Case report of bilateral penetrating renal trauma caused by a wooden stick

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Abstract

Rationale: Kidney is the most frequently injured organ of the genitourinary system during trauma. Bilateral penetrating renal trauma (BPRT) is extremely rare and sporadically reported in the previous literature. Here, we reported a unique case of BPRT.

Patient concerns: A 43-year-old man, with no medical history, was accidentally penetrated by a wooden stick and presented with sharp pain in the left flank.

Diagnosis: Laboratory tests revealed microscopic hematuria, mildly elevated leucocyte and amylase, normal hemoglobin (145 g/L) and creatinine (1.05 mg/dl). Computed tomography demonstrated bilateral penetrating renal injuries with perinephric/subcapsular hematoma, fracture of the second lumbar vertebra and 10th rib.

Interventions: An emergency exploratory laparotomy was executed immediately. According to the American Association for the Surgery of Trauma Organ Injury Scale grading system, grade V and III injuries were considered for the left and right kidney, respectively. Nephrectomy and renorrhaphy were performed on the left and right kidney, respectively.

Outcomes: The postoperative course was uneventful. Eleven days after the surgery, the patient discharged with no complications.

Lessons: We present a rare and challenging case which was handled successfully, and it may provide useful information for the management of BPRT.

Abbreviations: AAST = American Association for the Surgery of Trauma, BPRT = bilateral penetrating renal trauma, CT = computed tomography.

Keywords: bilateral penetrating renal trauma, nephrectomy, renal salvage, renorrhaphy

1. Introduction

Although located in relatively protected retroperitoneum, kidney is the most frequently injured organ of the genitourinary system during trauma. Renal injuries accounts for approximately 0.3% of all trauma according to the National Trauma Data Bank database.[1] It occurs more common in the young population with an obvious male predominance. Compared to blunt trauma, penetrating trauma is less common, accounting for 20% to 39% of renal trauma cases.[2,3]

The primary mechanism of penetrating renal injury varies considerably among different regions. In the United States, gunshot wound accounts for approximately 72.2% of penetrating renal injuries.[3] While in other countries such as United Kingdom and Canada, stabbing wound contributed to 87.3% and 88% of penetrating renal traumas, respectively.[4,5] Bilateral renal trauma is infrequent in penetrating renal injuries and its management remains challenging, with the potential risk for complete loss of renal function. Here, we reported an interesting case of bilateral penetrating renal trauma (BPRT) in a 43-year-old man with no medical history. As far as we know, such unusual condition and associated management have not been previously reported.

2. Case report

A 43-year-old man, working in a furniture company with no medical history, was accidentally penetrated by a wooden stick during his routine factory touring. He was immediately taken to the emergency department of the local hospital by ambulance. Feeling tearing anguish in the left flank, the patient was dysphoric and drenched in sweat. On physical examination, he was hemodynamically stable (blood pressure, 110/70 mmHg) and tachypneic (respiratory rate, 30 times/minute). There was a solitary entrance wound in the left flank, with a stick penetrated in and continuing blood leakage (Fig. 1). Urethral catheter was inserted and no gross hematuria was observed. Laboratory tests revealed microscopic hematuria, mildly elevated leucocyte and amylase, normal hemoglobin (145 g/L) and creatinine (1.05 mg/dl). Chest and abdomen computed tomography (CT) scan was performed in the local hospital, which demonstrated bilateral penetrating renal injuries with perinephric/subcapsular hematoma, fracture of the second lumbar...
vertebra and 10th rib. Neither pleural injury nor lung injury was observed. The stick went through the left kidney, the anterior body of the second lumbar vertebra and bilateral psoas muscle, terminating in the right renal parenchyma (Fig. 2). Fortunately, there was still a distance between the stick and ventral aorta and inferior vena cava. However, there was concern that any displacement of the wedge-shaped stick might cause life-threatening hemorrhage.

Owing to the intractability of this case, the patient was transported to our hospital. An emergency exploratory laparotomy with the midline abdominal incision was performed immediately. We used a self-retaining retractor to obtain satisfactory visibility. After clamping the left renal pedicle, we slowly pulled out the stick according to its penetrating path on CT scan. The hilum of the left kidney was transected, and the collecting system was seriously damaged and contaminated, with extensive parenchymal and vascular injuries. It was considered a grade V injury according to the American Association for the Surgery of Trauma (AAST) Organ Injury Scale grading system (Table 1). Since the left kidney was shattered beyond repair, we decided to excise it totally. Then we explored the right kidney and found an approximately 2.0 cm posterior laceration in the inferior pole, without urinary extravasation. It was deemed a grade III injury according to the AAST grading system. After washing out the sawdust and sterilizing the laceration with 0.5% iodophor, we meticulously performed renorrhaphy of the right kidney. Then the abdominal cavity was explored and no intestinal injury was found. The fracture of the second lumbar vertebra was handled by spine surgeons. Intraperitoneal drainages were routinely placed on both sides and the laceration of the left flank was repaired. During the operation, four units of packed red blood cells were transfused. Tetanus antitoxin and piperacillin and tazobactam were injected to prevent tetanus and bacterial infection. The patient was transferred to surgical intensive care unit for resuscitation.

The postoperative course was uneventful. There was approximately 2000 mL of urine for the next 24 hours postoperatively. Postoperative chest radiograph revealed slight exudation of bilateral lungs. Eleven days after the surgery, the patient recovered well and discharged with no complications. His discharge blood pressure was 120/76 mmHg and creatine was 1.50 mg/dl.

3. Discussion

For patients with suspected renal trauma, initial assessment including airway, breathing, and circulation is necessary. In cases of hemodynamic instability and severe hemorrhage, immediate exploration may be considered preferentially. If the patient is hemodynamically stable, a thorough evaluation including history collection, physical examination, laboratory tests and imaging should be performed. Patient history and the injury mechanism are very important for making the right treatment decisions, especially in cases of solitary kidney. Physical examination may help to assess the location, extent and severity of the trauma. Any sign indicating renal trauma should be noted, such as visible hematuria, rib fractures and

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Figure 1. The patient was penetrated by a wooden stick in the left flank, with continuing blood leakage. No gross hematuria was observed in the catheter.

Figure 2. Preoperative CT scan (A: The stick went through the right psoas muscle and terminated in the right renal parenchyma. B: The stick went through the left kidney, the left psoas muscle and the anterior body of the second lumbar vertebra.)
I Contusion Microscopic or gross hematuria, urologic studies normal

Grade Type of injury Description of injury
I Hematoma Nonexpanding perirenal hematoma con
hemodynamically stable patients. In a multicenter study,
injuries, and is also recommended for high-grade renal injuries in
management is currently the standard care for low-grade renal
nephrectomy, partial nephrectomy, renorrhaphy, renal packing,
placement of ureteral stent, perinephric drain and nephrostomy
includes angioembolization for uncontrolled bleeding, or
there is any deterioration. Minimally invasive intervention
monitoring, serial laboratory evaluation and reimaging when

Table 1
Renal trauma classification by the American Association for the Surgery of Trauma\[9]\.

| Grade | Type of injury | Description of injury |
|-------|---------------|-----------------------|
| I     | Contusion     | Microscopic or gross hematuria, urologic studies normal |
|       | Hematoma      | Subcapsular, nonexpanding without parenchymal laceration |
| II    | Hematoma      | Nonexpanding perirenal hematoma confirmed at renal retroperitoneum |
|       | Laceration    | <1.0 cm parenchymal depth of renal cortex without urinary extravasation |
| III   | Laceration    | >1.0 cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation |
| IV    | Laceration    | Parenchymal laceration extending through renal cortex, medulla, and collecting system |
|       | Vascular      | Main renal artery or vein injury with contained hemorrhage |
| V     | Laceration    | Completely shattered kidney |
|       | Vascular      | Avulsion of renal hilum which devascularizes kidney |

flank/upper abdomen hematoma. Hematocrit and creatinine
levels are necessary to evaluate current blood loss status and
baseline renal function. Urine analysis is used to diagnose
microscopic hematuria.

Currently, the gold standard imaging for hemodynamically
stable patients with penetrating renal trauma is intravenous
contrast-medium enhanced CT. It has replaced intravenous
pyelography in virtue of its wide availability, superior anatomical
and functional information and the ability to identify associated
injuries. Although the contrast medium was reported to induce
nephropathy in blunt trauma patients, the rate was low (4%) and
its toxicity has not been confirmed in penetrating renal injury
patients.\[7]\ The goal of initial imaging is to demonstrate
contralateral kidney and potential renal abnormalities, accurate-
ly grade the renal injury, and identify the associated injuries. For
penetrating renal trauma patients, the most frequent findings on
CT were parenchymal disruption and perirenal hematoma. Reimaging
is recommended for patients with high-grade injuries 2 to 4 days later, and patients with clinical signs of deterioration or postoperative complications, such as fever, persistent hematuria and ongoing blood loss.\[8]\ Renal trauma is most commonly classified according to AAST grading system, which is
based on the extent of damage to the renal parenchymal,
collecting system, and/or renal vasculature.\[9]\ The AAST
classification was validated by several researches and paramount
in treatment decision making. It was reported to be significantly
associated with the need for surgical intervention and the risk for
nephrectomy.\[10]\

Treatment options include conservative management, mini-
mally invasive intervention, and open surgery.\[16]\ Conservative
management typically involves bedrest, analgesia, hemodynamic
monitoring, serial laboratory evaluation and reimaging when
there is any deterioration. Minimally invasive intervention
includes angioembolization for uncontrolled bleeding, or
placement of ureteral stent, perinephric drain and nephrostomy
tube for urinary extravasation. Open surgeries were generally
nephrectomy, partial nephrectomy, renorrhaphy, renal packing,
or autotransplantation. In the past few decades, the management
of renal trauma has undergone a paradigm shift. Nonoperative
management is currently the standard care for low-grade renal
injuries, and is also recommended for high-grade renal injuries in
hemodynamically stable patients.\[11]\ In a multicenter study,
nonoperative management was performed in approximately
75% of grades IV and V renal injury patients, and only failed in
6.5% of those patients. Moreover, conservative management of
high-grade renal injuries was not associated with prolonged hospital stay.\[12]\ Penetrating renal injuries frequently involve the renal vascular
system, disrupt Gerota fascia, and limit the inherent mechanism
of retroperitoneal tamponade, which may lead to an increase in
rates of nonoperative failure. In a previous study analyzing the
data of >9000 renal injuries, angioembolization was showed to
be threefold likely to fail for penetrating renal injury compared
with blunt renal trauma.\[11,13]\ Moreover, a significant risk of
renovascular sequelae was observed in penetrating renal injury
patients treated with nonoperative management.\[14]\ Patients with
penetrating renal injuries were noted to have higher proportion of
grade IV and V renal injuries, higher overall rate of concomitant
injuries, angioembolization and nephrectomy (27% vs 7% for
blunt).\[5,10]\

BPRT is extremely rare and sporadically reported in the
previous literature. The management of BPRT remains challeng-
ing, placing particular emphasis on renal parenchymal preserva-
tion. Schetzer reported 3 BPRT cases in detail, which were all
with unstable hemodynamics and managed with immediate
laparotomy.\[14]\ Conservative management of stable perinephric
hematomas discovered at laparotomy was recommended,
particularly if the contralateral kidney required exploration for
hemostasis. Optimal control of the ipsilateral renal vessels before
mobilizing the kidney is important, because it permits rapid
hemostasis and avoids unnecessary nephrectomy, thus increasing
the chance of renal salvage. Synchronous IV and V bilateral
penetrating renal injuries, with stable retroperitoneal hematoma,
were reported to be successfully managed by angioemboliza-
tion.\[13]\ In the unusual setting of devastating bilateral renal
injuries or solitary kidney injury, renorrhaphy and vascular
repair in situ or extracorporeal renorrhaphy with immediate
autotransplantation may be considered as a last resort.\[16]\

In this case, contrast-enhanced CT was not performed because
non-contrast enhanced CT had already been performed in the
local hospital. We attempted to avoid excessive radiation
exposure and carry out the emergency laparotomy immediately.
Exploratory laparotomy was mandatory, because the stick as a
foreign body must be taken out and the left kidney was seriously
damaged. Renal exploration was done via a transperitoneal
approach with early control of the renal pedicle, which enabled us
to thoroughly evaluate the retroperitoneal area. Nephrectomy
and renorrhaphy were respectively performed on the left and
right kidney, according to the severity of renal injuries. Close
monitoring is imperative after the surgery. We recommend that
postoperative hospital stay should be at least one week, since
nonnegligible complications such as arterial pseudoaneurysms or
to arterovenous fistula may occur 6 to 8 days after penetrating renal
injury.\[14]\ In summary, we present a rare and challenging case
which was handled successfully, and it may provide useful information for the management of BPRT.

4. Consent
Written informed consent was obtained from the patient before and after all procedures, and for the publication of this paper.

Author contributions
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