PRACTICE GUIDELINES: MANAGEMENT OF LIVER INJURIES

OBJECTIVES:

1. Define situations in which non-operative management of liver injuries is safe and desirable.
2. Outline a protocol for non-operative management of liver injuries.
3. Outline a protocol for the operative management of liver injuries.

DEFINITIONS:

Fractures of the liver:

Grade I:		Capsular avulsion
		Parenchymal fracture <1 cm deep
Grade II:	Parenchymal fracture 1-3 cm deep	
		Subcapsular hematoma <10 cm in diameter
		Peripheral penetrating wound
Grade III:	Parenchymal fracture >3 cm deep	
		Subcapsular hematoma >10 cm
		Central penetrating wound
Grade IV:	Lobar tissue destruction	
		Massive central hematoma
Grade V:	Retrohepatic vena cava injury	
		Extensive bilobar disruption

GUIDELINES:

1. Indications for operative and non-operative management of liver injuries:
   a. ***Operative management of liver injuries should be considered when there is ongoing bleeding from the liver injury resulting in <u>unstable vital signs</u> or there is the possibility of other injuries.***
      i. *Markedly unstable patient with rapidly expanding abdomen or increasing rigidity.*
      ii. Grossly positive peritoneal lavage.
      iii. Grade V liver injury on CT scan.
      iv. A "swirl" pattern on CT scan suggestive of ongoing bleeding when angiography is not available in a timely fashion.
      v. High velocity gunshot wound to the abdomen in the RUQ.

   b. Non-operative management of active bleeding can be undertaken if:
      i. Angiography for embolization is readily available
      ii. Vital signs respond appropriately to fluid resuscitation
      iii. There are no other obvious injuries in the abdomen
      iv. The trauma team is available to monitor the patient in the angiography suite.

   c. Non-operative management of liver injuries can be undertaken in the otherwise stable patient.
      i. Liver injury diagnosed on CT scan with normalizing vital signs Grade I to IV:
         a) Injury not into hilum.
         b) Rim of blood fairly localized around liver.
      ii. FAST positive for intraperitoneal fluid & liver injury diagnosed on CT in stable patient.

2. Operative management:
   a. Transfer patient immediately to the operating room, have self-retaining retractors available (Bookwalter).
   b. Prep from chin to mid-thigh, table to table.
   c. Generous midline incision from xiphoid to below the umbilicus.
   d. Pack the RUQ with multiple lap pads. If bleeding is brisk or patient is hypotension, consider the use of the aortic occluder device!!
   e. Pack the other quadrants and check the mesentery for bleeding.
   f. Assess the bleeding from the liver.
      i. If the bleeding is brisk, clamp the porta hepatis with your finger or a non-crushing clamp (Pringle maneuver).
         a) If bleeding persists, consider hepatic vein injury or retrohepatic caval injury.
            i) Consider veno-veno bypass.
            ii) Consider resectional debridement to get to the vena cava and the branches of the hepatic veins.
            iii) Consider median sternotomy for better control
            iv) Consider packing (See Damage Control Guideline).
         b) If bleeding subsides:
            i) Control bleeding with suture ligatures.
            ii) Release Pringle maneuver and control major bleeding with suture ligatures.
            iii) Consider omental pack.
         c) If bleeding subsides but worsens because of coagulopathy, consider packing as definitive interim procedure.
      ii. If bleeding is moderate but controllable with packs:
         a) Mobilize the liver:
            i) Divide falciform ligaments.
            ii) Divide lateral triangular ligaments.
            iii) Rotate liver medially into wound.
         b) Explore injury (but do not worsen it).
         c) Control bleeding with suture ligatures.
            d) Consider liver edge approximation with large absorbable sutures (0-chomic on liver needle).
            e) Consider omental pack.
      iii. If bleeding is controllable but then worsens because of coagulopathy, then consider packing as interim definitive procedure.
   g. When hepatic hemorrhage is controlled, explore the rest of the abdomen with particular attention to porta hepatis, duodenum, pancreas and right colon.
   h. Drain liver if lacerations are deep and there is possibility of bile leak and fluid collection.
   i. If packs are placed, leave abdomen open with abdomen vac-pac.
   j. If packs are placed, they should be removed in 24-48 hours. Prepare for this procedure with the availability of autotransfusion, the argon beam coagulator and blood products.
   k. If packs are placed, treat with antibiotics.

3. Non-operative management:
   a. Admit all Grade III-IV liver lacerations or those with significant blood around the liver (with normalizing vital signs) to telemetry unit. Admit those with large amounts of blood around the liver with hematocrit <32% to the ICU. All others can be admitted to the trauma floor.
      i. Monitor hourly vital signs until normal (e.g., pulse < 100/min) X 3.
      ii. Bed rest.
      iii. NPO.
      iv. Draw serial hematocrit and hemoglobin every 6 hours until stable (within 2 %) X 2.
   b. When hematocrit is stable and there have been no adverse hemodynamic events:
      i. Transfer to regular floor.
      ii. Advance diet.
      iii. Hematocrit and hemoglobin daily.
      iv. Liver enzymes and bilirubin on day 2 to help rule out biloma. If bilirubin elevated, consider a HIDA scan to rule out bile leak.
      i. Bed rest 2 days. Grade I and II liver fractures may ambulate immediately.
      ii. ALL Patients receive a SOLID ORGAN INJURY Card
      vi. If stable and tolerating diet:
         a) Grade I and II injuries: discharge on day 1-2.
         b) Grade III and IV injuries: discharge on day 4.
   c. After discharge:
      i. No school for a week.
      ii. No physical education for six weeks.
      iii. No major contact sports:
         a) Grade I and II: for six weeks.
         b) Grade III, IV and V: for three months.
      iv. Return to clinic in two weeks.
      v. Avoid alcoholic beverages
      vi. Instruct to return to the ED if:
         a) Worsening RUQ pain
         b) Fever
         c) Jaundice
         d) Hematemesis

4. Pitfalls:
   a. Fever and/or jaundice – consider biloma.
      i. CT scan to confirm fluid collection around liver.
      ii. Radionuclide biliary excretion exam to confirm active leak.
      iii. Percutaneous drainage.
      iv. Consider ERCP with stent placement and/or sphincterotomy.
   b. UGI bleed two to four weeks after injury – consider hemobilia.
      i. CT scan to confirm large intrahepatic injury or clot.
      ii. Angiography to confirm etiology.
      iii. Angiographic embolization of vessel.
      iv. Do not explore for hemobilia.
   c. Hypotension, drop in hematocrit seven to ten days after non-operative management of severe liver injury:
      i. Repeat bleed, usually arterial.
      ii. Admit to ICU, stabilize.
      iii. Angiography to confirm etiology.
      iv. Angiographic embolization of the vessel.

v. Attempt to avoid exploration at this time