CASE REPORT

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Grade - V [AAST Classification] Acute Liver Injury Managed via Non-Surgical Approach: A Case Report

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ABSTRACT

Blunt abdominal traumas involving the liver are frequently encountered as part of Road Traffic Accidents [RTA]. Despite aggressive management and resuscitation efforts when encountering such patients in the Emergency Room [ER], the concept of developing trauma centers appears mandatory for prompt intervention and therapeutic accuracy. Hemodynamic status appears to play a key role in initiating further treatment strategy. Radiographic imaging namely CT-scans have an established role and has been a gold standard in diagnosing the gravity of the underlying organ injury. Non-Operative Management [NOM] of traumatic liver injury has been considered feasible for grade I - III liver injuries primarily. Surgical exploration of the liver has been restricted to cases of penetrating trauma associated with traumatic liver hemorrhage. Here in, we report a case of a young male who presented in the surgical ER of a tertiary care teaching hospital after his car collided with a tree. ATLS [Advanced Trauma Life Support] protocol was delivered successfully. The patient was resuscitated and further investigations carried out accordingly. CECT [Contrast-Enhanced Computed Tomography] scan of the abdomen revealed grade - V [AAST Classification] acute liver injury which was managed conservatively. Patient was ultimately followed in the surgical Outpatient Department [OPD] after 1 week, 2 weeks, 1 month, and then 3 months of discharge from the hospital with his visits being uneventful.

Keywords: *Blunt trauma; Liver trauma; Liver injury; ATLS; Non-operative management [NOM]; CT-imaging; Surgical exploration.*

**AAST [American Association for the Surgery of Trauma] classification*

INTRODUCTION

Worldwide statistics claim traumatic injuries as the third leading cause of trauma-related mortalities with the anterior abdominal wall being affected most frequently.[1,2] Recent literature highlights such injuries to the abdomen being frequently encountered as part of the Accident and Emergency [A&E] units in hospitals, and has been clearly stated to evolve around 5% of all emergency admissions ranking the liver, a vital organ grossly occupying the anterior abdomen, amongst the most common to be affected.[1,3,4] Road Traffic Accidents [RTA] appear to contribute to the majority of cases of liver injury where non-interventional therapeutic management is preferred for Grade I to III liver trauma pathologies.[6]

The American Association for the Surgery of Trauma [AAST] has classified liver injuries into six grades [Table 1, Figure 1] which can be appreciated with contrast-enhanced computed tomography imaging of the abdomen.

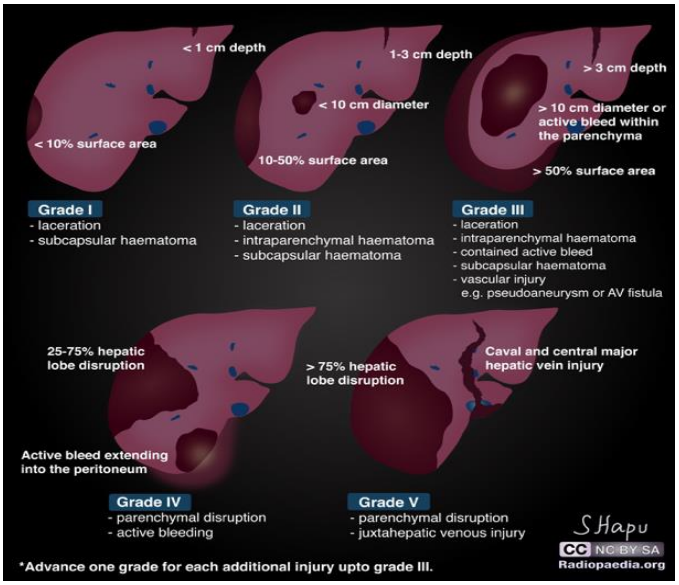
Treatment of the morbidity imposes a complex physician challenge to opt the most beneficial therapeutic strategy between the operative and non-operative protocol. The ultimate decision of managing the patient conservatively or the surgical approach via laparotomy is primarily centered around two pivotal factors; physiology or hemodynamic status of the patient, and anatomy or severity of the liver injury.[6]

Despite the treatment plan being emphasized around the prior two factors, the current literature clearly emphasizes non-operative management as an approach which, unless not applicable in cases of severe avulsion, should not be excluded during evaluation of liver trauma.[7]

Table 1: AAST liver injury classification[6]

Grade	Injury type	Injury description
I	Haematoma	Subcapsular < 10 % surface
	Laceration	Capsular tear < 1 cm parenchymal depth
II	Haematoma	Subcapsular 10–50 % surface area; intraparenchymal, < 10 cm diameter
	Laceration	1–3 cm parenchymal depth, < 10 cm in length
III	Haematoma	Subcapsular > 50 % surface area or expanding, ruptured subcapsular or parenchymal haematoma. Intraparenchymal haematoma > 10 cm
	Laceration	> 3 cm parenchymal depth
IV	Laceration	Parenchymal disruption 25–75 % of hepatic lobe
V	Laceration	Parenchymal disruption involving > 75 % of hepatic lobe
	Vascular	Juxtavenous hepatic injuries i.e., retrohepatic vena cav/central major hepatic veins
VI	Vascular	Hepatic avulsion

Figure 1: Diagrammatic representation of AAST liver injury grades[8]



CASE PRESENTATION

A 20-year-old male patient with no known co-morbidities was brought into the ER by a team of rescue workers. The patient had undergone a road traffic accident which had occurred 2 hours prior to his arrival in the ER. The injured patient was the sole passenger and driver of a car which was cruising at a speed of approximately 70 miles per hour. The accident occurred as the car took a sharp turn resulting in head-on collision with a tree. The patient was received on the surgical emergency floor in a conscious state with a Glasgow Coma Scale [GCS] of 15/15. There was no history of vomiting, loss of consciousness, fits or active bleeding from the ear, nose or throat. ATLS protocol was administered. His vital parameters were unstable where blood pressure was recorded at 90 / 60 millimeters of mercury (mmHg), pulse at 105 beats per minute, respiratory rate at 39 breaths per minute, and oxygen saturation at 97% without supplementary oxygen support.

Bruising in right subcostal region with tenderness was appreciated. Chest had bilateral equal air entry. There was a split laceration over the right eyebrow with the underlying orbital bone exposed which was managed by multiple sterile dressings while plastic surgery and eye consultations were sought simultaneously. Multiple superficial abrasions were noted on the left upper and lower limbs.

Intravenous access was gained in both forearms through 2 large, wide-bore 18-gauge cannulas and 3 liters of Ringer's lactate (RL) administered intravenously. After the infusion of the first two liters of RL, the patient's blood pressure started to improve gradually and was recorded at 110 / 70 mmHg. Blood samples were collected and sent for complete picture, coagulation profile, serum amylase levels, blood grouping and cross matching analysis. Tetanus toxoid was concomitantly injected intramuscularly in the right deltoid muscle as the left shoulder had a 6 cm by 3 cm abrasion. A single intramuscular dose of 25 mg diclofenac sodium, with a single intravenous dose of 30 mg ketorolac and 40 mg omeprazole was administered. A 16 french latex foley catheter was placed and central venous line secured in the right subclavian vein for strict monitoring of intake-output charting and central venous pressures respectively.

Patient was then subsequently moved to the radiology department where chest, pelvis, and cervical spine radiographs were found to be normal. Initial FAST scan revealed minimal free fluid in the pelvic cavity. The second FAST scan after 2 hours depicted similar findings as before. By this time the patient had become hemodynamically stable with a blood pressure of 130 /70 mmHg and pulse rate of 84 beats per minute with vital monitoring continued strictly at 1-hourly interval. The patient had a stable hemodynamic status overnight. The 3rd FAST scan was repeated 09 hours after the initial scan, which also showed minimal free fluid in the pelvic cavity concluding no new changes further.

Serial blood hemoglobin levels were: 11.0 g/dl [at time of presentation in ER] —> 10.9 g/dl [4 hours after presentation in ER] —> 11.3 g/dl [8 hours after presentation in ER].

Serum alanine transaminase [ALT] and aspartate transaminase [AST], were found to be elevated at 1499 and 1200 respectively. Serum amylase in the ER was 51 U/L.

Coagulation profile revealed deranged values of prothrombin time [PT] and activated partial thromboplastin time [aPTT] with an increase of 6 and 12 seconds respectively. Further, 6 units of fresh frozen plasma [FFP] were arranged and transfused accordingly

after patient blood group confirmation. Blood sugar levels in the ER were recorded on two occasions: 109 mg/dL [at the time of presentation in the ER] and 115 mg/dL [6 hours after presentation in the ER].

CECT scans of the chest, abdomen and pelvis were performed where Grade V acute liver injury was visualized in the abdomen - Figure 2; Table 2

Figure 2: CECT scan of abdomen revealing findings consistent with Grade V liver injury [See arrows]

Table 2: Report of CECT Abdomen

CECT Abdomen report	Large, diffuse, ill-defined, non-enhancing, hypodense area involving segment I, V, VI, VII and VIII of right liver lobe [> 75 percent of right lobe] and IVa of left liver lobe along with mild ascites and minimal right sided pleural effusion. CT features are suggestive of acute liver injury grade V [AAST classification].

Patient was then shifted to the surgical ward high dependency unit [HDU] with strict restriction on mobilization. Daily, 3 liters of intravenous replacement fluids were given including RL, 10% dextrose in water, and amino acid infusion aminoplasmal.

Eight hourly broad-spectrum antibiotic coverage with 500 mg imipenem and 500 mg cilastatin was initiated intravenously in co-relation to underlying raised total leukocyte count [TLC] of 17.0 x 10^9. Pain management included non-steroidal anti-inflammatory [NSAID] and opioid analgesics where 30 mg ketorolac and 100 mg tramadol were intravenously administered on eight hourly basis. 1 tablespoonful of aminoacid combination syrup Hepa-Merz was also given three times daily alongside the other medications. Patient's strict vital monitoring was continued accordingly to ensure hemodynamic stability at all times. Blood sugar monitoring was also continued with readings between 98 mg/dL and 119 mg/dL.

The patient remained vitally stable over the five-day period in the ward with an exception of a single fever spike noted on the second day. Urine output was adequate at 125 ml/hour throughout. Central venous pressure was maintained between 8-12 cm of H2O, and patient's oxygen saturation measured steadily between 96-98% without any supplemental oxygen support. Patient was discharged on the fifth day of the ward stay with the advice to follow up in the OPD after one week. Follow-up was found to be uneventful.

Our patient with grade-V acute liver injury was managed successfully via the non-surgical route. Follow-up of the patient at 1 week, 2 weeks, 1, and 3 months later was found to be uneventful.

DISCUSSION

Liver trauma, accounting for 5% of all ER admissions, poses a complex physician therapeutic task where a multidisciplinary team comprising of various other specialties is required to effectively manage patients and prevent mortality.[3] According to Sener M.T. et al, blunt liver injuries have been strongly correlated to traffic accidents at a startling rate of 70% where 54% of the cases are linked to mortality. These statistics have been highlighted in a retrospective analysis conducted from 2015 – 2019 which revealed an intriguing 57.3% of cases consistent with liver injury from a total of the abdominal trauma cases confronted.[9] These findings also correlate with another study clearly emphasizing the role of RTA as a dominant cause of liver damage.[10] Considering the conclusions of various studies, a rationale needs to be adopted when encountering such blunt traumas in the ER of all health care setups to prevent mortalities, and the drafting of a standardized treatment algorithm.

Prior studies highlight majority of liver trauma patients with minor injuries [grade I and II] being managed safely through a conservative approach [non-operative management]. However, grades III, IV and V liver injuries may require emergency laparotomy as an ultimate life-saving option to pursue.[11] Interestingly, a study had highlighted the implementation of NOM approach for blunt and penetrating liver injuries, where the NOM was suitable for over two-thirds of blunt hepatic versus below 20% of penetrating trauma cases. The study had concluded identical mortality rates in both classes of injuries. [5] These results further emphasize the need of an integrated, multi-faceted treatment approach to prioritize and thus reduce overall fatal complications.

Hemodynamic stability including the on-spot vigorous assessment of the airway, breathing and circulation dynamics have been claimed to evolve as prime key factors to initiate and continue further treatment accordingly. Stable vital assessment parameters facilitate the need of a non-surgical therapeutic approach involving vigilant monitoring of the patient clinically, alongside inclusion of radiological and laboratory investigations.[3,12] A similar approach was followed in relation to the patient we encountered who had undergone high-grade liver injury [Grade - V], was maintaining his pulse and blood pressure indices within the normal range. Serial hemoglobin levels of our patient were stable with concomitant FAST scans revealing no medical emergency to warrant an urgent surgical exploration of the abdomen. Scarcity of Grade V injuries being therapeutically managed without the traditional dogma of abdominal exploration have been found to prevail in the literature. Recent studies further elaborate a 70% safety profile of NOM in patients specifically with Grade IV – V liver injuries ultimately alleviating the concept of surgical exploration as a strategy.[13]

NOM of blunt liver trauma evolves as a significantly reliable therapeutic approach in the literature with its efficacy being annotated as highly beneficial and its supremacy being highlighted in the first line management protocol.[1,4] Over the past two decades, there has been an indefinite increase in the utilization of non-surgical protocol in treating blunt hepatic traumas especially in urban health care centers.[14,15] Studies suggest the non-utilization of surgical approach as a cornerstone for 20 years enabling physicians to counteract hepatic trauma cases more effectively.[13] This therapeutic strategy has been widely acclaimed in majority of cases of traumatic blunt hepatic lacerations encountered.[16] Considering these studies, the core principles of NOM hence acquire the need to be considered as a first-line treatment protocol when dealing with abdominal blunt trauma cases; hence correlating with our strategy implemented.

Screening and imaging techniques in evaluating the severity of trauma has been highlighted to play a dominant role. In agreement to what has been published, a preliminary diagnostic tool known as the Focused Assessment with Sonography in Trauma [FAST] has been utilized as a fundamental approach to evaluate intra-abdominal fluid collection and further determine the severity of underlying organ injury. [3]

Despite the positive role of FAST as an efficient diagnostic modality, contrast-enhanced computed tomography has been identified as a distinct evaluation and diagnostic tool for liver trauma implications including the occurrence of parenchymal lacerations, bruise, internal bleed, liver abscess, peritonitis and other complications. Various studies have guaranteed its constructive role in isolating the depth and gravity of liver injuries specifically.[3,7] Considering the importance and need of diagnostic scans, our patient underwent three FAST scans, a few hours apart, and subsequent CECT scans enabling us to pursue the ideal treatment plan accordingly.

Despite recent literature emphasizing on the dominance of NOM for blunt liver trauma, authors highlight the adaptation and use of CT-imaging in evaluating a potentially lethal complication of liver trauma known as the hepatic artery pseudoaneurysm. This disease complexity warrants the need of a vigilant surveillance protocol, angiography, and therefore further delays in hospital stay and management.[17]

Penetrating hepatic lacerations and lack of hemodynamic stability demands the need of an urgent abdominal exploration to halt the disintegration of the highly vascular liver bed justifying 40% of trauma penetration cases acquiring the need of surgical intervention as mentioned by Garcia I. C. et al.[4,7] A prospective study conducted in Egypt supports the core concept of initial conservative management playing an important role in effectively resuscitating patients. It has been stated that the predictor to a victorious conservative management plan is the patient's response to intravenous administration of fluids.[18] In our case, the patient responded well to intravenous fluids indicating the positive sustainability of patient hemodynamics by intravenous fluid therapy.

The establishment of multiple, well-equipped basic health units and availability of certified trauma care nursing team may enable physicians to swiftly and effectively treat patients with a severely injured liver, reducing the overall burden on the healthcare chassis[19]

CONCLUSION

Hemodynamic stability is considered as a prime aspect of managing patients with blunt liver trauma. NOM is now regarded as the gold-standard therapeutic approach by-passing the traditional surgical route. An algorithm needs to be established in order to approach trauma cases effectively. CECT-imaging resumes to play a vital role in grading the severity of liver injury. Implementation of trauma centers providing multidisciplinary physician approach in evaluating the severity of the injury irrespective of the patient age appears mandatory. An ideal, yet timely decision awaits a better overall prognosis in approaching blunt hepatic trauma cases in emergency health care.

CONFLICT OF INTEREST / DISCLOSURE

The Authors declare no conflict of interest.

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Figure 1 is a property of Radiopaedia.org. Case courtesy of Dr Sachintha Hapugoda, Radiopaedia.org, rID: 51390.

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ETHICAL APPROVAL

Ethical approval has been obtained from the IRB (Institutional Review Board) of the Hospital.

PATIENT CONSENT

Informed consent was taken from the patient.

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