

Shattered Kidney: A Fallout of Armed Banditry

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Abstract

Background: Abdominal trauma whether blunt or penetrating is a harbinger of the possibility of genitourinary injuries. The kidney is an organ frequently injured when there is a genitourinary injury. The menace of armed banditry has led to the increased presentation of life-threatening organ system injuries to our facilities such as a shattered kidney. The associated mortality can be significant even where there is a functioning trauma system.

Objectives: The aim of this study was to investigate a patient who survived shattered kidney injury despite non-existent functioning trauma system.

Case report: A 75-year-old farmer presented with a 4 h history of gunshot injury to the right flank and left cheek associated with bleeding, haematuria, and shock was investigated. His admitting packed cell volume was 16.4%. The serum chemistry was within normal range and no features of peritonitis was observed. He had resuscitation according to the principle of the Advanced Trauma Life Support protocol and emergency exploratory laparotomy with right simple nephrectomy.

Conclusion: The management of shattered kidneys involves prompt and simultaneous resuscitation using the Advanced Trauma Life Support (ATLS) protocol including emergency exploratory laparotomy and simple nephrectomy to guarantee patient survival.

Keywords: Abdominal Injuries, Kidney, Trauma, Advanced Trauma Life Support Care, Nephrectomy

1. Background

A shattered kidney is an extreme grade of renal injury resulting from high-impact force or energy.^{1,2} The kidney is an organ commonly injured when there is a genitourinary injury associated with blunt or penetrating abdominal trauma.^{3,4} The associated mortality following shattered kidney injury can be significant even where there is a functioning trauma system in place.⁵ Patients who suffered this form of injury especially where there is no viable trauma system are often unlucky to get to the hospital due to the associated exsanguinating haemorrhage from renovascular involvement. A functioning trauma system, where present, can go a long way in easing some of the challenges of these patients, especially prompt transportation to the health facility.⁵ This vital system has remained a mirage in our environment and the government needs to do much more in this field.

Since the beginning and subsequent escalation of various forms of security challenges in our environment ranging from cattle rustling, armed robbery, kidnappings, and armed banditry, there has been an increased inflow of trauma patients to our facilities resulting from these vices.^{6,7} This has led to a reversal of the usual and frequently

common cause and trend of trauma following road traffic accidents.⁸ The implication of this is also the changing trend in the severity or degree of organ system injury being witnessed currently in most of our tertiary facilities. The menace of armed banditry has led to an increased presentation of life-threatening injuries to our health center. The shattered kidney is one of these injuries.

The goal standard modality for investigating renal trauma patients is a computerized tomography scan in addition to other related investigations as determined by the individual patient case. However, it can be overlooked in haemodynamically unstable patients or where the facility is unavailable. The management of renal trauma patients depends on the severity of the trauma and may require conservative or non-operative measures, endourologic stenting, angioembolization, or open surgical intervention.⁴ However, at the presentation of a shattered kidney patient to a health center, the goal of management should be directed at speedy clinical evaluation, limited and important goal-directed investigations, resuscitation and by extension prompt surgical intervention to rescue the patient that survives to the hospital. This is where

adherence to the principles of Advanced Trauma Life Support (ATLS) becomes paramount.⁹ Therefore, this case management and outcome underscores the extra role and effort required by the attending healthcare team practicing in resource-deprived settings.

2. Case Presentation

The case of this study was a 75-year-old farmer presented to our health center with a 4 h history of being cut up in random gunfire by armed bandits in his village. He sustained an open abdominal injury to the right flank and left cheek associated with bleeding from sites, haematuria, and progressively worsening dizziness and body weakness. Physical examination revealed an acutely ill-looking elderly man, in painful distress, dehydrated and pale. The temperature, respiratory rate, pulse rate, and blood pressure at presentation were 36.7 °C, 24 cycles/min, 111 beats/min, and 60/40 mmHg respectively. He had gunshot wounds on the left cheek, and entry and exit abdominal wounds over the anterior and posterior right lumbar region respectively. There were no features of peritonitis.

The laboratory investigations revealed a random blood sugar of 5.5 mmol/L, and complete blood count was within the normal range except for the low packed cell volume of 16.4%. The urinalysis except for the presence of blood and serum electrolytes, urea, and creatinine was within the normal range.

He had resuscitation according to the principle of the Advanced Trauma Life Support protocol. Despite adequate resuscitation with intravenous crystalloid infusions with normal saline and blood transfusion of five units of blood, he remained haemodynamically unstable. Hence, he was counselled and offered emergency exploratory laparotomy with right simple nephrectomy. The intraoperative findings were a shattered right kidney with expanding haematoma sparing other intra-abdominal viscera (Figure 1). The cheek wound was debrided and managed non-operatively with wound dressing. He had additional four units of blood transfused: two units intraoperative and two units postoperative. The patient had an uneventful recovery and was discharged home on the 14th postoperative day to continue wound dressing on an outpatient. He had a satisfactory outcome during follow-up visits.

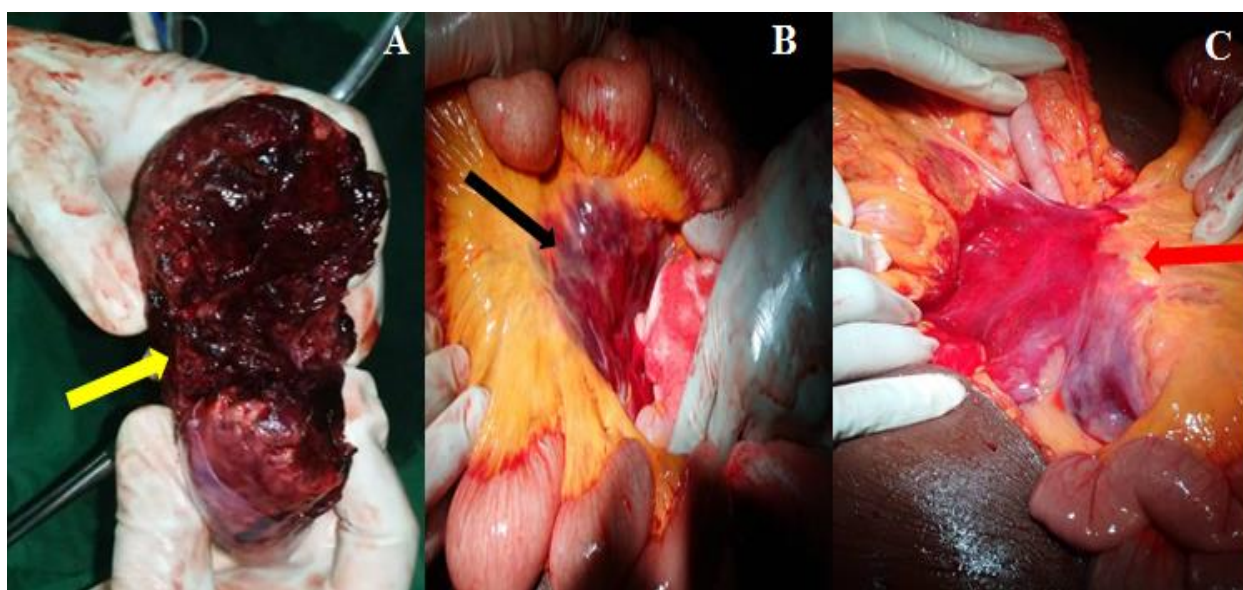


Figure 1. Intraoperative Findings. A) Right shattered kidney (yellow arrow), B) Retroperitoneal haematoma showing dark clot suggestive of earlier bleeding (black arrow), C) Expanding retroperitoneal haematoma showing an area of bright red blood suggestive of active and ongoing bleeding, (red arrow).

3. Discussion

Ninety percent of genitourinary injury results from abdominal trauma with renal injury seen in 10-20% of all blunt abdominal trauma.¹⁰ Kidney rupture can occur spontaneously due to toxic, tumorous or degenerative renal conditions, but it can also be iatrogenic or following trauma.¹¹ The kidney is the most injured organ in urological trauma, and the severity of the injury and management options range widely.¹² It is commonly seen in the young age group and even more common among the male sex. The age of presentation of our patient is at

variance with reports from Ofoha et al.,¹³ Sarvestani et al.,¹⁴ Barman et al.,¹⁵ and Salako et al.¹⁶ who reported predominance among the young age group. Similarly, most reports suggested that renal trauma is mostly common among the male sex which is in agreement with our case report.¹³⁻¹⁶

High-velocity deceleration is responsible for up to 90% of renal trauma resulting from blunt trauma while penetrating renal injuries usually arising from gunshot and stab wounds as seen in the index case.¹⁶ High-velocity weapons are particularly damaging due to the

high energy and collateral damage they cause.¹⁷ Furthermore, motor vehicle collisions remain the leading cause of genitourinary trauma. This is supported by Barman et al., who showed that 90% of genitourinary injuries is resulted from the road traffic accident.¹⁵ Injuries resulting in a shattered kidney can occur following both blunt and penetrating abdominal injuries.¹⁵ The mechanism of injury in our index case is a penetrating injury with the eventual finding of a shattered right kidney intraoperatively. This finding is at variance with reports from Salako et al.¹⁶ but similar to a report by Ofoha et al.¹³ The incidence of penetrating renal trauma has increased in our locality as a result of social conflicts related to cattle rustling and armed banditry activities. Isolated penetrating renal injury is uncommon in the context of gunshot abdominal injury.¹⁸ However, our index patient had isolated renal injury with an expanding retroperitoneal hematoma.

The most commonly used injury classification system is the American Association for the Surgery of Trauma (AAST) injury scoring scale.^{2,17} Laceration through the corticomedullary junction into the urine-collecting system or segmental renal vascular injury with hematoma is described as grade four.¹⁷ A shattered kidney is classified as grade five.^{2,17} Typically, grade 4-5 lacerations of the kidney show an injury of the urine-collecting system with Urine Extravasation (UE) and macrohaematuria however this index case didn't present with urinary extravasation. Grade five renal injuries, such as the index case often require nephrectomy, although selected grade five renal injuries can be managed conservatively.¹⁹ In selected patients with renal parenchymal bleeding, selective angioembolization is an alternative to surgery in controlling bleeding.¹¹

Renal injury is generally diagnosed based on a high index of suspicion for low-degree injury, the mechanism of injury and the presence of hematuria, but gross hematuria can be absent despite the presence of significant renal injury.¹⁹ However, for high-degree injuries diagnosis is mainly clinical. Similarly, our index patient was presented with penetrating abdominal injury to the right flank with no features of peritonitis but with haemodynamic instability and haematuria. Our index patient had both mechanisms and symptoms suggestive of renal trauma. The gold-standard image modality for diagnosing and grading renal injury is the contrast-enhanced abdominal CT scan.²⁰ It is superior to intravenous urogram because of its ability to identify other associated injuries and it provides better anatomic and functional information about the kidney.²⁰ It is very useful in the proper selection of patients for conservative management. Some authors advocate that patients who are unable to have a prior CT scan due to hemodynamic instability or other reasons should have an on-table one-shot Intravenous Pyelogram (IVP) to assess the presence of a functioning contralateral kidney. Our index patient did not have the on-table IVP,

however, the contralateral kidney was manually palpated to confirm its presence before the excision of the shattered kidney and subsequent monitoring of urine output.

Patients with suspected renal injury are initially resuscitated using the ABCD of resuscitation following the ATLS protocol.^{9,21} This protocol was similarly adopted in the resuscitation and management of our index patient. Patients who are considered hemodynamically stable are to undergo thorough evaluations consisting of full medical history and physical examination, laboratory investigations, and imaging. However, immediate exploration is warranted for cases with hemodynamic instability despite adequate resuscitation.²¹ Our index patient was not responding to both fluid resuscitation and multiple blood transfusions, therefore, immediate exploration was done without a prior CT Abdomen.

Our index patient had a right simple nephrectomy and received four units of blood intraoperative. He did well postoperatively and was discharged home without any complications. This is to show that nephrectomy is a viable option in the resuscitation and management of patients with shattered kidneys from gunshot injuries with excellent outcomes. Patients with renal injury are candidates for massive blood transfusion as seen in the index patient who received five units of blood during the preoperative resuscitation and received additional four units of blood intraoperatively to maintain hemodynamic stability. It is important to note that in the present-day management of urological trauma, conservative management is preferred in the management of renal injuries including high-grade renal injuries.¹⁶ Generally, the severity of the renal injury, hemodynamic instability, and the need for blood transfusions are reliable predictors of nephrectomy which was confirmed in the investigated patient.¹⁶

4. Conclusion

According to the findings of this study, it is suggested that a prompt and simultaneous resuscitation using the ATLS protocol and emergency exploratory laparotomy with simple nephrectomy in patients presenting with penetrating gunshot abdominal injury with a shattered kidney is associated with patient survival. Therefore, any possible action should be made in order to rescue those victims who survive to reach hospitals. It is also recommended that the government makes provision of a functioning trauma system in order to minimize mortality associated with this form of trauma.

Author Contributions

All the authors were responsible for the design and implementation of the research. KA, AIU, and AAM conceptualized the study and acquired the data. KA made the initial draft of this work. AIU, AAM, and ASM contributed in writing the initial draft. ASM, NPA, and AAA did an additional literature search on the topic and contributed to the review of the initial draft. NPA and AAA

Research Highlights

What Is Already Known?

Shattered kidney cases are extremely rare in hospital settings throughout the world. They are worse in resource limited environments due to numerous challenges including lack of a functioning trauma system. This is because these patients die of exsanguinating haemorrhages at the trauma scene. Therefore, the practical experience and knowledge which may accrue from this case management is lost in societies where autopsy is not routinely practiced owing to sociocultural and religion reasons.

What Does This Study Add?

The message herein especially the intraoperative findings can be a useful teaching or learning aid to trainees who may be unfamiliar or inexperienced with the nature of these injuries. Thus, aiding the prompt and right intraoperative decision positively impacts patients' quality of life.

supervised the writing and provided useful referenced data. AAA critically revised and made a major contribution to the intellectual content of the initial manuscript. All authors read and approved the final revised manuscript.

Conflict of Interest Disclosures

All authors declared that they have no conflict of interest.

Ethical Approval

The clinical picture meets ethical guidelines, adheres to the local legal requirements, and approved by the Institutional Health Research Ethics Committee (UDUTH/HREC/2023/1332).

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References

- Govindarajan KK, Utagi M, Naredi BK, Jindal B, Sambandan K, Subramaniam D. High grade renal trauma due to blunt injury in children: do all require intervention?. *J Bras Nefrol.* 2019;41:172-5. doi:10.1590/2175-8239-JBN-2018-0186
- Moore EE, Shackford SR, Pachter HL, McAninch JW, Browner BD, Champion HR, et al. Organ injury scaling: spleen, liver, and kidney. *J Trauma Acute Care Surg.* 1989; 29(12):1664-6.
- Salimi J, Nikoubakht M, Zareei MR. Epidemiologic study of 284 patients with urogenital trauma in three trauma centers in Tehran. *Urol J.* 2004;2:47-50.
- Erllich T, Kitrey ND. Renal trauma: the current best practice. *Ther Adv Urol.* 2018;10(10):295-303. doi:10.1177/1756287218785828
- Okereke IC, Zahoor U, Ramadan O. Trauma care in Nigeria: time for an integrated trauma system. *Cureus.* 2022;14(1):e20880. doi:10.7759/cureus.20880
- Olaniyan A, Yahaya A. Cows, bandits, and violent conflicts: Understanding cattle rustling in Northern Nigeria. *Afr Spectr.* 2016;51(3):93-105. doi:10.1177/000203971605100305
- Abdullahi A. Rural banditry, regional security and integration in West Africa. *J Soc Political Sci.* 2019;2(3):644-54. doi:10.31014/aior.1991.02.03.107
- Voelzke BB, Leddy L. The epidemiology of renal trauma. *Transl Androl Urol.* 2014;3:143-9.
- da Costa IA, Amend B, Stenzl A, Bedke J. Contemporary management of acute kidney trauma. *J Acute Dis.* 2016;5(1):29-36. doi:10.1016/j.joad.2015.08.003
- Halis F, Amasyali AS, Yucak A, Yildiz T, Gokce A. Intrathoracic Kidney after Blunt Abdominal Trauma: A Case Report and Review of the Literature. *Case Rep Urol.* 2015;2015:682649. doi:10.1155/2015/682649
- Wendler JJ, Jürgens J, Schostak M, Liehr UB. Traumatically shattered kidney without urine extravasation or vascular amputation. *Case Rep.* 2015;2015:bcr2014208303. doi:10.1136/bcr-2014-208303
- Tait CD, Somani BK. Renal trauma: case reports and overview. *Case Rep Urol.* 2012;2012:207872. doi:10.1155/2012/207872
- Ofoha CG, Shuaibu SI, Onowa VE, Galam ZZ. Contemporary management of genitourinary injuries in a tertiary trauma center in Nigeria. *Int J Res Med Sci.* 2018;6:1134-8. doi:10.18203/2320-6012.ijrms20181268
- Sarvestani AS, Zamiri M. Assessment of genitourinary trauma in Southeastern Iran. *Trauma Mon.* 2013;18(3):113-6. doi:10.5812/traumamon.11694
- Barman MK, Maitra T, Biswas A, Mukherjee K, Venugopal PN. Epidemiology and Management of Urogenital Trauma: The 7-Years' Experience at West Bengal, India. *Inter J Public Health.* 2014;1(2):66-9.
- Salako AA, Adisa AO, Eziyi AK, Banjo OO, Badmus TA. Traumatic urologic injuries in ile-ife, nigeria. *J Emerg Trauma Shock.* 2010;3(4):311-3. doi:10.4103/0974-2700.70742
- Coccolini F, Moore EE, Kluger Y, Biffl W, Leppaniemi A, Matsumura Y, et al. Kidney and uro-trauma: WSES-AAST guidelines. *World J Emerg Surg.* 2019;14:54. doi:10.1186/s13017-019-0274-x
- Kavakli HŞ, Delice O. Isolated Renal Injury After Blunt Trauma: Case Report. *J Emerg Med Case Rep.* 2010;1(1): 18-20.
- Spain DA, Berger Y, Boyarsky AH, Flancbaum LJ. Nonoperative management of bilateral shattered kidneys from blunt trauma. *Urology.* 1993;41(6):579-81. doi:10.1016/0090-4295(93)90110-V
- Fang C, Husainy MA, Huang D. A shattered kidney: a pitfall in imaging of renal trauma. *Case Rep.* 2015;2015: bcr2015211496. doi:10.1136/bcr-2015-211496
- Xie J, Liu Y, Chen T, Xiao KF. Case report of bilateral penetrating renal trauma caused by a wooden stick. *Medicine.* 2020;99(16):e19853. doi:10.1097/MD.000000000019853