

## Renal Trauma Diagnosis, Complications and Treatment in Aden

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DOI: [https://doi.org/10.47372/yjmhr.2023\(12\).1.5](https://doi.org/10.47372/yjmhr.2023(12).1.5)

### Abstract

**Introduction:** The kidney is the third most common injured solid organ in blunt abdominal trauma and the second most frequent in penetrating trauma. Significant complications and mortality can occur if not diagnosed and treated early. The purpose of the study is to determine the cause of injury, the frequency, complications, and death outcome in blunt and penetrating renal trauma in three hospitals in Aden Governorate.

**Methods:** Retrospective study was carried out for 90 on adult patients with renal trauma during the period March 2010 to December 2019 in three Hospitals in Aden Governorate (Al Gamhoreah General Teaching Hospital, Saber and Al Naquib Private Hospitals). Demographic data included age, sex, mode of injury, and type of trauma, detailed history and careful physical examinations, hemodynamic stability evaluation and laboratory tests. Radiological investigation included fast ultrasound, computerized tomography and emergency intravenous urography in isolated renal trauma. Post-operative follow-up was done to detect complications and death outcome.

**Results:** Ninety adult patients with blunt and penetrating renal trauma were included with 75 (83.3%) males and 15 women (16.7%). The most frequent age group was 21-30 years (52.2%). Motor vehicle accidents were the most common mode of injury in blunt trauma (66.7%) and gunshots in penetrating renal trauma (91.7%). Conservative treatment was done for 64.4% whereas 35.6% subjected to surgical intervention. Urologic complications involved 12.2 % and 5.5% died.

**Conclusions:** Associated organ injuries are the frequent injuries in blunt renal trauma. Complications and death outcome are most common in penetrating renal trauma with associated injuries owing to severity of injury.

**Keywords:** Renal trauma, Adults, Accidents, Gunshot, Aden Governorate.

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## تشخيص ومضاعفات الإصابات الكلوية وعلاجها في عدن

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### ملخص الدراسة

**المقدمة:** تعتبر الكلية العضو الثالث الأكثر إصابة في حالات إصابات البطن الكليّة، والعضو الثاني الأكثر إصابة في الإصابات الاختراقية. هناك مضاعفات خطيرة ممكن أن تؤدي إلى الوفاة في حالة عدم التشخيص والعلاج المبكر. الغرض من الدراسة هو التعرف على نمط الإصابة وتحديد تكرار المضاعفات والوفاة الناتجة من الإصابات الكلوية الكليّة والاختراقية في ثلاثة من المستشفيات في محافظة عدن.

**المنهجية:** أجريت دراسة استرجاعية على مرضى يعانون من إصابات الكلى من مارس 2010 إلى ديسمبر 2019 في ثلاثة من المستشفيات في محافظة عدن وهي مستشفى الجمهورية التعليمي العام و مستشفى صابرز مستشفى النقيب الخصوصيان. المعلومات المأخوذة تضمنت العمر، الجنس، كيفية ونوع الإصابة وتفاصيل تاريخ المرض والفحص السريري الدقيق و تقييم حالة المريض والفحوصات المخبرية. الفحص الإشعاعي تضمن الكشف بالسونار والأشعة المقطعية، والأشعة بالصبغة في بعض الحالات التي عندها إصابة في الكلى فقط. تم متابعة المريض ما بعد العملية لحدوث أي مضاعفات أو وفاة.

**النتائج:** شملت الدراسة 90 مريضًا بالغًا يعانون من إصابة الكلى منهم 75 من الرجال (83.3%) و15 من الإناث (16.7%). كانت أكثر الإصابات في الفئة العمرية 21 – 30 سنة (52.2%) وكانت حوادث العربات هي الأكثر شيوعًا في حالات الإصابة الكليّة (66.7%) وحالات إطلاق النار هي الأكثر شيوعًا في الإصابات الاختراقية (91.7%). شكل العلاج الدوائي 64.4% والتدخل الجراحي 35.6%. حدثت المضاعفات عند 12.2% والوفاة عند 5.5% من المرضى.

**الاستنتاج:** إصابات الكلى المغلقة والأعضاء المصاحبة لها هي الأكثر شيوعًا. المضاعفات والوفاة أكثر حدوثًا في الإصابات النافذة والإصابات المصاحبة لها، وتعتمد على درجة شدة الإصابة.

**الكلمات المفتاحية:** إصابات الكلى، البالغين، الحوادث، الطلق الناري، محافظة عدن

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## Introduction

**R**enal trauma represents approximately 3% to 5% of all trauma admission [1]. The kidney is the third most common injured solid organ after the liver and spleen in blunt trauma, and the second most commonly affected in penetrating trauma [2]. The kidney is involved in approximately 24% of abdominal injuries [3]. Blunt renal trauma constitutes about 70 to 80% of renal trauma. Penetrating trauma constitutes 20% of all renal traumas. Renal trauma is more common in men than in women with a proportion of 4:1. Common renal trauma is associated with multiple organs injuries. Isolated renal trauma occurs in 2% of all traumatic patients. Gross hematuria is the most frequent clinical manifestations which occur in 95% of patients and microscopic hematuria in 5% of patients. Most of penetrating renal trauma patients have high grade injury than blunt trauma [4].

Shock indicates major renal trauma or associated organs injuries [5]. Extended-focus abdominal ultrasound is the first study routinely performed at bed side to identify hemoperitoneum but it has a lower sensitivity and specificity for identification of the origin of hematoma or the retroperitoneal free fluid and staging of renal trauma [6]. Multidetector computerized tomography is the gold standard imaging study for staging of renal trauma and the associated organs injuries [7]. The majority of renal trauma is minor injuries but major renal injuries are reported in > 25% of blunt renal trauma and in 70% of

penetrating trauma [8]. In the United States of America (USA) frequency of nephrectomy is from 11- 47% of all patients exposed to surgical explorations [9]. Renal trauma with an associated organs injuries have high incidence of complications and high mortality rate in high grade injury [10]. Advances in the imaging and staging of trauma and treatment strategies during the last 20 years using conservative treatment decreased the need for surgical interventions and increased renal preservation even in high grade trauma [11]. In response to the observed increment of road-traffic accidents and penetrating trauma that occurred in the civil war, the present study aimed to determine the pattern of injury, and to determine the frequency, complications, and death outcome in blunt and penetrating renal trauma in three hospitals during the period March 2010 through December 2019 among Yemeni population in Aden Governorate.

## Methods

### *Study design and setting*

Retrospective analysis carried out for patients diagnosed as blunt and penetrating renal trauma admitted in the surgical and urologic department in Al Gamhoreah General Teaching Hospital and Al Naquib and Saber Private Hospitals in Aden Governorate during the period March 2010 through December 2019.

### *Participants*

**Inclusion criteria:** Comprises adult patients admitted in these three hospitals in Aden Governorate, included Grade (I-V) with abdominal

injuries and renal trauma and the associated injuries. Determined the cause of injury and injury severity score (ISS) using the American Association for the Surgery of Trauma (AAST) Guidelines. Criteria for conservative management and surgical intervention.

**Exclusion criteria:** Children and patients died in polytraumatic emergency department before performance of the complete conservative management or surgical interventions and abdominal injuries that not included the kidney injury.

### ***Data collection***

Data were retrieved from the medical documents in the registries of the included hospitals. A detailed history and continuous repeated physical examinations including vital signs, grade of hematuria, and hemodynamic stability were retrieved. Laboratory tests included urine analysis, complete blood count, hematocrit, blood sugar and creatinine levels. Blood grouping and cross matching and serum electrolytes was taken in severe injuries. Liver function test (LFT), serum amylase and lipase were done in associated organs injuries. Bed side ultrasound (US) was performed for all patients and for minor injuries as the first imaging study to determine hemoperitoneum. Emergency intravenous urography was performed in isolated renal injury in seven patients (7.8%). Computerized tomography (CT) scan performed in hemodynamically stable patients in 56 patients (62.2%) for staging of renal and associated organs injuries was done. The frequency of isolated and associated abdominal and extra-abdominal injuries of blunt and penetrating renal trauma was recorded. Urologic complications,

and treatment type whether conservative or surgically intervened and death outcome in each type of renal trauma were determined. Follow-up reimaging for two years with ultrasound and computerized tomography diagnosis of possible complications and to evaluate clinical deterioration of patients.

### ***Statistical analysis***

Summary measures with frequency and percentages and confection of tables were carried out using a summary measure for qualitative variables for frequency of renal trauma, complications and death outcome was performed. Data were processed using SPSS version 21.

### ***Ethical consideration***

Ethical clearance and consent for patients were not applicable as data were retrieved from the available admission records and hospitals registries.

## **Results**

The study included 75 men (83.3%) and 15 women (16.7%). The most common age group was 21-30 years (52.2%), with a mean age of 31 years ranging from 16 years up to more than 50 years old. The most common age group was 21-30 years (52.2%). Blunt renal trauma seen in 54 patients (60%). In blunt renal trauma, motor vehicle accidents constituted 66.7%, a fall from height 24%, sport injuries 5.6%, and assaults 3.7%. Penetrating injuries included gunshots (80.6 %), explosive devices fragments (11.1 %) and stab wounds (8.3 %) as shown in Table 1.

In Table 2, associated organ injuries constituted 90.7% while isolated found in 9.3%. Penetrating renal trauma found in 36 patients (40%), associated organ injuries found in 34 (94.5%) while isolated renal trauma was seen in two (5.5%). Blunt renal trauma with associated abdominal injuries revealed in 29 patients (59.2%) while non-abdominal associated injuries in 20 (40.8%). Penetrating renal injury with associated abdominal injuries

demonstrated in 25 patients (73.5%) and non-abdominal in nine (26.5%) (Table 2). Associated abdominal injuries in blunt renal trauma included spleen and liver as the most frequently found and small intestines and large intestines in penetrating renal trauma. The associated extra-abdominal injuries included thoracic injury, extremities and head injury in decreasing order of frequency.

**Table 1:** Etiology, Type of Trauma and Age (n=90)

Etiology	Blunt (n=54)		Penetrating (n=36)		
	No.	%*	No.	%**	
Motor vehicle accidents	36	66.7	Fire arms	29	80.6
A fall from height	13	24.0	Explosive devices	4	11.1
Sport injury	3	5.6	Stab wounds	3	8.3
Assaults	2	3.7			
Age in years	No.	%***	Age in years	No.	%***
16 - 20	13	14.4	41 - 50	7	7.8
21 - 30	47	52.2	> 50	6	6.7
31- 40	17	18.9			

\* % were taken from the total of 54

\*\* % were taken from the total of 36

\*\*\* % were taken from the total of 90

**Table 2:** Patients by the Type of Renal Trauma and Associated Injuries

Type of renal trauma	Associated		Isolated	
	No.	%	No.	%
Blunt (n=54)	49	90.7	5	9.3
Penetrating (n=36)	34	94.5	2	5.5
Associated injuries	Abdominal		Non-abdominal	
	No.	%	No.	%
Blunt (n=54)	29	59.2	20	40.8
Penetrating (n=36)	25	73.5	9	26.5

Table 3 shows that trauma was classified into Grade I in 23 patients (25.6 %), Grade II in 25 (27.8%), Grade III in 17 (18.9 %), Grade IV in 15 (16.6 %), and Grade V in 10 (11.1%). They were classified as minor renal injury (Grade I, II, II) 65

patients (72.3 %) and major injury in 25 (27.7%). Urologic complications found in 11 patients (12.2%); five patients with blunt trauma (45.5%) and six with penetrating renal trauma (54.5%).

**Table 3:** Treatment Types of Blunt and Penetrating Renal Trauma Relating to Grade of Injury and Surgical Procedures

Grade	Medical		Surgical		Surgical procedures		
	No.	%	No.	%	No.	%	
Grade I	23	100.0	0	0.0	Suturing	7	21.9
Grade II	25	100.0	0	0.0	Renorrhaphy	11	34.4
Grade III	10	58.8	7	41.2	Nephrectomy	9	28.1
Grade IV	15	0.0	15	100	Partial nephrectomy	5	15.6
Grade V	10	0.0	10	100	<b>Total</b>	<b>32</b>	<b>100</b>

Table 4 reveals that blunt trauma included urinary extravasation, pyelonephritis, hypertension, septicemia, loss of renal function and recurrent hematuria in one patient each. In penetrating renal trauma, urinary extravasation, perinephric abscess, septicemia, recurrent bleeding and pulmonary embolism. Death outcome involved two patients

with blunt and three with penetrating renal trauma. Death was produced by peritonitis septicemia, and renal failure. They occurred in penetrating high grade renal injury and the associated organs injuries. Death was produced by respiratory failure, hemorrhage and embolism.

**Table 4:** Complications and Death Outcome of Blunt and Penetrating Renal Trauma

Complications	Blunt		Penetrating		Death outcome		
	No.	%	No.	%	No.	%	
Extravasation	1	20	1	16.7	<b>Blunt (n=2)</b>		
Perinephric abscess	—		1	16.7		Renal failure	1
Acute pyelonephritis	1	20	—		Septicemia	1	50
Hypertension	1	20	—				
Renal dysfunction	1	20	—		<b>Penetrating (n=2)</b>		
Septicemia	—		2	33.4	Respiratory failure	1	33.3
Recurrent hematuria	1	20	1	16.7	Hemorrhage	1	33.3
Pulmonary embolism	—		1	16.7	Embolism	1	33.3
<b>Total</b>	<b>5</b>	<b>100</b>	<b>6</b>	<b>100</b>			

## Discussion

In this study, blunt and penetrating renal trauma were commonly seen in the age 21-30 years and among males. Motor vehicles were the common cause in blunt renal trauma and gunshots in penetrating renal trauma corresponding with what was reported by Santucci *et al* in 2010 who described motor vehicle accidents in 63%, falls from height in 43%, sport injury in 11% and pedestrian accidents in 4% [12]. Gunshots were the most common in penetrating renal trauma. This study revealed similar results as mentioned by Velazke *et al* in 2014 [13]. The most common associated extra abdominal injuries involved the thorax (fractured lower ribs and hemothorax) followed by the extremities, and head injury. The most common solid abdominal injuries involved the spleen and liver while in penetrating renal trauma the large and small intestines were the commonly seen. This is consistent with the Injury Severity classification according to the American Association of Surgery Trauma based on national trauma registry studies and a systematic review reported by Bjurlin *et al* in 2017 [14]. It is widely used and is a powerful predictor of clinical outcome.

The grade correlates with the need of surgical intervention and death outcome [15]. Presence of hypertension post operatively, nephrectomy occasionally is needed for control [16]. The European Urological Association (EUA) guidelines have detailed description developed in 2015 as the primary

guide to determine the severity of injury, the need for nephrectomy and the predictor for mortality in both blunt and penetrating trauma [17]. The hemodynamic findings in patients with abdominal solid organs trauma also is a guide for the diagnosis, the need for blood transfusion and treatment evaluation. Computerized tomography is currently the most useful imaging study in hemodynamically stable patients. It consists of four phases: precontrast phase can identify active bleeding or intraparenchymal hematoma. Post contrast phase detects arterial and nephrographic and venous. It reveals parenchymal and vascular injury, extravasation of contrast and associated organs injuries. Delayed phase can visualize the collecting system, ureteropelvic junction injury or ureteral injury [18]. Presence of gross hematuria and expanding prerenal hematoma and systolic blood pressure < 90 mm Hg, presence of worse clinical deterioration manifested by fever, abdominal distension, gross hematuria and persistent flank pain postoperatively reimaging is needed for further evaluation [19].

Conservative treatment was the commonest especially in blunt renal trauma in the present study. Penetrating renal trauma surgical intervention carried out commonly in patients with high grade injuries so an emergency laparotomy performed owing to associated injuries consistent with what mentioned by Patel *et al*; 2014 [20]. In penetrating renal trauma with gunshots, operative

management was applied in 75%, and stab wounds in 50% of patients mentioned by Veratterapilly *et al* in 2017 [21]. In this study, two cases of grade IV blunt renal trauma who treated conservatively, one of them post-operatively developed urinary extravasation and perinephric abscess which was treated by percutaneous drainage under ultrasonography guide. The most frequent surgical procedures were renorrhaphy especially in penetrating renal trauma and nephrectomy. Review of 16, 250 cases of trauma in Vancouver General Hospital in Canada indicated that half of Grade IV renal injuries subjected to nephrectomy. The current indications for renal emergency interventions including patients with severe hemorrhage and hemodynamic instability and absence of response to the aggressive resuscitation in severe renal hemorrhage and expanding perirenal hematoma seen during exploratory laparotomy and Grade V renal injury [22]. Complications occurred in 12.2% of patients of associated blunt and penetrating renal trauma in this study.

Death did not occur in isolated blunt and penetrating renal trauma. Complications of renal trauma occurred from 3% to 33% as described by Guareshi *et al* [24]. Delayed hemorrhage commonly found in severe lesions or conservatively managed penetrating trauma owing to the occurrence of ruptured pseudoaneurysm or arteriovenous fistula. Hypertension occurred due to arterial occlusion or compression of renal parenchyma and parenchymal vessels by hematoma or urinoma, decreasing blood flow, and stimulates renin-angiotensin system secretion resulted in maintained hypertension [24]. Lee *et al* in 2071

reported complications in 20% of cases [23]. They included urine leakage (6.5%), delayed bleeding (4.8%), hydronephrosis (3.2%), pseudoaneurysm (3.2%), abscess (1.6%), and renal failure (1.6%). Early complications included extravasation of urine produced by collecting system or parenchymal laceration which lead to perinephric abscess and urosepsis [26].

Mortality depends on the severity of injury and the associated organs injuries described by Raheem *et al* [25]. The purpose of reimaging is to diagnose the complications and evaluation of the clinical deterioration in presence of persistent fever or back pain, and abdominal distension or continuous blood loss in patients with high-grade injuries and usually is performed after 2-3 days of treatment.

Follow-up comprised physical examination, vital signs monitoring, urine analysis and complete blood count and assessment of renal function. Abdominal and pelvic ultrasonography and computed tomographic performed in high-grade injury renal trauma [27].

## Conclusion

Blunt renal trauma is the frequent type. Complications and death outcome are more common in associated penetrating renal trauma, attributed to high grades of trauma

## References

1. Bent C, Lyngkaran T, Power N. Urological injuries following trauma. *Clin Radiol* 2008; 63: 1361-71.



2. Hardee MJ. Process improvement in trauma compliance with recommended imaging evaluation in the diagnosis of high-grade renal injuries. *J Trauma Acute Care Surg* 2013; 74 (2): 558-62.
3. Santucci RA, Wessel H, Bartsch G. Evaluation and management of renal injuries: consensus statement of the renal trauma subcommittee. *British J Urol* 2004; 33: 937-54.
4. Zabakowski T, Skiba R, Saracyr M. Analysis of renal trauma in adult patients: 6-year own experience of trauma center. *Urol J* 2015; 12: 2276-9.
5. Peng N, Wang X, Zhang Z, Fu S, Fan J, Zhang Y. Diagnosis value of multi-slice spiral CT in renal trauma. *J X Ray Sci Technol* 2016; 24: 649-55.
6. Becker A, Lin G, Mc Kenny MG, Mattos A, Shulman CL. Fast examination reliable in severely injured patients? *Injury* 2016; 41: 479-83.
7. Park SG, Kim JK, Kim KW, Cho KS. MDCT findings of renal trauma: Genitourinary imaging. Pictorial Essay. *Am J Roentgenol* 2006; 187: 541-7.
8. Mc Cling CD, Hotaling JM, Wang J, Wessels H, Velazke BB. Contemporary management of penetrating kidney injuries using a national database. *J Trauma Acute Care Surg* 2013; 75 (4): 602-6.
9. Buckley JC, Mc Anninch JW. Revision of current American Association for the Surgery of trauma renal injury grading system. *J Trauma* 2011; 70 (1): 35 .
10. Mc Combie SP, Thyer I, Corocan NM. The conservative management of renal trauma: a literature review and practical guidelines from Australian and New Zealand. *British J U Int* 2014 (1):13-21.
11. Matteo B, Lombardo F, Vezzali N, Zamboni F, Ferro P, Pertner P *et al.* MDCT of blunt renal trauma: imaging findings and therapeutic implications. *Insights Into Imag* 2016; 6 (2): 261-72.
12. Santuci RA, Bartley JM. Urologic trauma guidelines: a 21 st century update. *Nat Rev Uol* 2010; 7: 510-19.
13. Velazke BB, Leddy L. The epidemiology of renal trauma. *Transl Andriol Urol* 2014; 3: 143-149.
14. Bjurlin MA, Fantus RJ, Villines D. Comparison of non-operative and surgical management of renal trauma: can we predict when non-operative management fails? *Trauma Acute Care Surg* 2017; 82: 356-62.
15. Shoobridge JJ, Bultitude MF, Corcoran N. A 9 –year experience of renal injury at an Australian Level 1 trauma Center. *B J U Int.* 2013; 112 (2): 53-60.
16. Serafetinides E, Kittrey ND, Djakovi N. Review of the current management of upper tract injuries by the European Association of Urology (EAU) Trauma Guidelines Panel. *Eur Urol* 2015; 67: 930-36.
17. Chouhan JD, Winner AG, Johnson C, Weiss JP,

- Hyacinth LM. Contemporary evaluation and management of renal trauma. *Can J Urol* 2016; 23 (2): 8191-7.
18. Osman NM, Eissawy MG, Mohamed AM. The role of multi-detector computed tomography with 3 D images in evaluation and grading of renal trauma. *Egypt J Radiol Nucl Med* 2016; 47: 305-17.
  19. Erlich T, Kittery ND, Sheba C, Israel T. Renal trauma: the current best practice. *Ther Adv Urol* 2018; 10: 295-303.
  20. Patel P, Duttary D, Kacheriwala S. Management of renal injuries in blunt abdominal trauma. *J Res Med Dent Sci* 2014; 2 (2): 38-42.
  21. Veratterapilly R, Fuge O, Haslam O, Harding C, Thrope A. Renal trauma. *J Clin Urol* 2017; 10: 379-81.
  22. Fisher W, Wansaselja A, Steenburg SD. Journal Club: Incidence of urinary leak and diagnostic yield of excretory phase CT in the setting of renal trauma. *Am J Roentegenol* 2015; 204: 1168-71.
  23. Lee MA, Jang MJ, Lee GJ. Management of high-grade blunt renal trauma. *J Trauma Injury* 2017; 30 (4): 192-6.
  24. Guareshi BL, Becker VK, Batista MF, Buss PL, Von Banthen LC, Stahl Schmidt CM. Epidemiological analysis of polytrauma patients with kidney injuries in a university hospital. *Rev Col Braz Surg* 2015; 42 (6): 382-5.
  25. Raheem O, Flyod MS, Casey RG, Cullin IM, Corcoran MO, Bredin HC. Renal trauma in the west Ireland- a regional review. *Sci World J* 2009; 20 (5): 137-43.
  26. Coccolini F, Moore EE, Kluger Y, Biffi W, Leppaniemi A, Mastumara Y. Kidney and uro-trauma. World Society of Emergency Surgery (WEST). *World J Emer Surg* 2019; 14: 54-  
[doi.org/10.1186/S1307-019-0247-X](https://doi.org/10.1186/S1307-019-0247-X)
  27. Yang CS, Chen IC, Wang CY, Liu CC, Shih HC, Huang MS. Predictive indications of operations and mortality following renal trauma. *J Chin Med Assoc* 2012; 75 (1): 21-4.