Conservative Management of Blunt Hepatic Trauma for Patients with High Severity Grades Injuries: A Clinical Selective Prospective Study

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Abstract

Design: This study was designed to evaluate the role of conservative treatment of blunt hepatic trauma to investigate the possibility of expanding its indications for high severity grades liver injuries.

Background: The treatment of complex liver injuries remains a challenge. Non operative treatment for such injuries is increasingly being adopted as the initial management strategy. We reviewed our experience, at Shebin El-Kom Teaching in the non operative management of high severity grades liver injuries with the intent to evaluate failure rates; and in-hospital mortality and complications.

Methods: This study was conducted in Department of General Surgery in Shebin El-Kom Teaching Hospital from October 2013 to October 2015. All patients admitted to the hospital with blunt abdominal trauma and diagnosed as liver injuries that fulfilled the selected criteria for conservative treatment were the candidates of this study. All cases were treated conservatively by resuscitation and closed ICU monitoring. Failure of conservative treatment depends on failure criteria designed in the study. The patients records were reviewed to determine the general condition of the patient, CT findings regarding the site and extent liver injury, necessity to blood transfusion, complications related to the conservative treatment and necessity to adjunctive treatment, and mortality.

Results: Over 24 months, 54 patients with blunt hepatic trauma that fulfilled the selected criteria were the candidates of this study. Twenty nine liver injuries (53.7%) were of low severity (grades I and II), while 25 (46.3%) were of high severity (grades III and IV). All cases of low severity were treated conservatively without complication. Of the 25 cases with high severity; one case (1.9%) was explored for hemodynamic instability and one case (1.9%) developed haemobilia and needed adjunctive treatment in form of selective angiography to close the bleeding source. No mortality was recorded in our study.

Recommendation: In our experience, non operative management of high grade liver injury for stable blunt trauma patients is associated with high success rates without significant complications.

Key Words: Conservative – Treatment – Blunt – Liver – Injuries.

Introduction

LIVER trauma has been the main cause of death in patients with severe abdominal injuries, with related mortality of 10%-15% [1].

Until the beginning of the 1990s, liver injury cases were identified primarily by diagnostic peritoneal lavage, CT, or laparotomy. Historically, the accepted standard of care was uniform operation for suspected liver injuries, with repair of vascular, parenchymal, or biliary structures and drainage of the perihepatic spaces to control biliary leakage and to avoid potential perihepatic sepsis [2].

One of the most significant advances in the management of trauma patients in recent years was the introduction of Computed Tomography (CT) scan for stable patients. The recommendations on the use of CT for hemodynamically stable patients are well established, as outlined by the manual of the Advanced Trauma Life Support (ATLS) of the American College of Surgeons [3].

CT scan allows detection and classification of hepatic lesions and excludes the presence of associated injuries; especially injuries to hollow viscera, although in some cases it underestimates the findings. CT scan, due to its high sensitivity, specificity and accuracy, is an important screening and diagnostic tool for intra-abdominal injuries in hemodynamically stable patients; patients with altered level of consciousness; and those with difficult
clinical examination or associated pelvic fractures [4].

Liver injuries were classified according to the extent and size of hematomas and/or lacerations affecting the liver segment, in addition to any major vascular compromise. A liver injury scale (Table 1) was introduced by American Association for Surgery of Trauma (AAST) and approved worldwide [5].

Table (1): AAST liver injury scale.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Hematoma</th>
<th>Laceration</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Subcapsular</td>
<td>&lt;10% surface area, deep.</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>&lt;1 cm deep.</td>
</tr>
<tr>
<td>II</td>
<td>Subcapsular</td>
<td>10-50% surface area, &lt;1 cm diameter.</td>
</tr>
<tr>
<td></td>
<td>Parenchymal</td>
<td>1-3 cm depth, &lt;10 cm length.</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Parenchymal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;3 cm depth.</td>
</tr>
<tr>
<td>III</td>
<td>Subcapsular</td>
<td>&gt;50% surface area or expanding.</td>
</tr>
<tr>
<td></td>
<td>Parenchymal</td>
<td>&gt;1 cm or expanding.</td>
</tr>
<tr>
<td></td>
<td>Ruptured</td>
<td>Subcapsular or parenchymal hematoma</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Parenchymal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;3 cm depth.</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Parenchymal disruption involving 25-75% of hepatic lobe or 1-3 Couinaud's segments in a single lobe.</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>Parenchymal disruption involving &gt;75% of hepatic lobe or &gt;3 Couinaud's segments in a single lobe.</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Juxtahepatic venous injuries: retrohepatic vena cava or central hepatic veins.</td>
</tr>
<tr>
<td>IV</td>
<td>Hepatic avulsion.</td>
<td></td>
</tr>
</tbody>
</table>

The treatment of complex liver injuries remains a challenge for surgeons despite the last decade's advances in diagnostic and therapeutic techniques. The mortality rate for liver injuries grade IV parenchymal disruption, involving 25-75% of hepatic lobe or 1-3 Couinaud's segments in a single lobe, varies from 8% to 56% [5,6].

The advent of improved and expeditious imaging technologies for the diagnosis and treatment of solid-organ injuries, accompanied by advances in critical-care monitoring, prompted a paradigm shift toward nonoperative management for the treatment of solid organ injuries. Subsequently, the shift toward nonoperative management yielded a decrease in total mortality rates [2].

At present, the reported success rate of nonoperative management of hepatic trauma ranges from 82% to 100% [6-8]. Furthermore, an absolute increase in the incidence of nonoperatively managed liver injuries is unequivocal [9].

Follow-up CT is unnecessary in low-grade injuries unless developed symptoms as pain in right hypochondrium, jaundice, fever, anemia, or melena. While routine weekly CT scan is a must in high-grade injuries to identify potential complications that are amenable to early intervention [11].

Moreover, follow-up CT can document the tissue healing process after blunt liver injury: Hemoperitoneum usually resolves within 1 week, subcapsular hematomas in 6-8 weeks, parenchymal homogeneity is restored in 4-8 weeks and lacerations in 3 weeks, whereas hematomas and bilomas may persist for years [12].

Patients and Methods

This study was conducted prospectively from October 2013 to October 2015 in Department of General Surgery in Shebin El-Kom Teaching Hospital and. All patients admitted to the hospital with blunt abdominal trauma and diagnosed as liver injuries that fulfilled the selected criteria for conservative treatment were the candidates of this study.

On admission all patients will be managed according to the protocol of ATLS. Clinical assessment, laboratory investigations (CBC, Coagulation profile, LFTs & S. Creatinine) and radiological studies as CXR, ultrasonography (FAST) and CT Scan with contrast (only for stable patients) were done.

A protocol was introduced for our study (Table 2) to determine the criteria of patient's selection, the exclusion criteria, how to monitor patients undergoing conservative treatment, and criteria of failure of conservative treatment.

The patients records were reviewed to determine the general condition of the patient, necessity to blood transfusion, CT findings regarding the site and extent of liver injury, failure of conservative treatment, complications related to the conservative treatment and necessity to adjunctive treatment, and mortality.
Table (2): Protocol of conservative management in grade IV blunt hepatic trauma.

**Criteria for patient selection:**
1. Abdominal blunt trauma.
2. Hemodynamic stability after initial resuscitation:
   A. Pulse rate <120 beats/minutes.
   B. Systemic blood pressure >90mmHg.
   C. Initial hemoglobin level >8gm.
3. Evaluation by computed tomography with:
   A. Absence of associated injuries on hollow viscus and pneumoperitoneum.
   B. Absence of contrast blush (evidence of active arterial bleeding is indication for angiography and embolization).
4. Clinical evaluation with no signs of peritonitis.

**Exclusion criteria:**
1. Hemodynamic instability.
2. Peritoneal signs on abdominal examination.
3. Presence of associated abdominal injuries.

**Monitoring of patients undergoing nonoperative management:**
1. ICU Admission for 3:5 days.
2. Closed monitoring of vital signs.
3. Hg/Ht, CBC, LFTs and ABG measurements every 6 hours or more frequently if any clinical deterioration.
4. Follow-up CT Scan for low grade injuries, if signs of complications developed, while for high grade injuries will be done weekly.
5. Admission to the HDU (3:5 days), then shift to the ward for similar period.

**Criteria for failure of nonoperative management:**
1. Need for surgical intervention determined by:
   A. Hemodynamic instability.
   B. Failure of angio embolization to control active bleeding.
   C. Progressive fall of hemoglobin/hematocrit levels with recurrent blood transfusion.
   D. Clinical signs of peritonitis.

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### Results

During the study period (since October 2013 to October 2015), 164 patients with hepatic trauma were admitted to Shebin El-Kom Teaching Hospital. This total admission included 91 patients (55.5%) with blunt abdominal trauma. Of them, 54 patients with blunt hepatic trauma that fulfilled the protocol criteria were the candidates of this study.

**Analysis of the medical record of the 54 patients that included in the study showed the following data:**

**Age and sex incidences are shown in (Tables 3,4) respectively.**

Table (3): Age incidence.

<table>
<thead>
<tr>
<th>Age</th>
<th>Number</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:30Yrs</td>
<td>29</td>
<td>53.7%</td>
</tr>
<tr>
<td>31:45Yrs</td>
<td>16</td>
<td>29.6%</td>
</tr>
<tr>
<td>46:60Yrs</td>
<td>9</td>
<td>16.7%</td>
</tr>
</tbody>
</table>

Table (4): Sex incidence.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>39</td>
<td>72.2%</td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
<td>27.8%</td>
</tr>
</tbody>
</table>

**Assessment of general condition of patients after initial resuscitation is summarized in (Table 5).**

<table>
<thead>
<tr>
<th>Grades of shock</th>
<th>Numbers</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>19</td>
<td>35.2%</td>
</tr>
<tr>
<td>Grade 2</td>
<td>24</td>
<td>44.4%</td>
</tr>
<tr>
<td>Grade 3</td>
<td>11</td>
<td>20.4%</td>
</tr>
</tbody>
</table>

Of the 54 patients of our study, only 21 (38.9%) patients received blood transfusion. Seven patients received only one unit of packed RBCs, while the others 14 patients (25.9%) received two units of packed RBCs.

CT Scan with contrast was the basic diagnostic tool for all patients providing hemodynamic stability. Liver injuries were classified according to the liver injury scale of AAST as shown in (Table 6).

Table (6): Liver injury grades according to AAST.

<table>
<thead>
<tr>
<th>Grade</th>
<th>No. (%)</th>
<th>Grade</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low grade injuries</td>
<td>29 (53.7%)</td>
<td>Grade I</td>
<td>11 (20.4%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grade II</td>
<td>18 (33.3%)</td>
</tr>
<tr>
<td>High grade injuries</td>
<td>25 (46.3 %)</td>
<td>Grade III</td>
<td>10 (18.5%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grade IV</td>
<td>15 (27.8%)</td>
</tr>
</tbody>
</table>

Of these high grade injuries, 10 patients (18.5%) were belonging to grade III liver injury Figs. (1,2) while 15 patients (28.8%) were belonging to grade IV liver injury (Figs. 3-6).

Failure of conservative treatment was documented in two cases (3.7%) of grade IV injury. One of them due to hemodynamic instability secondary to severe hemorrhage (Fig. 7). The other one due to peritonitis secondary to associated perforated colon. Both cases were explored immediately after being diagnosed and managed accordingly.

Delayed complication in the form of haemobilia was documented in one case (1.8%) that presented by hematemesis and treated by selective angio embolization (Fig. 8A-C).

No mortality was reported in our study.
Fig. (7): Failure of Conservative Treatment: Grade IV liver injury with disrupted parenchymal hematoma and marked intraperitoneal hemorrhage.
Discussion

Since 1980 several studies have proposed that nonoperative treatment of blunt liver injuries be considered the treatment of choice for patients with hemodynamic stability. The great capacity of the liver for regenerating, the pattern of venous bleeding, and the high rate of spontaneous hemo-

stasis, may explain and be responsible for high success rates associated with nonoperative treat-
ment [13].

The role of the grade of hepatic injury in de-
ciding whether a patient needs surgery is more controversial. Whereas some surgeons are reluctant to manage high grade liver injury nonoperatively, others do not consider a high grade of injury an indication for surgery. Although paradoxical, most patients with a high-grade hepatic trauma selected for nonoperative management will still not require a delayed surgical intervention [14].

In our study we evaluated the non operative management of blunt liver trauma of both low and high grades liver injuries. We created a protocol to be applied to all our patients including inclusion and exclusion criteria, conservative measures, and failure criteria. The concept and strategy of our study coincide with those in the literature [9,10, 13,14].

Our study reported success of conservative treatment in 52/54 cases (96.4%), this included all the study candidates of different injury grades. This coincide with many studies [13-16,19,20].

However, this success rate is reduced to 23/25 cases (92%) when conducted only to cases of high grade injuries which coincide with literature [6,8,9].

Failure of conservative treatment in our study was recorded in two cases. One of them developed hemodynamic instability twelve hours after initial resuscitation, anti shock measure were given followed by CT scan that proved deterioration of the case in form of marked increase of free intraperi-
toneal fluid. The other one developed manifestation of peritonitis, two days later, due to associated perforated gut in the form of abdominal pain and distension, fever, tachycardia, leucocytosis, and proved by plain films and U/S. Both cases were explored immediately after being diagnosed and treated accordingly.

Delayed complication in our study was reported in one case (1.8%) in the form of haemobilia. This result is similar to few literature [19,20] while other studies reported zero incidence of complication [13,14]. This patient developed hematemesis three weeks after the initial trauma. Contrast-enhanced CT scan was done to confirm the diagnosis, followed by selective angiography to obliterate the pseudo aneurysm. The patient did well after that.
Conclusion:

In our experience, non-operative management of high grade liver injuries in hemodynamic stable patients is associated with high success rates without significant complications. The implementation of this regimen necessitates the availability of trained surgical teams; blood banks; critical care support; and imaging tools as CT scan.

References

المختصر العربي

الكبد هو أكثر الأعضاء عرضة للإصابة بسبب حممة وموقع القلب (الجزء الأول من الليمين من البطن). وتعتبر إصابات الكبد خطيرة وتؤدي إلى نزيف بسبب تشبع بالأوردة والشريانين. وهي تشكل نسبة 5% من مجمل الإصابات التي تصل للمستشفيات. وقد تؤدي إصابة الكبد إلى تجمع دموي أو قطع وقد يكون هناك تضر للعاءة الصفراوية دون أي عواقب خطيرة. وفي الإصابات الخطيرة إذا كان هناك كمية نزيف كبيرة فإن هذا يتطلب تدخين جراح عاجل وقد يؤدي إلى الموت.

وإذا تم تقييم حالات إصابات الكبد من خلال إنتاج البروتينات العامة لعلاج حالات الحوادث والاحميات المتعددة ثم اجزاء الفحوص الخاصة بالكبد والتي تشمل الأشعة الأثائقية والأشعة المقطعية بالصبغة والتي تعتبر هي الأفضل على الاطلاق بسبب قدرتها العالية على تحديد تفاصيل إصابات الكبد.

وقد قامت الجمعية الأمريكية لجراحة الحوادث بتقسيم إصابات الكبد إلى ستة مستويات حسب نوع وحجم ومكان الإصابة وهذا يعرض اختيار النوع الأمثل للعلاج. ومن المتفق عليه في الإحساس العلمي أن المستوي الأول والثاني من إصابات الكبد يمكن التعامل معها عن طريق العلاج التحفظي دون الاحتياج إلى تدخل جراحي. إلا أن علاج باقي مستويات الإصابات الكبدية ما زال تحت البحث العلمي للتأكد من مدى امكانية تطبيق طريقة العلاج التحفظي على هذه المستويات.

ويهدف هذا البحث إلى تقييم مدى امكانية تطبيق العلاج التحفظي على المستويات القصوى (الثاني والرابع) من إصابات الكبد. وقد تم عمل بروتوكول لهذا البحث يشمل على نواحي ومواد الضرور عن هذا البحث بالإضافة إلى تفاصيل العلاج التحفظي الذي يتم في العملية المركزية في معاملة الكبد.

وقد تواتت طرق ونتائج هذا البحث مع العديد من الأبحاث المشتركة في مختلف المدارس الأصلية التي تركز على ضرورة النظر بشكل كبير في تطبيق نظام العلاج التحفظي لإصابات الكبد ذات المستويات القصوية لما تلاحظ أن هذا النظام العلاجي من لدجاء كبير جدا المريض.

ويمثل بشكل كبير من الأبحاث العملية استثناء من المستويات القصوى لذات إصابات الكبد.