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PARADIGM CHANGES IN LIVER TRAUMA MANAGEMENT

Surgery

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KEYWORDS

INTRODUCTION:

Liver is one of the most frequently injured organs following abdominal trauma. [1] The anterior location in the abdominal cavity and fragile parenchyma with easily disrupted Glisson's capsule make this organ vulnerable to injury.[2] Liver is the most common abdominal organ associated with penetrating injuries with 40% stab injuries involving liver. Following blunt trauma abdomen, it is only next to spleen with 35-45% of patients with blunt mechanisms having sustained hepatic trauma. [3]

Entering the abdomen is the norm for both diagnosis and management of liver injury in an unstable patient. But in a patient who is haemodynamically stable, non- operative management has been shown to demonstrate excellent results , even with high grade injuries.[4,5] Owing to the advancement of diagnostic and therapeutic modalities there has been a paradigm shift in the management of liver trauma over the last two decades. Introduction of computed tomography (CT) scan, use of ultrasonography in trauma, availability of angiography, enhanced critical care monitoring and damage control surgery have revolutionized the management of liver trauma. [6]

DIAGNOSIS:

Radiological imaging is the main diagnostic modality for evaluation of liver injury.

1) Computed tomography scan

CT scan is the first imaging study which gives relatively detailed delineation of solid organ injuries and retroperitoneal injuries as well. The sensitivity and specificity of the CT scan for liver injuries are 92–97% and 98.7%, respectively.[7] Bleeding from the liver can be seen as extravasation of contrast maerial either within the liver parenchyma or into the peritoneal space. The charecteristics of liver injury on CT scan is used to categorize the injury with the AAST injury scoring scale (Table1). Injuries upto grade 3 are characterized as low grade injuries whereas Grade 4 and above constitute high grade injuries. [8]

CT scan plays an integral role in the nonoperative management of liver injuries. Routine CT follow up is not recommended in low-grade liver injuries. Follow-up CT scan is recommended for high-grade injuries (grades IV–V) in 7–10 days to determine the injury status and complications as well. [9] Haemoperitoneum usually resolves within one week, subcapsular haematomas in 6-8 weeks, and lacerations in 3 weeks. Haematomas and bilomas may persist for years (Figure 20)4. Complete restoration of hepatic integrity is seen at the end of 3 months. The overall liver-related complication rate was low, reported as 5% [10]

Table 1: AAST liver injury scale

Grade	Description
1	Haematoma: Subcapsular, nonexpanding, < 10% surface area. Laceration: Capsular tear, nonbleeding, < 1cm deep.
2	Haematoma: Subcapuslar, nonexpanding, 10-50% surface area; intraparenchymal, nonexpanding, < 10cm diameter. Laceration: Capsular tear, active bleeding; 1-3cm deep, < 10cm in length.
3	Haematoma: Subcapsular, > 50% surface area or expanding; ruptured subcapsular or parenchymal haematoma with active bleeding. Laceration: > 3cm deep.
4	LacerationParenchymal disruption involving 25–75% of hepatic lobe or one to three Couinaud's segments within a single lobe
5	Laceration : Parenchymal disruption involving >75% of hepatic lobe or >3 Couinaud's segments within a single lobe. Vascular:Juxtahepatic venous injuries (i.e., retrohepatic vena cava/central major hepatic veins)
6	Vascular: Hepatic avulsion

2) Ultrasonography

The drawback of ultrasonography is that it is highly operator dependent and can miss out retroperitoneal and hollow viscus injuries. It is advocated in the initial evaluation of a trauma patient in the form of FAST (Focused assessment by ultrasound for trauma). [11]

3) Angiography and embolisation :

Embolisation aims to achieve haemostasis and salvage organs without the need for surgery, reducing the resuscitation period and transfusion requirements. [12] The efficacy of embolisation at a number of sites within the abdomen has been demonstrated, including the hepatic, internal iliac, renal, superior mesenteric and also gluteal vessels. [13] Velmahos demonstrated a success rate of 91% with embolisation used as a first line treatment, after operative failure to control bleeding or because of post-operative vascular complications. [14]

The sensitivity and specificity of angiogram identifying active bleeding in liver injuries is 75% and the success rate of controlling the hemorrhage is 68–93%. [13]

4) Diagnostic peritoneal lavage (DPL).

Advanced Trauma Life Support course (ATLS) still includes this modality and it remains one of the skills that physicians need to learn for ATLS certification but it has been overshadowed by CT and FAST.

Management:

1) Nonoperative management

Penetrating injury : Nonoperative management is now recommended for stab wound as well as low-velocity gunshot wound to right upper quadrant in stable patients, if other injuries have been excluded which require laparotomy.[15,16] Most of the injuries which fall in this category are grade I and grade II injuries.

Blunt injury: In blunt liver trauma, nonoperative management is a standard of care in hemodynamically stable patients. It is not the grade of the injury, but rather the hemodynamic parameters of the patient which dictate the conservative versus operative management decision. The patient's positive response to an initial fluid bolus or maintenance of a stable hemodynamic state allows for a CT scan of abdomen and pelvis. If extravasation is identified, angiogram and angioembolization should be considered. Failures of these steps then mandate operative intervention. [17]

The most common reasons for failure are advanced age, delayed bleeding, hypotension and active extravasation of contrast not controlled by angioembolization.

There is an overall survival benefit and 23% reduction of mortality for conservative approach in blunt liver injury. [18]

2) Operative management:

Penetrating injury : Recent literature supports operative intervention only in hemodynamically unstable patients, usually as a result of a high-velocity gunshot wound. Other indication for operative intervention is an associated hollow viscus injury. [19]

Blunt injury: Haemodynamic instability and not grading remains the most important indication for operative approach. Rebleeding, constant decline of hemoglobin and increased transfusion requirement, as well as the failure of angioembolization of actively bleeding vessels are a few factors which indicate the need for laparotomy.

Operative management of hepatic injuries is presented in figure 1. Peri-hepatic packing with damage control surgery, direct suture ligation, omental pack and vascular isolation with venous repair are the methods employed.[20]

Peri-hepatic packing is the first and the most important step of operative management and consists of packing all four quadrants with laparotomy pads and manually compress the liver using both hands for 15–20 minutes which allows time for resuscitation. The lower quadrant packing is removed first, followed by left upper quadrant and finally right upper quadrant. If vessel or laceration identified, direct ligation and omental pack is used. If no cause found and bleeding is controlled, damage control surgery with bogata bag closure with immediate shifting of the patient to the ICU for resuscitation and definitive procedure in the form of embolisation or re-laparotomy done once the metabolic derangements get corrected. Safe time for re-exploration is considered to be 12-24 hours but it depends of the correction of acidosis, coagulopathy and hypothermia.

Pringle maneuver (apply a noncrushing clamp through the foramen of Winslow) can be used for uncontrolled bleeding. [21] The clamp can be safely applied up to 1 hour. If bleeding continues despite the Pringle maneuver, then retrohepatic, caval or hepatic vein injury should be suspected and total vascular isolation technique is performed. [22] This approach allows direct repair of the vascular injury and has a better survival rate compared to atriocaval shunt. Aortic clamping is not recommended for the vena caval or hepatic vein injury. [23] Anatomical lobectomy is rarely performed; however, in the hands of an expert, the outcome is very good. [24]

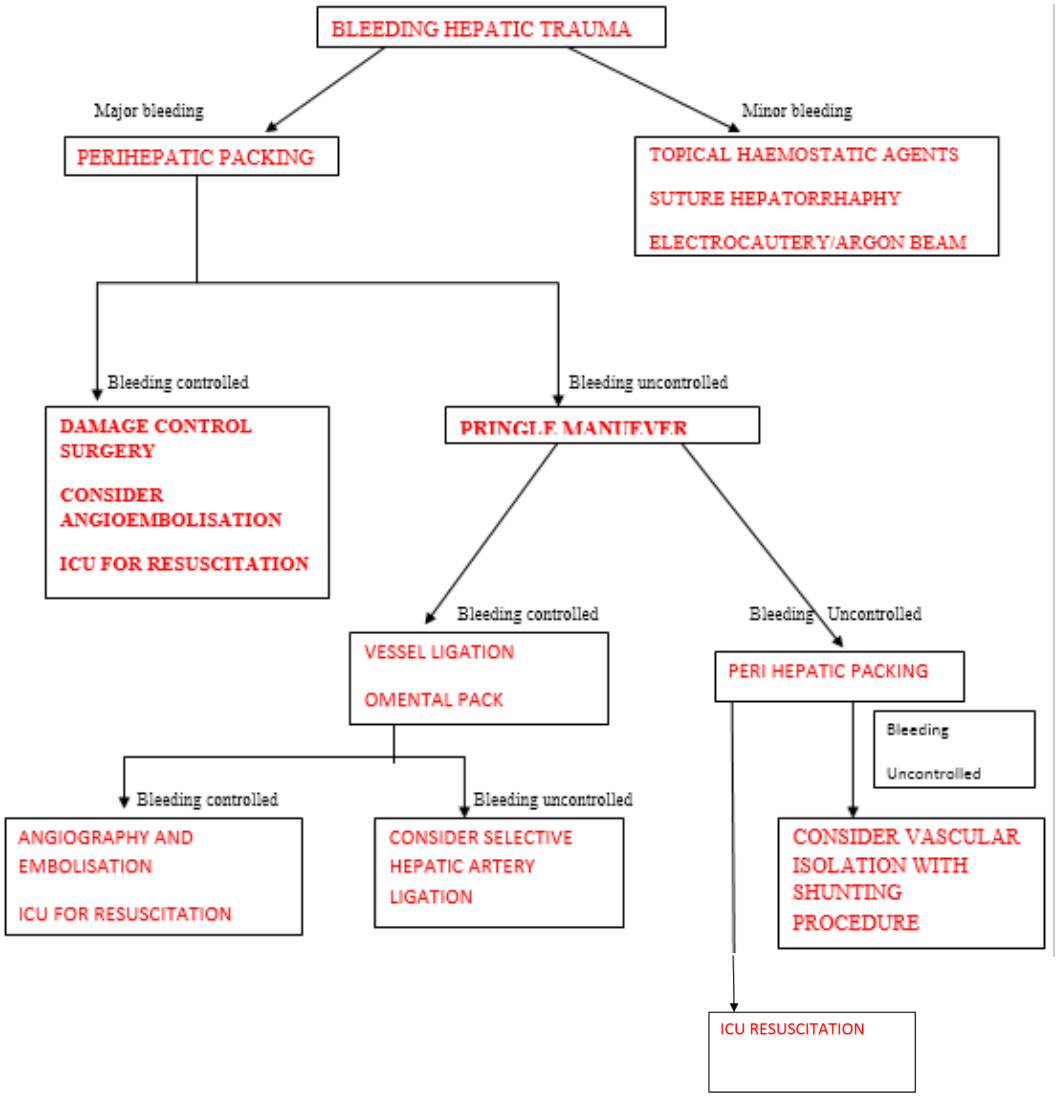

FIGURE 1: Algorithm for operative management of hepatic injuries [4]

Role of interventional radiology in liver injury:

The interventional radiologist plays an integral role in the nonoperative management of liver injuries. Angiography and angioembolization has become the gold standard in the management of liver injuries for hemodynamically stable patients, if a contrast extravasation is seen on CT scan. Furthermore, conservative management may cause vascular/or biliary complications, particularly in high-grade injuries which require imaging intervention. Post-traumatic pseudoaneurysm, intrahepatic arteriovenous fistula and hemobilia are a few vascular complications which may appear following liver injuries and angioembolization is the first step in the management of these complications. [25] Symptomatic biloma, liver and intra-abdominal abscesses can also be successfully managed by CT-guided percutaneous drainage. [26]

CONCLUSION:

Management of liver injury has evolved over the last two decades. Hemodynamic status, not the grade of the injury, should dictate the management. CT scan of the abdomen and pelvis is a standard diagnostic modality in hemodynamically stable patients. Extravasation of contrast during CT scans requires further intervention. Unstable patients should mandate emergency laparotomy. Direct control of bleeding vessels, vascular isolation and damage control surgery are preferred and the most popular approaches compare to anatomical resection of liver and the use of an aortocaval shunt.

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