



# Liver lacerations in abdominal trauma - Management based on anatomical Knowledge: Case series

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## Abstract

The Liver is commonly injured following penetrating trauma and the second most commonly injured organ following blunt trauma. Due to the soft consistency of the liver parenchyma, the injuries are often minor and can be easily managed. The article pinpoints the various anatomical and surgical characteristics and how they relate to liver injuries and trauma management. We reported here two cases of abdominal trauma where both the patients had liver injuries in the form of lacerations and bleeding within the substance of liver. The first case was of a young patient who had a high velocity road traffic accident and was brought to the casualty in a state of shock. The second patient had a fall from bike and fell on the road by his side.

## Key words

Trauma, Couinad, Liver, Portal vein, Hepatic artery, Segments.

## Introduction

Trauma to abdomen is common and the liver is commonly injured. The large size of this largest

gland, soft consistency of the liver, the location of liver in upper three quadrants of abdomen and high vascularity makes it vulnerable and injuries of liver can well managed by having a good understanding of anatomico-surgical knowledge of liver.

### Case series

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The first case of trauma was of a young patient who had a high velocity road traffic accident and was brought to the casualty in a state of shock. The second case was also a trauma case of a patient who had a fall from bike and fell on the road by his side. The second patient had slow developing pain on upper right abdomen.

#### Investigations of case - 1

- Temperature: 98.7 °F
- Blood pressure (BP): 126/78 mmHg
- Respiratory rate (RR): 12/min
- Pulse: 82/min
- Hemoglobin (Hb): 13.7 gm/dl
- White blood cell count (WBC): 11,200/microlitre
- Platelet count: 2,30,000/microlitre (n 150000-400,000)
- Sodium: 144 meq/L (n 135-145)
- Potassium: 4 meq/L (n 3.5-5)
- Chest X-ray (CXR): Normal
- USG Abdomen: Initially normal
- CT scan: Liver laceration (**Photo – 1**)

#### Investigations of case - 2

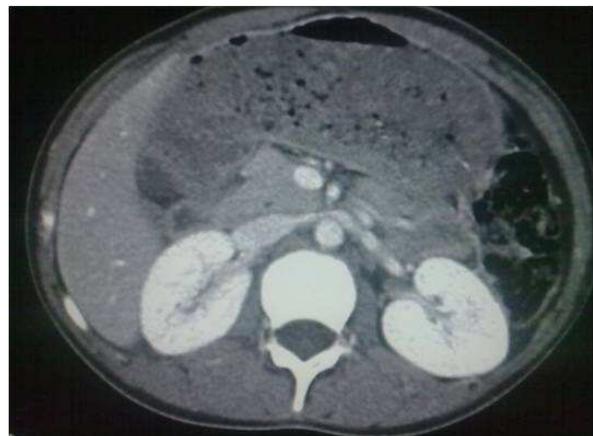
- Temperature: 98.6 °F
- Blood pressure (BP): 120/72 mmHg
- Respiratory rate (RR): 14/min
- Pulse: 88/min
- Hemoglobin (Hb): 12.7 gm/dl
- White cell count (WBC): 7000/microlitre
- Platelet count: 2,38,000/microlitre (n 150000-400,000)
- Sodium: 140 meq/L (n 135-145)
- Potassium: 4.2 meq/L (n 3.5-5)

- Chest X-ray (CXR): Normal
- CT scan: Liver laceration with renal injury (**Photo – 2**)
- CT Scan head: Normal
- Glasgow coma scale: Normal

**Photo - 1:** Liver laceration in a case of trauma.



**Photo - 2:** Liver laceration and renal injury in a case of trauma



### Discussion

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Trauma to abdomen is common and the liver is commonly injured in about 10% of abdominal trauma [1]. The liver is divided anatomically into two lobes, the right and a left lobe which are divided by falciform ligament anteriorly and superiorly, by the fissure for ligamentum teres inferiorly and by the fissure for ligamentum



venosum posteriorly. The blood supply of the liver is unique in the fact that it receives most of its blood from a vein (Portal Vein). The liver receives 20% of its blood from the hepatic artery and 80% from portal vein. Before entry, these divide into right and left branches. Within liver they divide to form segmental vessels and re-divide into interlobular vessels which run in portal canals. Further divisions open into the hepatic sinusoids. Thus in the hepatic sinusoids both arterial and venous blood mix. In isolated cases of abdominal trauma, when liver is the only organ injured, most of the lacerations are non-bleeding and do not require any surgical intervention [2, 3].

The trauma can be from blunt mechanisms as in the result of vehicular collisions, fall from height, direct blow in abdomen or penetrating trauma from stab injury or gunshot wound or can be in the form of lacerations, hematoma, active hemorrhage, major hepatic vein injury or fistulas. The association can be with injuries like renal injuries of right side, rib fractures on right side, right lower lobe pulmonary contusion.

Patients may present with a wide range of symptoms and the astute clinician must always have a high index of suspicion for internal injury. The trauma patient may range from entirely asymptomatic or may present with right hypochondriac pain, and even hypotension or shock. In more severe injury, where there is bleeding and the source is within the substance of the liver, and control can be obtained by direct ligation of the vessel torn or area of liver severed. This is followed by obtaining adequate exposure and assessing the depth of the wound and taking notice of any significant vascular or biliary damage. In case of severe and deeper lacerations, bleeding may initially be so significant as to prevent adequate exposure. Under these conditions, the next maneuver is that of inflow occlusion also termed as the

Pringle [4] maneuver, where a clamp is placed across the hepato-duodenal ligament, which occludes the common hepatic artery and the portal vein. It is an effective method that often controls and slows bleeding enough to provide adequate exposure and to allow visualization and direct ligation of vessels and biliary radicals. In underdeveloped countries Pringles maneuver is still practiced. But in case of more severe degrees of liver trauma additional requirements are needed. Surgeons often notice that deep liver lacerations should not simply be sutured closed as this predisposes to liver abscesses and hemobilia [5].

In most of the trivial cases, the injuries can be observed without any procedure [6, 7] but severe cases may require extensive procedures. The role of examination as well as the emerging role of ultrasound in diagnosis of liver trauma cannot be underestimated as in developing countries the more sophisticated diagnostic modalities do not always exist.

The advocacy of the procedure of selective ligation of the right or left hepatic artery was done in most cases initially but it is nowadays reserved for selected stab wound or the gunshot wound involving one lobe where exposure of the wound will require extensive incision of the liver. The proper hepatic artery must never be ligated. Injudicious hepatic artery ligation may result in liver infarction, particularly if associated with portal vein injury. Resection of hepatic parenchyma is not a common procedure. In most circumstances, resection is performed to debride a segment or lobe that has been completely fractured or devitalized. The liver is divided into two functional (physiological) right and left lobe, based on the intra-hepatic distribution of the hepatic artery, portal vein and biliary ducts. These lobes do not correspond to the anatomical lobes of the liver. The physiological lobes are separated by a plane



passing on the antero-superior surface along a line joining the cystic notch to the groove for inferior vena cava, on the inferior surface the plane passes through gall bladder fossa and on the posterior surface through the middle of caudate lobe. But the more effective way of determining liver lobes is by classification of Couinads segments and resection should be followed on basis of this classification.

## Conclusion

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The knowledge of anatomy of the liver and the distribution of injuries permit separation of the role of each of these approaches. Hepatic trauma management remains a significant challenge for emergency surgeons. In both the cases mentioned the repair was done and the knowledge of the anatomy of liver was given due consideration.

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