Life threatening combined renal and hepatic injury caused by severe trauma - therapeutic difficulties

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Abstract

Introduction: Kidney injury occurs in approximately 6-10% of all traumas, 10 to 40% of these being penetrating cases. [1,2] Although the majority of renal injuries are mild and can be managed conservatively, renal trauma can be life-threatening requiring, surgical treatment for penetrating injuries and blunt traumas with persistent bleeding, urinary extravasation or renal pedicle necrosis. [2] Triage based on clinical signs and symptoms is difficult to accomplish, and hematuria, the hallmark sign of renal injury, is neither sensitive nor specific enough for differentiating minor and major injuries. Classifying renal injuries helps to standardize different groups of patients, to select appropriate therapy and predict results. Polytrauma patients with associated renal injuries should be evaluated on the basis of the most threatening injury.

Objectives: The aim of this paper is to present the diagnosis and management of a complex free fall trauma, with liver laceration and a shattered kidney, at a patient suffering from AIDS and schizophrenia.

Material and method: We present the case of a 33-years-old woman known with AIDS and schizophrenia, trauma victim of a free fall from a height of 8 meters. Patient was admitted with hypotension, tachycardia and macroscopic hematuria. Computed tomography detected perihepatic fluid collections and kidney laceration. The patient underwent emergency surgical intervention, through a median incision, which unveiled a grade II laceration of the right hepatic lobe (sixth segment) and massive retroperitoneal hematoma caused by right kidney shattering (grade V trauma). The right kidney was damaged beyond reconstruction and emergency nephrectomy was performed.

Results: Postoperative evolution was favorable, without any incident. Follow-up confirmed the favorable evolution with compensatory kidney hypertrophy and normal hemoglobin and azotemia.

Discussions: In polytrauma cases where the decision for surgical intervention is made, associated injuries should be evaluated simultaneously. Renal reconstruction should be attempted in cases where the primary goal of controlling hemorrhage is achieved and a sufficient amount of renal parenchyma is viable. In our case hemodynamic instability and a diagnosed grade 5 injury were the strongest indications for operative management. Evaluation of the collecting system and, if possible, contralateral kidney function, is recommended. The overall rate of patients who have a nephrectomy during exploration is around 13%. This group of patients is usually associated with high mortality, as a consequence of overall severity of the injury and of the nephrectomy itself [15,16].

Conclusions: Early diagnosis and a proper therapy minimize complications and ensure the patient’s survival. Most renal injuries are successfully treated conservative. But for grades 4 and 5 emergency surgical exploration may be required, especially in the context of polytrauma. Nephrectomy should be performed in cases with a shattered kidney beyond repair or extensive vascular lesions, in order to prevent exsanguination.

Key words: polytrauma, nephrectomy, renal injury, shattered kidney

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Introduction

Trauma is the leading cause of death among people under 45-years old, spleen and liver being the most commonly affected organs. Physicians with different specialties evaluate the trauma patient, as a high level of expertise is required to prevent mortality and reduce morbidity.

Kidney injury occurs in approximately 6-10% of all traumas, 10 to 40% of these being penetrating cases. [1,2] Although the majority of renal injuries are mild and can be managed conservatively, renal trauma can be life-threatening requiring, surgical treatment for penetrating injuries and blunt traumas with persistent bleeding, urinary extravasation or renal pedicle necrosis. [2]

Blunt trauma is usually secondary to motor vehicle accidents, falls, contact sports and violence. Brandes et al. in a 20-year review following free falls found a rate of 16.4% renal injuries. [3] Renal lacerations and renal vascular injuries make up only 10-15% of all blunt renal injuries, while isolated renal artery injury following blunt abdominal trauma is extremely rare and accounts for less than 2% of cases [4].

Triage based on clinical signs and symptoms is difficult to accomplish, and hematuria, the hallmark sign of renal injury, is neither sensitive nor specific enough for differentiating minor and major injuries, being present in 70-75% of cases. [5] Advances in the imaging and staging of trauma, as well as in the treatment strategies during the last decades, have facilitated precise diagnosis, decreased the need for surgical intervention and increased renal preservation.

Classifying renal injuries helps to standardize different groups of patients, to select appropriate therapy and predict results [1]. Classifications ponder upon pathogenesis (blunt or penetrating injury), morphological findings (type and degree of lacerations) and clinical course (nature and time course of symptoms).

The Committee on Organ Injury Scaling of the American Association for the Surgery of Trauma (AAST) has developed a renal-injury scaling system that is now widely used [6]. Abdominal computed tomography (CT) or direct renal exploration is used to accomplish injury classification. Renal injuries are classified as grade 1 through 5 (Table 1).

Most cases with 1st and 2nd grades of injury are treated conservatively. For the 3rd degree emergency angiography with selective embolization can be used, while in the 4th and 5th the options can vary depending on hemodynamic stability and associated injuries, including operative revascularization or nephrectomy.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion</td>
<td>Microscopic or gross hematuria, urologic normal studies</td>
</tr>
<tr>
<td></td>
<td>Hematoma</td>
<td>Subcapsular, nonexpanding hematoma without parenchymal laceration</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>Nonexpanding perirenal hematoma confirmed to renal retoperitoneum</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Laceration &lt;1 cm parenchymal depth of renal cortex without urinary extravasation</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>Laceration &gt; 1 cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Parenchymal laceration extending through renal cortex, medulla and collecting system</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Main renal artery or vein injury with contained hemorrhage</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>Completely shattered kidney</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Avulsion of renal hilum which devascularizes kidney</td>
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Approximately 8-10% of blunt and penetrating abdominal injuries involve the kidneys[1]. The incidence of associated injuries in penetrating renal trauma ranges from 77-100%.

Liver injuries associate kidney trauma in 2% of all cases, and when this happens the hepatic damage is massive because of the high energy that caused it. Kidney injury associated to hepatic trauma has an incidence of 0.64%. [7, 8, 10]

<table>
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<th>Grade</th>
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<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>Hematoma: subcapsular &lt;10% surface area</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Laceration: capsular tear &lt;1 cm parenchymal depth</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>Hematoma: subcapsular 10 to 50 % surface are, intraparenchymal &lt;10 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Laceration: capsular tear 1 to 3 cm parenchymal depth, &lt;10 cm in length</td>
</tr>
<tr>
<td>III</td>
<td>Hematoma</td>
<td>Hematoma: subcapsular &gt; 50 % of surface area or ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma &gt;10 cm or expanding.</td>
</tr>
</tbody>
</table>
Laceration Laceration >3 cm in depth

IV Laceration Laceration: parenchymal disruption involving 25 to 75 percent of a hepatic lobe, or 1 to 3 Couinaud segments

V Laceration Laceration: parenchymal disruption of >75 percent of a hepatic lobe, >3 Couinaud segments within a single lobe

Vascular Vascular: juxtahepatic venous injuries (retrohepatic vena cava, central major hepatic veins)

VI Hepatic avulsion

Most of the 1\textsuperscript{st} through 3\textsuperscript{rd} degrees of liver injuries (80%) are treated nonoperatively, and only 6% of the patients with low-grades of injury require surgery for hemostasis. Higher grades of injury (IV-V) always require surgery.

In a report reviewing this combination of injuries over a period of 17 years, 58% of patients underwent a surgical exploration, with nephrectomies performed in 16% of them [8].

Polytrauma patients with associated renal injuries should be evaluated on the basis of the most threatening injury. Patients with penetrating trauma often have multiorgan involvement that may complicate the management of any single organ system [9].

The decision for conservative management should regard all injuries independently and it has become a standard care to manage stable patients in a nonoperative fashion.[10]

Indications for surgical management include:
1. Hemodynamic instability
2. Exploration for associated injuries
3. Expanding or pulsatile perirenal hematoma identified during laparotomy
4. A grade V injury
5. Incidental finding of pre-existing renal pathology requiring surgical therapy

Objectives
The aim of this paper is to present the diagnosis and management of a complex free fall trauma, with liver laceration and a shattered kidney, at a patient suffering from AIDS and schizophrenia.

Materials and methods
At the emergency unit, presents a 33 years-old female, known with AIDS and schizophrenia, trauma victim of a free fall from a height of 8 meters.

The patient is conscious (GCS=15), with peripheral blood oxygen saturation of 100% under mask (six liters per minute flow rate), hemodynamic stability, slim and mobile abdomen, sensitive spontaneously and to palpation in the right hypochondria, with macroscopic hematuria.

Biochemical profile shows hepatic cytolysis (SGOT=1013 UI/L, SGPT=1144 UI/L), mild anemia (Hb=10.1g/dL) and leukocytosis with lymphocytosis.

Native CT examination detected: subdural space widening of approximately 0.8 cm of fluid density in the right fronto-parietal and left frontal areas (hygroma); normal liver size, homogeneous structure and a fine perihepatic blade of fluid-density; giant right kidney with axial diameter of 11/11 cm, longitudinal 19.5 cm, irregular shape, heterogeneous structure with density in the limit of liquid / solid; left kidney and spleen were normal. It highlighted a fracture with anterior displacement of the sacral wing, oblique fracture of the left iliac crest, acetabular microfractures on both sides and fractured transverse apophyses of the third lumbar vertebra.

During the CT scan, the patient became unstable, with hypotension (70/35 mmHg), tachycardia (125/min), tachypnea (20 /min), and severe anemia (Hb=6.74 g/dL). So the contrast enhanced stage could
not be performed.

The patient underwent emergency surgical intervention, through a median incision, which unveiled a grade II laceration of the right hepatic lobe (sixth segment) and massive retroperitoneal hematoma caused by right kidney shattering (grade V trauma). For the hepatic lesion, the edges of the liver parenchyma were sutured to achieve hemostasis. The right kidney was damaged beyond reconstruction, and because of the severe blood loss already suffered by the patient, the decision to perform an emergency nephrectomy was taken, with subsequent double ligation of the right renal artery and vein. Then the retroperitoneal hematoma was evacuated, and a drainage system was left in place. The remaining bone lesions were conservatively treated.

Results
Postoperative evolution was favorable, without any incident. The drainage was removed during the 4th day, and in the 10th day after admission, the patient was discharged, with good general condition, without fever, having a slim abdomen, and a moderate anemia (Hb=9.9 g/dL).

Follow-up confirmed the favorable evolution with compensatory kidney hypertrophy and normal hemoglobin and azotemia.

Discussions
In polytrauma cases where the decision for surgical intervention is made, associated injuries should be evaluated simultaneously. Renal reconstruction should be attempted in cases where the primary goal of controlling hemorrhage is achieved and a sufficient amount of renal parenchyma is viable.

Due to the success of renal sparing procedures, nephrectomy for trauma is done infrequently, remaining a marker of severe intra-abdominal injuries. The need of surgery depends on the trauma severity according to AAST score and on hemodynamic stability of the patient: expectation, revascularization or nephrectomy. The majority of 1st and 2nd grade injuries are treated conservatively while the 5th grade usually requires nephrectomy,[11, 12]

In our case hemodynamic instability and a diagnosed grade 5 injury were the strongest indications for operative management.

Unlike for injuries to the spleen and the liver, in renal trauma evaluation of the collecting system and, if possible, contralateral kidney function, is recommended.

The initial hemodynamic stability allowed us to perform a CT scan in order to determine if there is peritoneal violation and to predict the need for laparotomy (active bleeding, peritoneal violation and fluid in the paracolic gutters, damage of the collecting system).

Abrupt and rapid clinical and biological degradation required immediate laparotomy for hemostasis and prevented further assessment of contralateral kidney function with iv contrast, but kidney salvage proved to be impossible anyway, and further delay was life threatening.

A peculiarity of this case was represented by mental suffering, which prevented a proper anamnesis and clinical examination. Detection of HIV infection posed problems to ensure safety of the operating team in an emergency setting, and also required prolonged preventive antibiotherapy and hospitalization due to immunosuppression.

In a recent review, Knudson et al. found that blunt trauma, a grade V injury and an attempted arterial repair were adverse prognostic factors [13]. Nephrectomy seems to be the treatment of choice, a repair attempt being justified for cases in which there is a solitary kidney or the patient has sustained bilateral injuries [14].

The overall rate of patients who have a nephrectomy during exploration is around 13%. This group of patients is usually associated with high mortality, as a consequence of overall severity of the injury and of the nephrectomy itself [15, 16]. Renorrhaphy is the most common reconstructive technique [17, 18]. Partial nephrectomy is required when nonviable tissue is detected. Water-tight closure of the collecting system is imperative [19]. Renal vascular injuries are associated with extensive associated trauma and increased peri- and post-operative mortality and morbidity [20].

Conclusions
10% of abdominal trauma involves the kidney, commonly accompanied by injuries to the head, central nervous system, spleen, and liver. In renal trauma we also need to evaluate the contralateral kidney function.

Early diagnosis and a proper therapy minimize complications and ensure the patient’s survival. Most renal injuries are successfully treated conservative. But for grades 4 and 5 emergency surgical exploration may be required, especially in the context of polytrauma.
Nephrectomy should be performed in cases with a shattered kidney beyond repair or extensive vascular lesions, in order to prevent exsanguination.

References
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