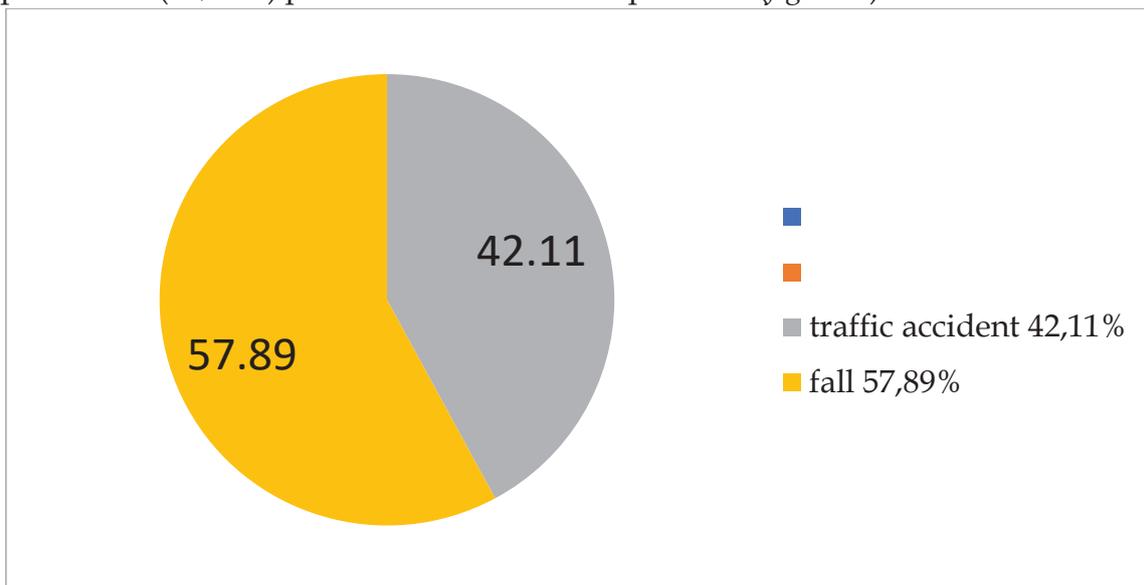


Figure 3: Prevalence of causative agents of kidney blunt injuries of children.

The number of isolated kidney injuries and associated injuries was also the subject of analysis. We found that 14

(73.68%) patients with blunt kidney injury had associated injuries, while only 5 (26.32%) patients had isolated blunt kidney injury. (*figure 4*)

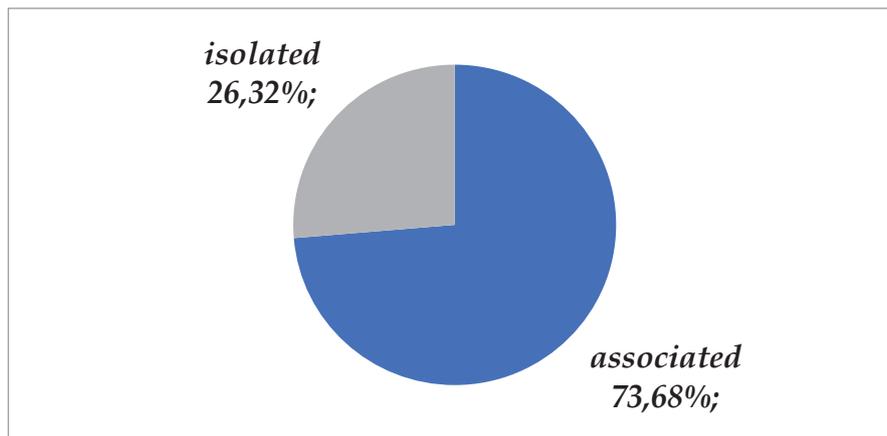


Figure 4: Relationship between isolated and associated blunt injuries kidney of children.

Analyzing the associated kidney injuries, we noticed that the spleen (34%) is the most represented organ (figure 5).

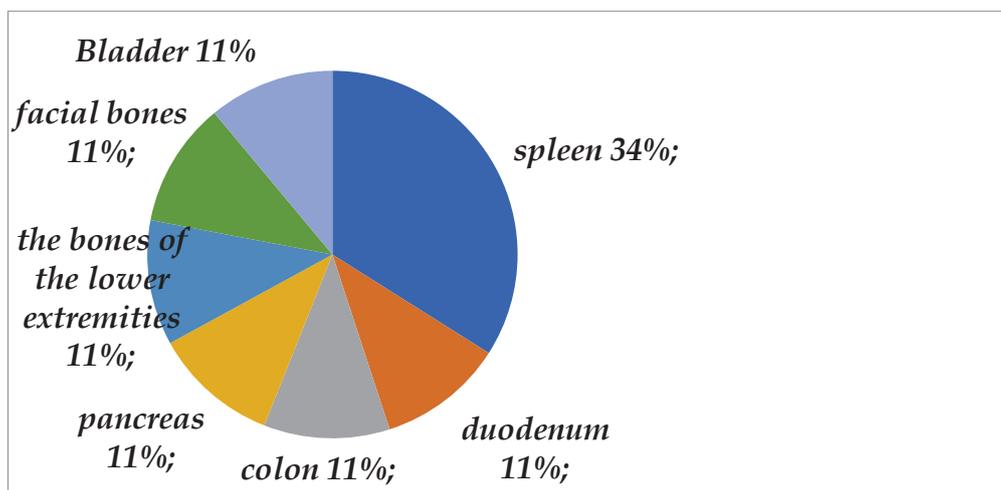


Figure 5: Representation of other organs associated injuries.

Of the nineteen patients who underwent review, eleven children presented with a grade III renal injury,

five with a grade IV injury and three with grade V injury (Table 1).

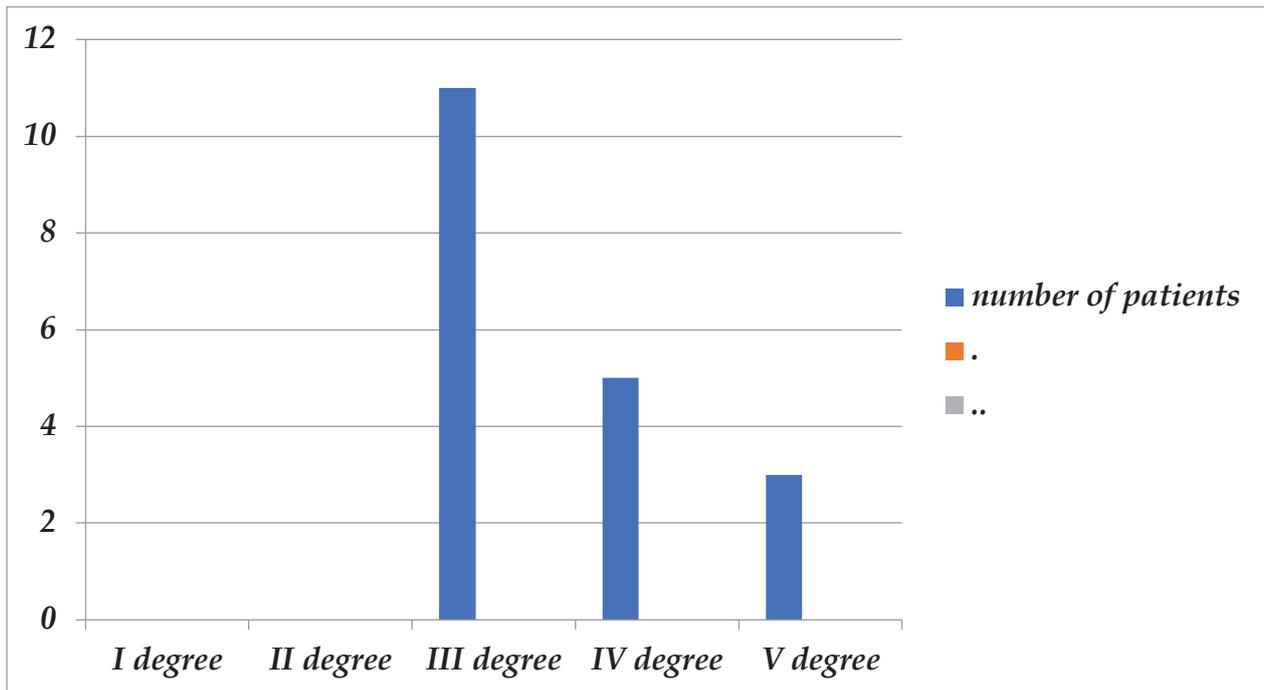
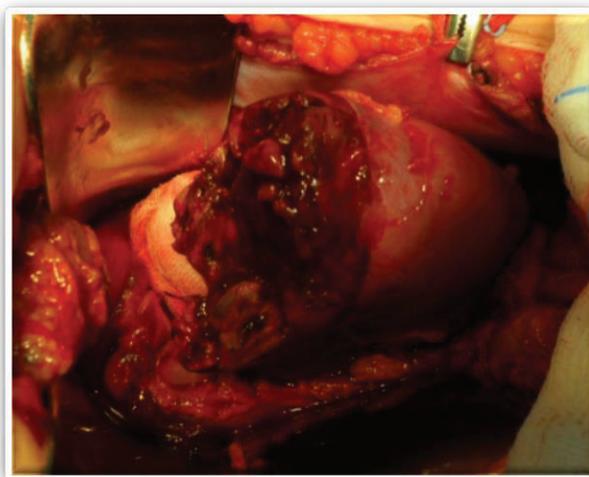


Table 1: Classification of blunt kidney injury of children

Six patients presented with gross hematuria and 3 with microscopic hematuria. Only four patients (22%) required blood transfusions, with the average hematocrit nadir being 31 +

5.3% (24.8-37.8). One of the two patients transfused had a concomitant grade IV splenic laceration with a hematocrit nadir of 24.8% and clinical symptoms consistent with shock.



Figures 6-7: MRI of a patient with blunt renal injury who has been treated with delay surgery.

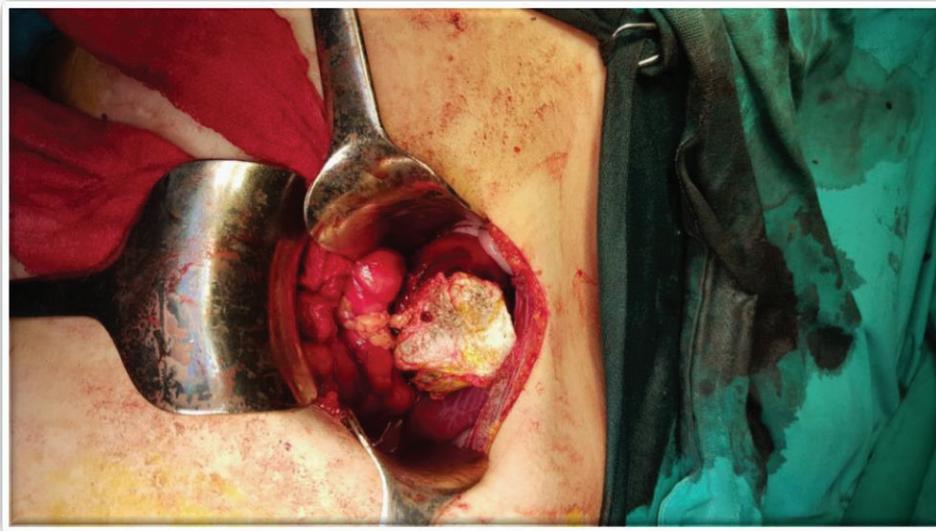


Figure 8: A partial upper nephrectomy with sutures and Tachosil was performed

Only 3 explorations were performed in 3 (15.79%) patients, partial nephrectomy with sutures was performed in 5 (26.32%) patients, while

only sutures were performed in 4 (21.05%) patients. 7 (36.84%) patients had effective nephrectomy (figure 9).

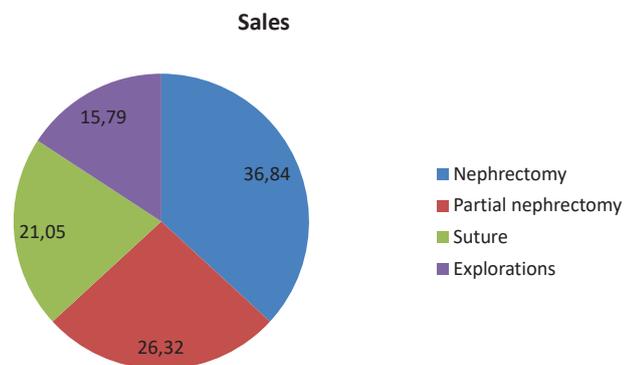


Figure 9: Representation of individual surgical procedures in patients with blunt kidney injury.

We monitored all patients treated surgically. There were no complications or renal hypertension developed.

Discussion

Pediatric patients with blunt abdominal trauma have greater risk for renal injury than adults due to anatomical differences that result in less overall protection to the kidney. Pediatric kidneys are also large proportional to their surrounding organs and are predisposed to parenchymal disruption. Blunt abdominal trauma is reported to involve renal trauma in 10% of all cases.⁴

All children injured with blunt trauma require special care if they have flank pain. Traffic accidents in our study were the cause of 42.11% of blunt injuries to the kidneys which is slightly higher than the results in the literature where the traffic accident cause over 33% of total violation of the pediatric population. Fitzgerald, et al, from Detroit Medical Center retrospectively reviewed 39 children with blunt renal trauma and found a combined (Grade I to V) non-operative rate of 97%.⁵ Henderson, et al, from Children's National Medical Center retrospectively reviewed 164 children with blunt renal trauma and found a non-operative rate of 70%. For high-grade renal injuries specifically (grades IV and V), the non-operative rate was only 56%. These numbers do not exclude patients who underwent non-kidney related surgeries and the authors maintain that if this is taken into account that the non-operative rate overall is mid 90%.⁶ Renal salvage often still includes interventions such as percutaneous

drainage and/or ureteral stent placement. Reported intervention rates vary from 20%-65%.⁷

There was an intervention rate of 67% for grade IV injuries. In our study, we treated patients surgically only for blunt renal trauma. Of the 19 patients, 36.84% of patients underwent nephrectomy. 3 patients had major blood vessel disruption and 4 patients with devitalized complete kidney grade IV. In 26.32% of cases, with grade IV injury, we had to perform partial nephrectomy with parenchyma sutures. In 21.05% of patients we performed only the suture of the parenchyma, while in 15.79% of cases we performed exploration of the retroperitoneum in associated abdominal injuries. Seven of these interventions were performed emergently and all of them were performed to treat collecting system injuries as opposed to parenchymal or vascular injuries.

The urology literature suggests that mild urinary extravasation can be treated with a Foley catheter and antibiotics whereas significant extravasation requires a double J stent with percutaneous drainage.⁸

These severe injuries often present with massive hemorrhage and can necessitate operative intervention for clinical instability with published rates of non-operative management from 0% - 60%.^{9, 10,11} Pediatric patients treated at adult trauma centers were three times as likely

to undergo nephrectomy versus those treated at pediatric hospitals.¹²

New-onset hypertension is an important variable in renal trauma, with rates ranging from 0% to 7.5%. A three-year prospective study is underway, as these children are at risk if they continue to have untreated hypertension.¹³ Patients who do not present with hypertension during the initial three to four weeks post-trauma, are highly unlikely to develop hypertension after this time period.¹⁴ None of the children reviewed at our institution developed post-injury hypertension with the caveat that while all patients were seen in clinic for follow-up, not all patients had follow-up as far out as one month. Our center is actively seeking to obtain longer term follow up on these patients.

This study supports the previously published research that encourages non-operative management for blunt renal trauma. The main limitations to this study are small sample size and retrospectively gathered data.

Conclusions

-The specificity of the child's anatomy is an aggravating prognostic factor (the kidney is larger in relation to the body cavity than in adults, less protected against the ribs, the muscles of the body and the lower abdomen, the less developed peritoneal and retroperitoneal fatty tissue).

-It is recommended to initiate conservative treatment (leaching, infusion solution, monitoring) and

possibly delayed surgical treatment. Indications for early surgical treatment are reserved only for patients with bleeding (absolute) and extravasation (relative).

-If it is necessary surgical treatment should be maximally preserve kidney tissue.

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