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A Potentially Fatal Grade V Liver Injury and Concomitant Hemopneumothorax Undergoing Multiple Surgeries: A case Report Study

Nima Nabavi[1], Mahdi Attarian[2*]

[1]Student Research Committee, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
[2]Department of General Surgery, Imam Reza Hospital, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

*** *Corresponding author:*** Mahdi Attarian, Department of General Surgery, Imam Reza Hospital, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran. Tel: +9159359815 ; Email: m.atarian@yahoo.com

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Abstract

Background: Due to its size, vascular structure, and fragile parenchyma, the liver is considered the most common cause of mortality due to abdominal solid organ injury. Here we present a case of a patient suffering from blunt liver trauma with a review of the literature.
Case Presentation: A young 33 years old male patient was referred to our medical center by the EMS with a chief complaint of pain and dyspnea due to direct thoracoabdominal trauma. The patient presented with hypotension and was transferred to the intensive care unit for close monitoring. Radiologic investigations showed lung contusion with grade V liver injury. The patient underwent damage control surgery and the definitive surgery following that and showed no signs of complication during the hospital stay and follow-up visits.
Conclusion: Trauma is among the leading causes of death worldwide, with the head and extremities being the most affected injury sites, followed by abdominal trauma. The most affected group is young males. During the last decades, non-operative management(NOM) of abdominal trauma has increasingly gained popularity among surgeons due to the prevention of laparotomy complications such as infections. Concomitant injuries, including solid and hollow organs alongside liver trauma, affect the morbidity and mortality status of the patient and are associated with high mortality rates if not addressed immediately and appropriately.

Keywords: blunt liver trauma, lung contusion, hemopneumothorax

1. Introduction

Trauma is a leading cause of death worldwide, with abdominal trauma among the most common cause of morbidity and mortality following head and extremity trauma (1). Motorcar accidents, pedestrian accidents, and falls are the leading causes of blunt abdominal injuries. These, often high-energy mechanisms, damage solid abdominal organs the most. In fact, in these situations, the liver stands as the second most injured solid organ, only after the spleen. However, liver injuries are responsible for 10 to 15% of mortalities following severe abdominal traumas, more than any other cause. This is chiefly due to the liver's size, vascular structure, and fragile parenchyma (2).

The liver is a large organ that lies under the diaphragm in the anterior part of the right upper quadrant, making it susceptible to both blunt and penetrating abdominal injuries. Moreover, the liver's vast and fragile vascular structure receives 25% of the cardiac output; thus, any significant damage to its vasculature can escalate into potentially fatal hemorrhages. (2,3)

The management of blunt liver trauma has shifted toward selective non-operative management rather than operative management during the last decades. Therapeutic modality selection relies on many factors, such as liver injury grade, which can be assessed accurately using abdominal CT scans. However, Unstable hemodynamics in patients necessitates operative management as the appropriate choice of therapy for either damage control surgery or definitive surgery (3, 4).

This study presents a case of a patient with liver trauma regarding a heavy steel door falling. Moreover, a review of the literature regarding management is performed.

2. Case Presentation

A young 33 years old male patient was referred to our medical center by the EMS with a chief complaint of dyspnea and pain due to direct thoracoabdominal trauma resulting from a colossal steel door falling on the ventral body side of this construction worker. No significant past medical or surgical history was mentioned, and the patient was not currently using any medication and did not mention any history of substance abuse either.

On admission, the patient was alert and awake with a Glasgow coma scale (GCS) of 15/15. The patient's heart was beating at a rate of 104 per minute, and his blood pressure was 79/59. Generalized abdominal tenderness and reduction of the left lung sounds were detected. Chest movements were symmetric, and no paradoxical thoracic movement was seen. Jugular vein pressure was not increased, and heart sounds were not muffled. The patient's range of motion (ROM) was normal in all four limbs, and vertebral column examination was insignificant. Pupils were midsize and reactive to light, and no signs of head injury

Table1. Patient's vital signs within the first 2 hours

Temperature	Heart rate	Respiratory rate	Blood pressure	Time
37	104	16	79/59	19:30
37	100	14	121/79	20:00
37	99	14	111/61	20:30
37	89	14	115/72	21

were present. The patient's vital signs in the first 2 hours can be seen in table 1. Peripheral intravenous access and central venous access were established, and the patient received sodium chloride 0.9% IV solution and oxygen therapy. The focused assessment with sonography in trauma (FAST) was normal, and no signs of intra-abdominal hemorrhage were detected. After stabilizing the patient's hemodynamics, an abdominal CT scan with contrast and chest CT scans were performed. On the abdominal CT scan, a rim of fluid was seen in Morrison's space, and the chest CT scan demonstrated signs of lung contusion. The abdominal and chest CT scans are demonstrated in figures 1 and 2.

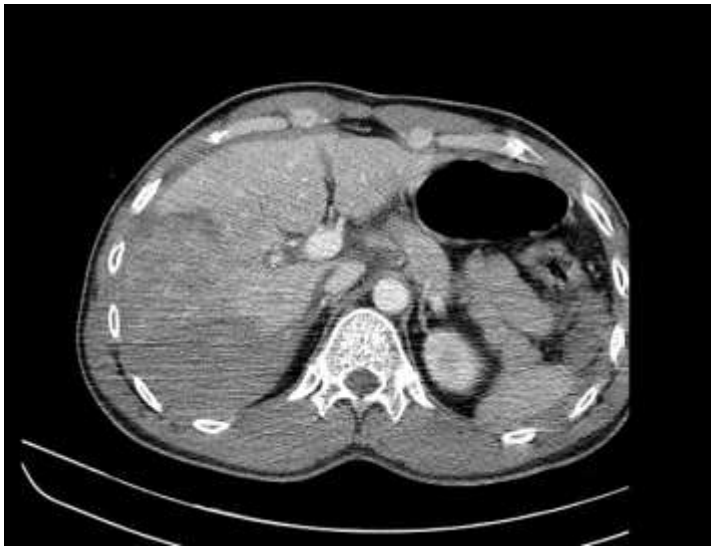

Figure1. Abdominal CT scan with contrast revealed a major liver injury

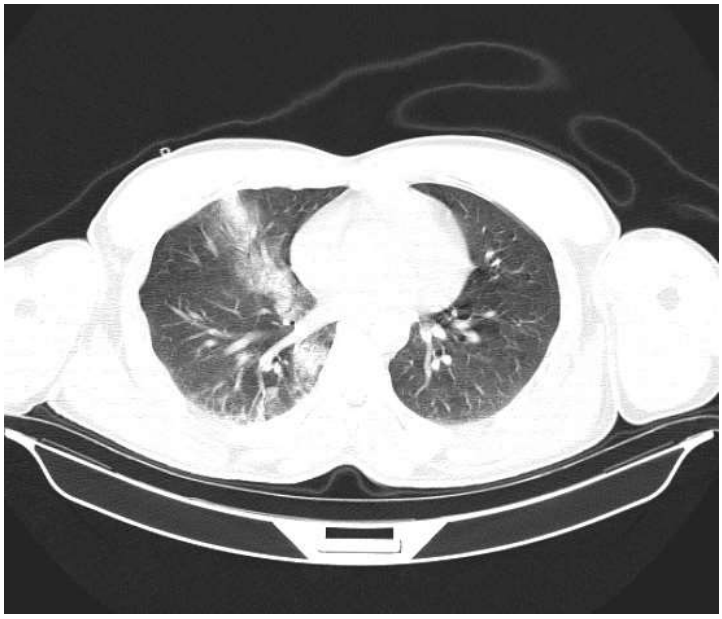

Figure2. Chest CT showing lung contusion

Due to the need for close monitoring of the patient, the patient was immediately transferred to the intensive care unit. Laboratory investigations were carried out, and consultations for the provision of the best quality care were performed. The patient received conservative treatment for his lung

contusion.

The patient's initial laboratory results are presented in Table 2. Follow-up laboratory investigations revealed a grade 3 thrombocytopenia which mandated damage control surgery.

Table2. Patient's laboratory results on admission

Item	Result	Normal range
WBC	14.8x103	4-10 x 10^3
Hb	12.9	13-18 mg/dl
Plt	274	150-450 x 10^3
Na	140	135-145 mEq/L
K	5.1	3.5-5.3 mEq/L

The patient underwent his first operation 18 hours following admission. Grade V liver injury was determined with hepatic lobe avulsion and above 75% of injury to liver parenchyma. Extensive liver lacerations were seen in zones 5,6,7, and 8 alongside 3 liters of blood in the peritoneal cavity. Liver necrosis was present, and brief debridement was performed. Perihepatic packing was done for all four quadrants. Bleeding was seen from the liver, which was controlled after perihepatic packing. After maintaining primary hemostasis, the skin was closed, but the fascia remained open for the definitive operational management following the damage control surgery.

The second look surgery was performed within 48 hours after the damage control surgery to assess and continue liver injury surgical treatment. No active abdominal hemorrhage was seen. The Pringle maneuver was performed, and active bleeding was seen from a branch of the right hepatic vein on the posterior side of the liver, which was repaired. Hepatic segmentectomy was performed for segments 6 and 7, and another hepatic laceration was seen on the posterior side of lobe five, which was repaired by hepatorrhaphy using 3-0 prolene fiber. Segments 5 and 8 also showed color changes. Oozing sites were covered using surgicel. The fascia remained open, and the skin was closed with two drains placed in the peritoneal cavity. A chest tube was established, which drained 400 ccs of bloody secretions.

After the second surgery, the patient experienced low-grade fevers. A chest CT scan was performed, which revealed bilateral consolidations and ground-glass opacities in the base and periphery of the lung field, which was in favor of hemorrhage rather than COVID-19. As a result, an antibiotic regimen of cefepime and vancomycin was started.

The third operation was performed within one week, in which two chest tubes were implanted in anterior and posterior axillary lines of the left hemithorax with 300cc of serous secretions.

After surgery, the patient was febrile with three chest tubes and two peritoneal drains; thus, cefepime was discontinued, and meropenem was initiated. Upon laboratory assessments, hypokalemia, hypocalcemia, and hypophosphatemia were discovered which appropriate workup was performed.

Following that, the next and fourth operation was performed four days after the third surgery; another chest tube was implanted at the site of the previous chest tube, with another chest tube implanted in the midaxillary line and posteriorly.

Five days after the fourth surgery, the patient experienced a better general condition and mitigated dyspnea. The antibiotic regimen was changed by discontinuing meropenem and vancomycin and switching to ceftazidime.

The fifth surgery was performed in 9 days, with severe intestinal adhesion; thus, enterolysis and enterorraphy were performed. A peritoneal drain was placed, skin, abdominal muscles, and fascia were repaired, and an extensive skin flap was provided.

During the patient's hospital stay, the patient experienced deterioration of sleep quality, irregular sleep, and stated ideas of death and suicide, suggesting severe depression. A psychiatric consultation was performed, and medication therapy, including sertraline and quetiapine, was initiated for the patient.

The patient was discharged from the surgery ward three days after the fifth surgery. The patient was followed up in 3-month periods and follow-up visits to the clinic for 12 months. The patient showed signs of complication neither during the hospital stay nor during follow-up visits.

3. Discussion

Trauma is among the leading causes of death worldwide, with the head and extremities being the most affected injury sites, followed by abdominal trauma. The most affected group is young males, and falls, road accidents, and direct trauma is among the mechanisms leading to such outcomes (5). Liver injury is the most common cause of death regarding abdominal solid organ injuries (6). During the last decades, non-operative management(NOM) of abdominal trauma has increasingly gained popularity among surgeons due to the prevention of laparotomy complications such as infections and adhesions (1, 4). Operative and non-operative management of blunt liver trauma, including angioembolization, perihepatic packing, and liver resection, are performed according to the patient's condition (6). The most critical absolute indication for operative management is hemodynamic instability and signs of peritonitis (2). Other than these, recent studies propose non-operative management as a viable therapeutic choice even in high-grade liver injuries (4). NOM is also suggested to reduce the length of hospital stay, reducing the chances of associated complications such as nosocomial infections and preventing psychological disturbances (3). However, NOM has a high failure rate in high-grade liver

injuries and may result in severe complications, including tissue necrosis. In some very severe conditions and under specific circumstances, even liver transplantation is considered (2, 7). An accurate liver injury level can be estimated using an abdominal CT scan. However, abdominal CT scans can be performed in hemodynamically stable patients; thus, the role of abdominal sonography in the initial assessment of the patient is vital (4).

A fatal complication in managing a trauma patient is forming the lethal triad of coagulopathy, acidosis, and hypothermia. The primary mortality mechanism due to trauma is the bleeding that contributes to this triad (8). Definitive surgical therapy can halt the bleeding, but due to the use of anesthesia and the invasive nature of the surgical interventions, exacerbation of the patient's condition may occur due to the lethal triad (9). So, the concept of damage control surgery was coined, a surgical yet no definitive intervention between 60 to 90 minutes to minimize the impacts of injury and restore the hemostasis (9). The idea of damage control surgery proposes that the treatment of the condition can be performed in several steps, not all at once. This helps to control the internal complications without suffering the adverse reaction of the prolonged duration of surgery. Damage control consists of 3 phases. The first phase aims to control the bleeding with rapid surgical maneuvers, and the second phase seeks the patient's stability and resuscitates the patient. The third phase is the definitive therapeutic surgery, usually within 12 to 48 hours after the damage control surgery (2, 6, 9).

Due to the liver's many thin-walled vascular structures, the liver is susceptible to bleeding due to vascular disruptions and parenchymal injuries. The origin of the vascular insult can be determined with the Pringle maneuver not stopping the hepatic veins injuries as opposed to arterial injuries. On the other hand, parenchymal lesions and lacerations can be repaired to resume the integrity of the liver using hepatorraphy (2, 7).

Concomitant injuries, including solid and hollow organs alongside liver trauma, affect the morbidity and mortality status of the patient. Hemopneumothorax formation is a severe risk factor associated with high mortality rates if not addressed immediately and appropriately (10).

4. Conclusion

Blunt liver trauma following abdominal injuries can lead to various complications, and selecting the appropriate course of action for this patient affects the patient's outcome. Hemodynamic instability is the rare yet primary criterion for emergent laparotomic management, while in about 80% of blunt liver traumas of all grades, non-operative management is the preferred choice.

Conflicts of interest

None declared.

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