

WHIPLASH INJURY OF LIVER- A CASE REPORT BASED ON HYPOTHESIS OF SUDDEN DECELERATION PRODUCING COMPLETE TRANSECTION OF LIVER

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ABSTRACT

Background: Injuries to internal organs are common in road traffic accidents. Autopsy surgeons frequently encounter damage to the vital organs of the abdomen during postmortem examination. The abdominal wall is a robust structure that transmits the impact force to the liver, stomach, intestine, or spleen, causing rupture of these organs. In cases of a blunt impact force, the abdominal muscles may also produce bruises in their muscle layers. However, severe injury to the internal organs of the abdomen without any injury to the muscular layers of the abdomen is rare. **Methodology:** The current study reports on an instance of a road traffic accident in which the liver was completely separated without sustaining any injuries to the anterior abdominal wall. **Results:** This document highlights a distinctive pattern of liver injury resulting from sudden deceleration forces without any direct impact on the abdominal wall, which is commonly referred to as whiplash. **Conclusion:** Severe injuries to the vital organs of the abdomen can occur without any direct blunt or sharp-force trauma to the abdominal wall. These injuries can develop as a result of sudden acceleration or deceleration.

Keywords: Sudden declaration, Liver injury, Forensic pathology, Whiplash injury, Road traffic accident.

INTRODUCTION

The liver is one of the heaviest solid glandular organs and is supplied with blood via major arteries and veins **Abdel-Misih SR et al. (2010)**. Trauma to the liver accounts for approximately 15–20% of all blunt abdominal injuries and 10% of all penetrating abdominal traumas **Croce MA et al. (1995)**. Certain situations may cause liver damage that is not due to a direct physical impact on the abdomen, neither from blunt nor penetrating trauma **Chen YC. (2016)**. The liver is connected to several ligaments in the abdominal cavity; thus, a

sudden change in inertia can disrupt its structure significantly **Devera R et al. (2018)**. Injuries and fatalities resulting from violence are investigated through medicolegal examinations in India. It is crucial to promptly identify these injuries and provide immediate treatment to save the lives of many patients. If the patient dies, autopsy is the definitive method for confirming, amending, or contradicting a physician's clinical diagnosis. Therefore, it is important to determine the exact cause and manner of death through postmortem examination **Gurung S et al. (2013)**. This case

report presents a situation in which the liver is completely divided into two lobes without any direct impact on the anterior trunk of the body. The authors attempted to explain the dynamics of this atypical injury through postmortem computed tomography, conventional autopsy findings, and reviewing the scene of the accident.

Case report-

A 22-year-old individual was brought to the mortuary by the police for postmortem examination. He was seated in the codriver's seat in a pickup truck, operating at an excessive speed. Consequently, the vehicle collided with the electric pole located ahead. Because the seatbelt was not worn, the victim projected forward and was impacted by the 'A' frame on the left side of the face. On external examination, an abraded contusion was present on the left side of the cheek and chin, with no underlying palpable fractures (Fig. 1).



Figure 1- External injury over the face.

Unsurprisingly, no apparent injuries were observed in front of the chest or abdominal area. Following a thorough internal examination, no fractures were observed in the skull or chest wall. The brain and lungs appeared pale. The intercostal muscles and anterior abdominal wall showed no indications of blood extravasation. The descending aorta showed several transverse tears in its intima (Fig. 2).

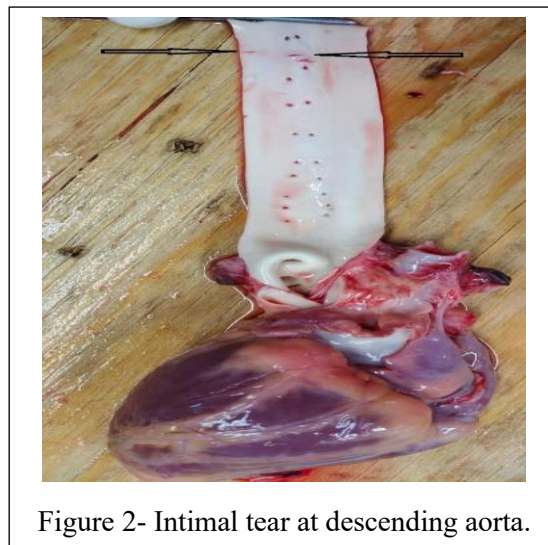


Figure 2- Intimal tear at descending aorta.

Upon opening the abdominal cavity, 1600 ml of blood was noted in the peritoneal cavity. After draining the blood using a suction catheter, the findings in the abdominal cavity were unexpected and astonishing. Our findings revealed complete separation of the liver, where the falciform ligament was attached, resulting in a tear of the inferior vena cava and porta hepatitis on the posterior aspect (Fig. 3). The authors opined that the cause of death was sustained liver injuries due to sudden deceleration, leading to hypovolemic shock.

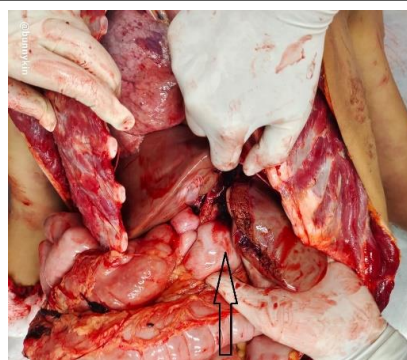


Figure 3- Liver injury.

DISCUSSION

The liver, the largest glandular organ in the body, is frequently injured during road traffic accidents. Multiple studies have corroborated this finding, identifying liver injury as a common outcome of such incidents. Slovic et al. emphasized that liver lacerations and destruction are among the injuries that often lead to fatalities at the accident site **Mihajlović F et al. (2013)**. Abymon K et al. also note that the liver was the most injured organ in

thoracoabdominal injuries, with a prevalence of 38% **Bhat AM et al. (2021)**. The liver occupies the entire right hypochondrium and the greater part of the epigastrium and extends into the left hypochondrium up to the left lateral line. Most of the liver is enclosed by the ribcage, except for the upper part of the epigastrium, which is in direct contact with the anterior abdominal wall. The liver comprises two lobes, right and left, divided by a falciform ligament. A rib cage guards the entire right lobe, whereas the left lobe is unsupported and situated in the epigastrium **Yang LL. (2021)**. In instances of liver injury, the primary causes are typically direct impacts, either through blunt or penetrating trauma or compression forces. However, there are a few less common mechanisms, such as acceleration and deceleration forces **Deng L et al. (2013)**. In the present case, the vehicle was driven at excessive speed. After the frontal impact, the head of the victim collided with the 'A' frame of the vehicle, and immediately, the victim entered static inertia without any direct impact over the anterior trunk. Consequently, the liver, one of the heaviest glandular organs suspended in the abdominal cavity, moves forward, and the right lobe is impacted by the rib cage. The authors believe that after the impact, they attempted to move backward and impact the posterior abdominal wall. However, the left lobe of the liver was impacted against the epigastric region of the abdominal wall. Because of its resilience, it does not produce any force to push the left lobe of the liver back toward the posterior abdominal wall. This movement creates significant tension between the right and left lobes of the liver, leading to complete separation of the lobes. The sudden forward motion of the right lobe of the liver, followed by a backward movement, resembles the mechanism of "*Whiplash Injury*." A similar case was reported by Chen et al., in which a laceration was produced on the liver without any direct impact. As per history, the patient jumped from a height of 2 meters on his feet. A laceration is produced because of the sudden deceleration force **Chen YC. (2016)**. The authors did not find any external injury to the anterior trunk or internal injury to the ribs, intercostal muscles, or abdominal wall, which ruled out any direct trauma. Using the hypothesis mentioned earlier, the authors attempted to explain the peculiar injury sustained by the victim. Complete transection

of the liver lobe without direct blunt or penetrating trauma is a rare and unusual finding.

CONCLUSION

We attempted to elucidate the biomechanics of the injuries present in this case. The absence of direct references to liver lobe transection without blunt or penetrative trauma suggests that such an event is exceedingly rare and not commonly reported in the medical literature. Complete severing of an organ can likely occur without any direct trauma, and the acceleration-deceleration force alone can cause such an injury. This makes this case exceptional and rare.

Statement & Declarations-

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REFERENCES

- Abdel-Misih SR, Bloomston M. (2010):** Liver anatomy. *Surgical Clinics*. 90(4):643-53. <https://doi.org/10.1016/j.suc.2010.04.003>
- Bhat AM, Bhat MA, KK A. (2021):** Pattern of Thoraco-Abdominal Injuries in Fatal Road Traffic Accidents in Mangalore City. *Indian Journal of Forensic Medicine & Toxicology*. 15(2). <https://doi.org/10.37506/ijfmt.v15i2.14265>
- Chen YC. (2016):** A rare hepatic trauma caused by vertical inertial force. *Formosan Journal of Surgery*. 49(2):74-7. <http://dx.doi.org/10.1016/j.fjs.2015.10.003>
- Croce MA, Fabian TC, Kudsk KA, Menke PG, Minard G, Waddle-Smith L, et al. (1995):** Nonoperative Management of Blunt Hepatic Trauma is the treatment of choice for hemodynamically stable patients results of a prospective trial. *Annals of surgery*. 221(6):744-55. <https://doi.org/10.1097/0000658-199506000-00013>
- Deng L, Jin W, Lv H, Zhang Q, Zhu J. (2013):** Mechanisms of blunt liver trauma patterns: An analysis of 53 cases. *Experimental and therapeutic medicine*.

- 5(2):395-8.
<https://doi.org/10.3892/etm.2012.837>
- Devera R, Rogers CB. (2018):** The forensic pathology of liver trauma. *Academic forensic pathology.* 8(2):184-91.
<http://dx.doi.org/10.23907/2018.019>.
- Gurung S, Jha S, Pradhan A, Subedi N, Yadav BN. (2013):** An autopsy study of liver injuries in a tertiary referral centre of eastern Nepal. *Journal of Clinical and Diagnostic Research: JCDR.* 7(8):1686-1688.
<http://dx.doi.org/10.7860/JCDR/2013/5913.3220>
- Mihajlović F, Slović ŽS, Trifunović A, Todorović M, Vitošević K. (2013):** Abdominal injuries in road traffic accidents: An autopsy study. *Vojnosanitetski Pregled.* 80(3):215-22.
<https://doi.org/10.2298/vsp221118042s>
- Yang LL. (2021):** Anatomy and Physiology of the Liver. *Anesthesia for Hepatico-Pancreatic-Biliary Surgery and Transplantation.* 15-40.
https://doi.org/10.1007/978-3-030-51331-3_2