International Journal of Advances in Medicine
Prayogo DL et al. Int J Adv Med. 2025 Mar;12(2):224-227
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: https://dx.doi.org/10.18203/2349-3933.ijam20250378

Case Report

Navigating hemodynamic turbulence in penetrating liver injury: a case report

Danniel Loogman Prayogo*, Wayan Wahyu Sutrisna

Department of Surgery, Udayana Army General Hospital, Denpasar, Bali, Indonesia

Received: 04 December 2024
Accepted: 07 January 2025

***Correspondence:**
Dr. Danniel Loogman Prayogo,
E-mail: danniellooogman@yahoo.com

ABSTRACT

Penetrating liver injuries caused by knife wounds present significant challenges due to the potential for hemodynamic instability, which increases mortality risk. Early intervention and therapy for patients with hepatic trauma are crucial for effectively stabilizing the patient's clinical condition. A 37-year-old male patient arrived at our emergency department (ED) presenting with clinical signs of Grade III hemorrhagic shock following a stab wound on the right upper abdominal quadrant. Initial stabilization in the ED included administration of 2000 ml of crystalloids while waiting for the blood products; however, the patient's present transient response hemodynamic exchange. He was emergently taken to the operating room, and we conducted an exploratory laparotomy. Intraoperation revealed a Grade 4 liver injury, affecting liver segments number five and six with a laceration size of around 12 cm. Immediate surgical interventions included the Pringle maneuver and Hepatorrhaphy. The intraoperative blood loss was approximately 3000 cc, resulting in a postoperative hemoglobin level of 3 g/dl. During both the intraoperative and postoperative periods, the patient was receiving a total of 8 units of blood in 48 hours. The patient's clinical condition improved significantly following all interventions. Patients with stab wounds, particularly those affecting the liver, face a significantly high mortality rate due to the potential for haemorrhagic shock. Immediate surgical intervention is crucial to controlling the bleeding in unstable hemodynamic patients. Additionally, blood transfusions play a vital role in stabilizing the patient's clinical condition. Early management of patients with stab wounds with hemodynamic instability needs effective initial interventions and surgical procedures.

Keywords: Penetrating liver injury, Haemorrhagic shock, Pringle maneuver, Hepatorrhaphy

INTRODUCTION

The liver is the most commonly injured intra-abdominal organ after penetrating trauma, occurring 26.1% of cases as reported by the American college of surgeons (ACS) from the national trauma data bank (NTDB). The mortality rate for these penetrating injuries is notably high at 22.0 %>. These traumas often result in direct lacerations to the liver and contusions in the surrounding tissues. The risk of complications increases considerably, particularly when the vascular or biliary structures are involved.[1-3] Effective management is crucial in patients with liver trauma, requiring careful consideration of the anatomical injury, hemodynamic status, and any associated injuries.[4] Liver trauma is categorized into blunt and penetrating injuries. Non-operative management (NOM) has become the standard of care for blunt trauma.[5] In contrast to blunt liver injury, penetrating liver injury has a different management strategy. Damage control surgery is a surgical intervention conducted for penetrating liver injuries especially with hemodynamically unstable patients. Damage control surgery is a critical intervention for penetrating liver injuries, particularly in patients who are hemodynamically unstable.[7] This case report reviews a patient with a penetrating liver injury, emphasizing the management of hemodynamic instability and surgical intervention in the acute phase. By examining the critical comprehensive interaction between initial resuscitation, surgical decision-making, and post-operative care, this report provides valuable insights into the challenges and key

considerations that define the treatment of complex liver injuries. Through this comprehensive case analysis, we aim to advance the understanding of best practices in managing penetrating liver trauma, with a particular emphasis on improving patient survival and minimizing complications.

CASE REPORT

A 37-year-old male patient arrived at our emergency department (ED) presenting with clinical signs of Grade III haemorrhagic shock following a stab wound on the right upper abdominal quadrant. (Figure 1). The patient was stabbed by an unknown person while walking on the street. The patient was being stabbed in the right periumbilical of the stomach with the stab direction upwards slight to right, when pulled by the perpetrator the knife was rotated causing the knife to go in and out in 2 directions. At the time of the incident the knife was immediately removed so that no remaining knife fragments were left in the abdomen.

At the time of admission, patients arrived with haemodynamically unstable with altered mental status with GCS level 13(E3M6V4). His airway was intact, oxygen saturations were 98%, and his respiratory rates was 34 breath /minutes. Patients, blood pressure was 70/40 mmHg and his heart rate was 132 beats/minutes. The patient's abdomen was not tender in the right upper quadrant, with abdominal distention and a muscular deafens, with decreased bowel sound. The advanced trauma life support (ATLS) protocol and damage control resuscitation (DCR) were implemented, and a massive transfusion protocol (MTP) was initiated. A focused assessment with sonography for trauma (FAST) revealed the presence of intra-abdominal fluid (Figure 2).

Initial stabilization in the ED included administration of 2000 ml of crystalloids 500 CC hydroxyethyl Starch (HES); while waiting for the blood products. However, the patient showed only a transient hemodynamic response. The patient experienced a transient improvement in hemodynamic following fluid resuscitation, but their condition then worsened due to ongoing intra-abdominal blood loss. A blood sample was obtained prior to any fluid resuscitation. Laboratory results revealed a haemoglobin level of 5 g/dl, a white blood cell count of 22,350 cells/µl, a platelet count of 189,000 cells/µl, a bleeding time of 3 minutes, and a clotting time of 9 minutes.

The patient underwent an emergency laparotomy for damage control surgery, revealing a massive hemoperitoneum. Intraoperative findings included a grade 4 liver injury involving segments 5 and 6 with a 12-centimeter laceration (Figure 3). Immediate surgical interventions included the pringle maneuver and Hepatorrhaphy. Active bleeding from segments 5 and 6 of the liver was controlled using blunt atraumatic 1/0 chromic catgut sutures. The abdominal cavity was irrigated with 0.9% saline, and a 24 F drain was placed in the subhepatic space. The abdomen closed using a mass closure technique, and the skin was secured with simple sutures.

The intraoperative blood loss was approximately 3000 cc, resulting in a postoperative haemoglobin level of 3 g/dl. The total operating time was 100 minutes and the patient was transferred to the intensive care unit (ICU). Throughout the intraoperative and postoperative periods, the patient received a total of 8 units of packed red blood cells over 48 hours. Additionally, we administered 1000 mg of tranexamic acid to help reduce bleeding. The patient's clinical condition improved significantly following all interventions.

Outcome and follow-up

The patient received treatment in the ICU for 5 days, followed by 3 days of care in a regular room. He was discharged 8 days after initially arriving at the ED. There is no specific complication after surgery and ressusitaiton.

Figure 1: External penetrating wound in the right upper quadrant of the abdomen observed in the emergency room.

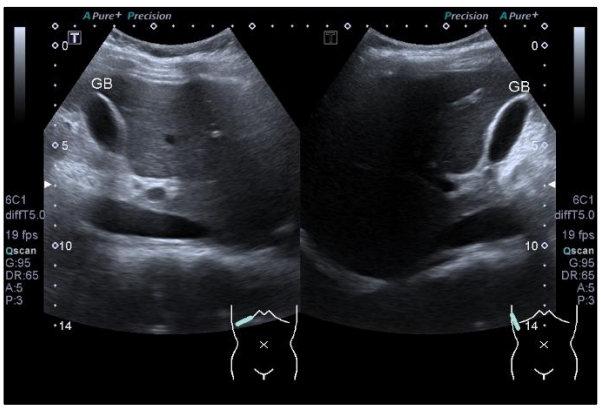

Figure 2: FAST ultrasound shows the presence of free fluid.

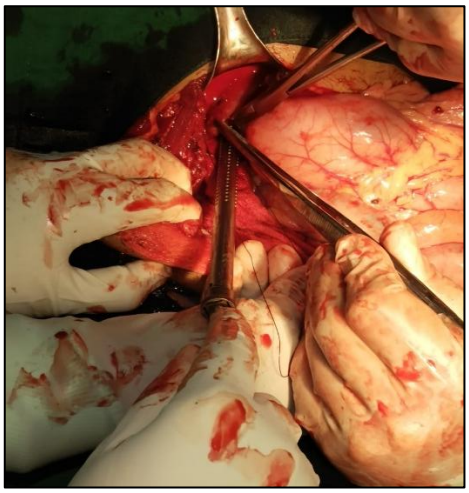

Figure 3: Intraoperative findings indicative of grade iv liver trauma with 12 cm tear observed in segments 5 and 6 of the liver.

DISCUSSION

Penetrating abdominal trauma has a high risk of mortality rates especially patients with unstable hemodynamic condition.[8,9] Arumugam et al, state that liver injury is the most common injury in abdominal trauma patients followed by spleen and kidney injury.[10] In our study, The patient sustained penetrating abdominal injuries from knife wounds, with varying angles of entry and exit. The knife was promptly removed from the patient's abdomen, resulting in severe abdominal bleeding. This massive bleeding caused the patient to fall into an unstable hemodynamic condition upon arrival in the emergency room.

The patient was in a grade 3 haemorrhagic shock, as evidenced by specific clinical manifestations of grade 3 haemorrhagic shock. Chai et al, state patients with penetrating liver injuries who are hemodynamically unstable face significantly higher mortality rates compared to those who are stable. Chai et al stated, the mortality rate for hemodynamically unstable patients was 19.6%, compared to just 3.7% for stable patients.[11] The patient underwent an emergency laparotomy for damage control surgery after showing a transient response to fluid resuscitation, followed by rapid hemodynamic deterioration. A bedside ultrasound upon initial presentation revealed free fluid, suggestive of intra-abdominal bleeding. Given the patient's deteriorating condition, an emergent laparotomy was deemed necessary.

The trend of non-operative management (NOM) has really emerged, especially in blunt trauma patients with stable hemodynamic conditions. In providing NOM, we must ensure that there is no active bleeding, no tachycardia, hypotension, metabolic acidosis, or physical examination evidence of shock. In our case, non-operative management (NOM) was not performed due to the patient's unstable hemodynamic condition. The concept of DCS was improved by several technological advancement such a radiologic imaging and endovascular approach.[4] Ordonez et al, stated that in patients with hemodynamic instability, the imperative intervention includes damage control resuscitation (DCR) in conjunction with massive transfusion protocol (MTP).

Recent research has elucidated the efficacy of a multimodal approach, integrating open surgical techniques with endovascular interventions such as resuscitative endovascular balloon occlusion of the aorta (REBOA) and resuscitative endovascular balloon occlusion of the vena cava (REBOVC). While the pringle maneuver effectively stop active bleeding in this case, REBOA or REBOVC serve as valuable adjunctive options in scenarios where the Pringle maneuver fails to control haemorrhage.[1] While this intervention offers substantial benefits, the limitations in available facilities and infrastructure present a significant challenge to delivering optimal patient care.

A comprehensive analysis of multiple trauma centers has revealed a correlation between REBOA implementation and enhanced survival rates among patients with severe haemorrhagic shock.[12] Junior et al, stated in their systematic review examines the long-term effects of REBOA on organ function despite on its significant roles in increasing survival rates. It concludes that while REBOA can be lifesaving in acute scenarios, there is a risk of long-term organ dysfunction, particularly in the kidneys and lower limbs.[12]

There was a significant decrease in the patient's haemoglobin level from 5 g/dl to 3 g/dl post operatively, indicating intraoperative active bleeding. Despite pre-operative fluid resuscitation, this was inadequate to replace the massive blood loss. Due to limited blood product availability, blood transfusion was performed immediately on the patient during surgery. JAMA surgery study in 2024, found that early whole blood transfusions have a crucial role for survival in trauma patients with severe haemorrhage.

Patients receiving whole blood within 14 minutes of injury demonstrated significantly lower mortality rates at 24 hours and 30 days post-trauma compared to those with delayed transfusions.[14] Another study from Beiriger et al, shown prehospital red blood cell transfusions have demonstrated significant improvements in survival rates for trauma patients. The timing of these interventions, particularly in the prehospital setting, is critical for reducing mortality.[15] According to data from the Indonesian ministry of health, Indonesia have a problem on sufficiency of blood supply, especially in remote area due to geographic burden.[16] In this case, the patient received a blood transfusion approximately 2-3 hours after requesting it. This delay could have worsened the prognosis, but timely surgical intervention and early fluid administration prevented further complications.

CONCLUSION

The early recognition and management of hemodynamic instability in patients with penetrating liver injuries are crucial for improving outcomes. This case highlights the importance of rapid assessment and intervention to prevent further complications.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Ordoñez CA, Parra MW, Millán M, Caicedo Y, Guzmán-Rodríguez M, Padilla N, Salamea-Molina JC, García A, González-Hadad A, Pino LF, Herrera MA. Damage control in penetrating liver trauma: fear of the unknown. Colombia Médica. 2020;51(4):78.
2. Folkman MJ, Hasselbach AN, Porter SC, Delaviz H, Lackey-Cornelison W, Maklad A. An Accessory Right Hepatic and Cystic Arteries Derived from the Superior Mesenteric Artery: A Cadaveric Case Report. The American Journal of Case Reports. 2024;25:945606.
3. Coccolini F, Coimbra R, Ordonez C, Kluger Y, Vega F, Moore EE, et al. Liver trauma: WSES 2020 guidelines. WJES. 2020;15:24.
4. Virdis F, Podda M, Di Saverio S, Kumar J, Bini R, Pilasi C, et al. Clinical outcomes of non-operative management and clinical observation in non-angioembolised hepatic trauma: A systematic review of the literature. Chin J Traumatol. 2022;25(5):257–63.
5. Elkbuli A, Carlin M, Ngatuvai M, McKenney M, Boneva D. Survival following devastating penetrating gunshots polytrauma with grade 5 liver injuries requiring multiple massive transfusion protocols: A case report and review of the literature. Int J Surg Case Rep. 2022;98:107608.
6. Smith A, Hendrix V, Shapiro M, Duchesne J, Taghavi S, Schroll R, et al. Is the “death triad” a casualty of modern damage control resuscitation. J Surg Res. 2021;259:393–8.
7. Park CH, Lee JW. Penetrating liver injury caused by a metal fragment from a blast accident in a factory: a case report. J Trauma Inj. 2022;35(1):8–14.
8. Jansen JO, Inaba K, Rizoli SB, Boffard KD, Demetriades D. Selective non-operative management of penetrating abdominal injury in Great Britain and Ireland: survey of practice. Injury. 2012;43(11):1799-804.
9. Arumugam S, Al-Hassani A, El-Menyar A, Abdelrahman H, Parchani A, Peralta R, et al. Frequency, causes and pattern of abdominal trauma: A 4-year descriptive analysis. J Emerg Trauma Shock. 2015;8(4):193–8.
10. Chai YS, Lee JK, Heo SJ, Lee YK, Lee YW, Jo YH, et al. Traumatic Liver Injury: Factors Associated with Mortality. Acute Crit Care. 2014;29(4):320–7.
11. Wannatoop T, Phuangphung P, Sornmanapong T. Resuscitative endovascular balloon occlusion of the aorta in trauma management: a comprehensive study of clinical indications and challenges. Trauma Surg Acute Care Open. 2024;9(1):1264.
12. Complications associated with the use of resuscitative endovascular balloon occlusion of the aorta (REBOA), 2024. Available at: https://www.ncbi.nlm.nih.gov. Accessed on 21st August 2024.
13. Torres CM, Kenzik KM, Saillant NN, Scantling DR, Sanchez SE, Brahmbhatt TS, et al. Timing to first whole blood transfusion and survival following severe hemorrhage in trauma patients. JAMA Surg. 2024;159(4):374–81.
14. Beiriger J, Silver D, Lu L, Brown JB. Transfusion Management in Trauma: What is Current Best Practice? Curr Surg Rep. 2023;11(3):43–54.
15. Hippy NS, Gantini RS. Blood transfusion service in Indonesia. Transf Apher Sci. 2023;62(5):103805.

Cite this article as: Prayogo DL, Sutrisna WW. Navigating hemodynamic turbulence in penetrating liver injury: a case report. Int J Adv Med 2025;12:224-7.