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Management of traumatic liver injuries, Mafraq hospital experience, UAE

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ABSTRACT

Background: The purpose of this retrospective study is to evaluate our institutional practice on the management of traumatic liver injuries and evaluate the main causes of failure of non-operative management (NOM).
Methods: This is a retrospective study done in Mafraq Hospital, Abu Dhabi, UAE, during the period between January 2014 and January 2016. The patients were reviewed with regards of the grade of liver injuries, blood transfusion, imaging done, surgical intensive care unit (SICU) admission and serial vital signs and hemoglobin level. Also, we included the patient who required emergency laparotomy and damage control surgery. Focused assessment by ultrasound for trauma (FAST) was done in all liver trauma patients upon arrival to ED along with arterial blood gases, chest and pelvic X-rays. Computed tomography (CT) scans with angiography was done in all responder and stable patients. In transient responder patient CT was done on the window period of responding to resuscitation. Non-responder patients were taken immediately for exploration laparotomy, which include either control of bleeding or perihepatic packing.
Results: This study included 75 patients admitted to our facility with different grades of liver injuries. 36 (48%) patients were admitted with grade I, II liver injuries which represent most of our admissions. 27 (36%) patients were admitted with grade III, 10 (13.33%) patients with grade IV while the least number was with grade V (2 patient, 2.66%). Non-operative management (NOM) or conservative treatment was successful in 34 patients admitted with grade I, II liver injuries whereas other 2 patients were explored for associated mesenteric and splenic injuries. On the patients admitted wit grade III liver injuries NOM was successful on 22 patients. The results of management of grade IV injuries showed that NOM was successful on 5 patients while the patients with grade V were managed operatively due to instability.
Conclusions: Management of traumatic liver injuries is a multidisciplinary team work requiring trauma surgeon, interventional radiology, intensive care unit beside facility for trauma CT and massive blood transfusion. Management of traumatic liver injuries is depending on hemodynamic status of the patient and not the grade of injury.

Keywords: Angioembolization, Liver packing, Liver injury, Nonoperative management

INTRODUCTION

In abdominal and lower chest trauma, the liver is considered as one of the most vulnerable organ for different types of injuries; this partially due to its large size and fragile parenchyma as it is an organ filled with blood.[1]

Pringle first described the operative management of severe liver trauma. He offered occluding porta hepatic to

give a chance for repair of the injury. However, the application of such maneuver was associated with a high mortality rate.[2]

On the last three decades, major liver trauma mortality was almost 70%. This figure decreased to 50-54% mortality on the first 24 hours after admission. This revolution in hepatic trauma management can be contributed to many factors including availability of focused assessment by ultrasound for trauma (FAST), computed tomography (CT) scan with angiography and embolization, advance in intensive care management and introduction of the concept of damage control surgery.[3-5]

FAST scan is a bedside, quick, non-invasive procedure with a high sensitivity (63-100%) and specificity (95-100%). Its main disadvantages are it is operator dependent and inability to diagnose associated hollow viscus injuries or retroperitoneal hematoma.[6,7]

CT scan with contrast has a crucial role on the diagnosis and the subsequent management of traumatic liver injuries. It has a high sensitivity and specificity rates, 92-97% and 98.2% respectively. Beside its advantage as a diagnostic tool CT scan can be also used for following up to evaluate the injury and diagnose the complications such as biloma, intra-abdominal collection or pseudoaneurysm formation. It can be also used during the management of complications.[8-10]

The management of traumatic liver injuries could be non-operative (NOM) or operative. Angio-embolization is categorized under NOM. Choice of operative or non-operative management for patient with liver trauma is that serious decision that almost equal to a decision of life or death to the patient.[11,12]

In blunt injuries NOM is the standard line of treatment for hemodynamically stable patients irrespective to the grade of injury. This can be modified to angio-embolization if CT scan revealed contrast extravasation still with hemodynamic stability. Failure of conservative management on this category of injury usually is due to an old age of the patient, failed angioembolization or delayed bleeding.[13,14]

In penetrating injuries NOM is still the recommended management plan for hemodynamically stable patients provided that other injuries that require laparotomy are excluded.[15]

With increased management plan towards NOM, managing Grade I and II injuries do not pose problems while managing higher grades of injuries can be tricky due to its serious complications.[16-18]

Complications of NOM can be

- Missed viscus injuries, which represent 0.7-26.5%, so on deciding NOM, exclusion of such injuries by both clinically and radiological facilities, should be done
- Biliary injuries with various presentations of biliary fistula, biloma, biliary peritonitis and haemobilia
- Abscess formation, which can be collected at the site of hematoma and can be drained with CT guidance
- IVC thrombosis.

Multidisciplinary team is one of the essential criterions on choosing NOM on managing traumatic liver injuries. The team should include trauma surgeon, intervention radiologist, intensive care specialist and radiologist. Presence of such team will account for significant reduction on the morbidity and mortality from severe liver injuries as well as increase the success of NOM.[19,20]

METHODS

This is a retrospective study done in Mafraq Hospital, Abu Dhabi, UAE, on the period between January 2014 and January 2016. The patients admitted during this period were reviewed with regards of the grade of liver injuries, blood transfusion, imaging done since arrival to the Emergency Department, surgical intensive care unit (SICU) admission and serial vital signs and hemoglobin level. Also, patient who required emergency laparotomy and damage control laparotomy were included.

Mechanism of injuries were motor vehicle collision, fall from height, blunt, penetrating traumas and motorbikes injuries. AAST grading system was used for grading of traumatic liver injuries.

Upon arrival to the ED vital signs were immediately obtained and FAST scan was done with chest and pelvic X-rays and arterial blood gases. The patients were immediate resuscitated with 2 liters of intravenous crystalloids; routine blood investigations including coagulation profile (PT, APTT and INR) during insertion of bilateral cannulas on the arms were obtained. During resuscitation, shock was defined as systolic blood pressure less than 90mmHg.

All stable patients, responders and some of transient responders were subjected to CT with contrast to diagnose the extent of liver injuries and if there were associated injuries specially that require immediate laparotomy.

Glasgow coma scale (GCS) was used to assess the neurological status of the patient and if there were associated neurological injuries.

After initial resuscitation with two liters of crystalloids, a massive transfusion protocol (MTP) was activated in all non-responder or transient responder patients. In our institution MTP includes 4 unites packed red blood cells (PRBCS), 4 unit's fresh frozen plasma and 4 unit's platelets together with 1 gram Tranexamic Acid and

Fibrinogen. Patients were considered non-responders after consuming 2 cycles of MTP.

Emergency laparotomy considered for the patients with positive FAST scan with uncontrolled liver bleeding; CT scan showed massive hemoperitoneum or associated hollow viscus injury.

A total number of 75 patients were admitted to our department with different grade of liver injuries. Among them, 36 (48%) patients were admitted with grade I and II liver injuries, 27 (36%) patients with grade III, 10 (13.3%) patients with grade IV and 2 (2.66%) patients with grade V injuries.

RESULTS

In our study 75 patients were admitted with different grades of liver injuries. Demographic distribution of patients can be seen in Table 1.

Table 1: Demographic data of patients with different grades of liver injury.

Variables	Grade I-II	Grade III	Grade VI	G V
Number of patients	36 (48%)	27 (36%)	10 (13.33%)	2 (2.66%)
NOM for liver trauma	34	22	5	-
SICU admission	No	Yes	Yes	Yes
Number of patients required blood transfusion (2 and more units)	2	10	10	2
Hemodynamic instability requiring				
MTP	1	4	10	2
Laparotomy/ patients	2 for associated injuries	1 For complication	2	2
Angioembolization per patients	Non	3	3	Non
Complications				
Biliary leak	Non	1	1	1
Pseudoaneurysm	Non	1	Non	Non

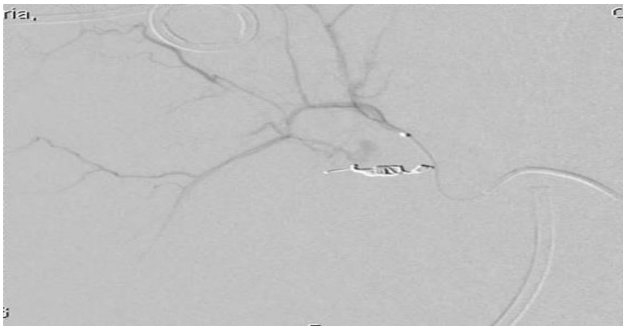


Figure 1: Angioembolization and coiling.

Figure 2: CT with contrast, grade IV liver injury.

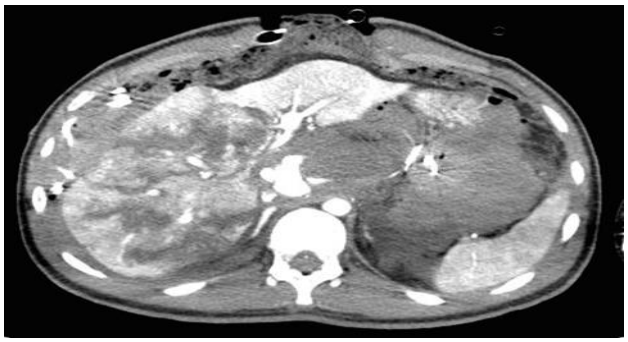


Figure 3: CT with contrast showing grade V liver.

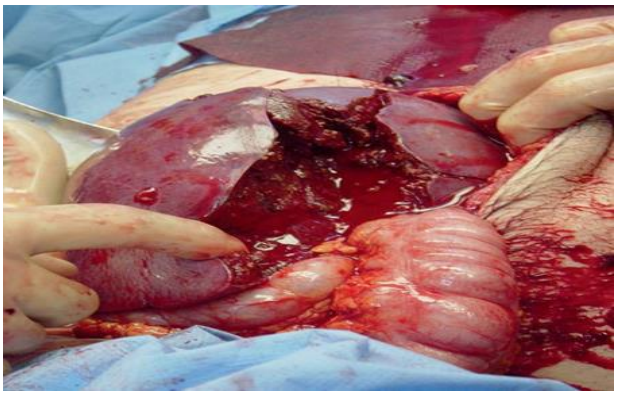
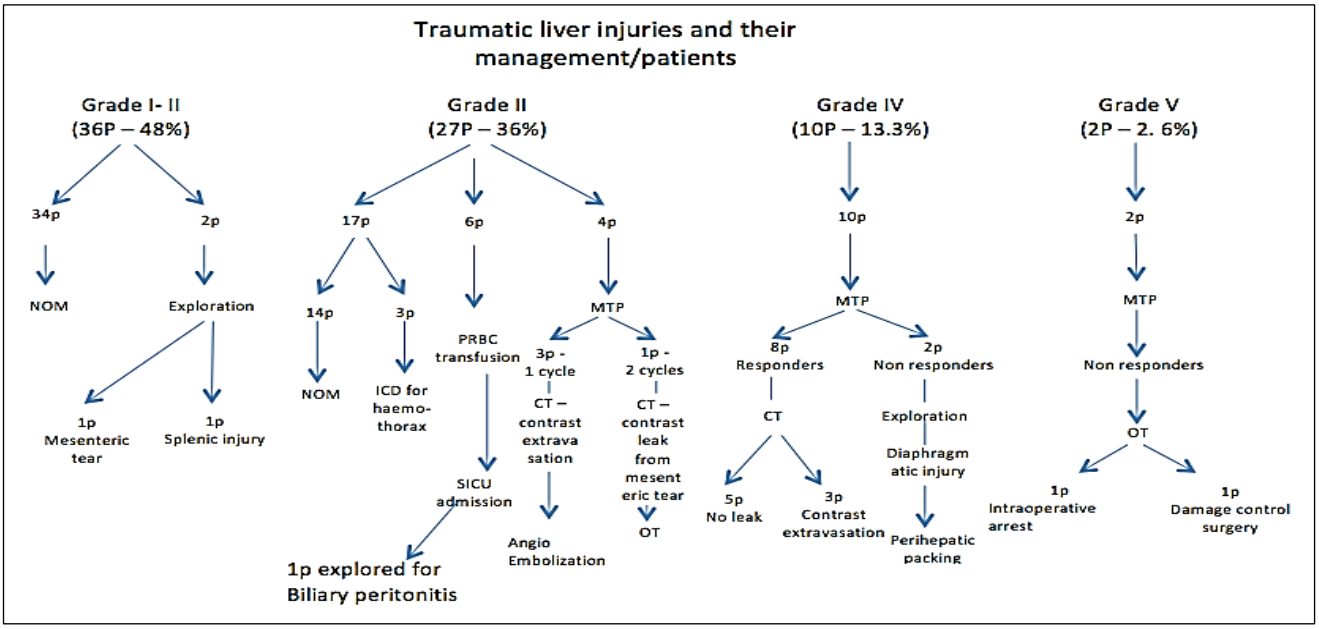


Figure 4: Intraoperative liver injury.

Grade I and grade II injuries were diagnosed on 36 (48%) patients and positive FAST findings were revealed on two of them. One of them required transfusion of 2 units of blood after initial resuscitation with 2 liters of intravenous crystalloids and his CT demonstrated mesenteric injury with contrast extravasation that required laparotomy. The other patient transiently responded to fluid resuscitation, however the hemoglobin level on the subsequent arterial blood gases dropped; massive transfusion protocol was activated with respond to the first cycle and CT revealed associated splenic laceration with contrast extravasation that also required laparotomy and splenectomy. In both patient's liver injuries were inspected during laparotomy and do not need further management.

The number of patient with GIII liver injuries was 27 (36%) and 17 of them were subjected to NOM with SICU admission, serial abdominal examination and hemoglobin level. Three out of the 17 patients were undergoing intercostal drains insertion (ICD) for associated hemothorax and pneumothorax. Six patients required transfusion of 2 units of packed red blood cells (PRBCS) and were admitted to SICU for NOM (one of then explored 2 days later for biliary peritonitis and one patient complicated with pseudoaneurysm). In four patients of grade III group MTP was activated three of them received only 1 cycle with their CT revealed contrast extravasation required angioembolization (Figure 1) and the other one received 2 cycles and was explored for associated mesenteric injury.



P= patient.

Figure 5: Results summary.

Ten (13.33%) patients were admitted with G IV liver injuries (Figure 2), MTP was activated in all of them. Five patients were responders and CT did not reveal contrast extravasation and they were admitted to intensive care unit for non-operative treatment. Three patients were also responders but their CT showed contrast extravasation and they were managed with angioembolization. Two patients were non-responders and emergency laparotomy was performed which demonstrated grade IV liver laceration with diaphragmatic injury. Liver injuries were managed by control of the bleeding and application of TachoSil® Fibrin Sealant Patch while diaphragmatic injury was primarily repaired. Biliary leakage with collection was a complication in one patient. It was managed by interventional radiological drainage.

Two patients were admitted with grade V liver injuries (Figures 3 and 4). MTP was activated for both patients with no response after 2 cycles and they were taken to emergency exploration laparotomy. One patient died on the table. The second patient was undergoing damage control laparotomy with perihepatic packing with closure of the abdominal incision with a Bogata bag and partial closure of proximal abdominal incision. Patient was transferred to SICU to continue resuscitation and warming for prevention of hypothermia and correction of coagulopathy. This patient was taken back to operating room after 48 hours after correction of metabolic derangement and coagulopathy.

DISCUSSION

Liver is the most vulnerable internal organ for injury in blunt abdominal trauma. Most of traumatic liver injuries are Grade I and II. With the recent advances on radiological imaging, interventional radiological

procedures and intensive care management most of liver injuries can be managed conservatively.[1,15]

Likewise, the large number of the patients admitted was with Grade I and II injuries and all of them were managed conservatively. However, two patients in this group required laparotomy, but not for liver injury; surgery was done for associated mesenteric and splenic injuries. So, it must be always keep in mind that bleeding can be also from another source than liver. Bucirt et al have reported that liver injuries that was inspected during laparotomy for associated injuries had no active bleeding.[21]

Richardson et al, commented that many experienced trauma surgeons apply surgical treatment for stable traumatic liver injury patients and it will have a positive impact on their survival. However, such a comment was not applicable to our study.[2]

Malhotra et al, reports a relation between the presence of massive hemoperitoneum and failure of conservative treatment which was not considered as a prognostic factor in our study.[13]

The present study showed that NOM was successful in 85% of cases, after excluding patients who were explored for associated injuries. This percentage is approximated to the published success rate by Trunkey et al.

In comparison with data presented by Christmas et al, our study showed a slight improvement which could be attributed to the fact of 24 hours availability of interventional radiology and that the most of our patients had G I and II injuries.[15]

Malhotra et al, reported failure of NOM in 14% of cases with grade IV and 22.6% with grade V injuries whereas failure rate in our study for grade III was 18% and 20% for grade IV patients.[13]

Failure of conservative management of liver trauma can be attributed to hemodynamic instability, bile leakage and biliary peritonitis or associated injuries.

Durham et al, reported 5% failure of conservative management due to secondary hemorrhage. In this study, none of our patients had secondary bleeding.[16]

In a study conducted by Buckman et al. the percentage of patients who were managed conservatively and developed bile leakage varied from 3 to 20% whereas in our study only 4% had such complication.[22]

Miller et al and Carrillo et al, reported that conservative treatment failure lies between 0.5-3.5% among patients with associated intraabdominal injury. In our study associated abdominal injuries were found on 4% of patients.[19]

CONCLUSION

The study demonstrated that the main selection criterion for operative or non-operative management for the patients with traumatic liver injuries is hemodynamic stability, which goes along with international guidelines. The main cause of failure of conservative management other than hemodynamic instability is associated intra-abdominal injuries. Availability of interventional radiology, strict intensive care and massive transfusion protocol are contributing factors to improve the success rate of conservative management.

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