Hepatic Injuries

Hepatic injuries vary from capsular tears and non-bleeding lacerations to large fractures and lobar destruction, with extensive parenchymal disruption and hepatic artery and venous injuries. The type of injury dictates surgical management. The principles of surgical management of liver injury are the same, regardless of the severity of injury and include: bleeding control, removal of devitalized tissue and adequate drainage. Simple lacerations, which are not bleeding at the time of surgery, do not require drainage unless they are deep into the parenchyma with the possibility of postoperative biliary fistula. Subcapsular hematomas can be simply observed or surgically evacuated if there is no associated parenchymal injury. Lacerations that continue to bleed will usually require a tractotomy. Bleeding vessels and biliary radicals should be individually ligated. In the event that bleeding continues despite directly ligating small vessels, a vascular clamp or vessel loops can be placed around the porta hepatis (Pringle maneuver). If bleeding stops after clamping the portal triad, it can be assumed to be originating in the portal veins or hepatic artery branches. If the bleeding continues despite clamping the portal triad, an injury of the hepatic veins or the retrohepatic vena cava is suspected. Packing the liver wound is used when the above described techniques fail in controlling hemorrhage in patients with hypothermia, coagulopathy, and severe acidosis with severe injuries in other intra abdominal organs (Damage Control). All necrotic tissue should be debrided before closure. If bleeding in the raw surface of the liver after resectional debridement is not significant, an omentum flap can be used to cover or fill the defect in the liver parenchyma. Significant complications following liver injury include pulmonary complications, post-operative bleeding, coagulopathy, biliary fistulas, hemobilia, and subdiaphragmatic and intraparenchymal abscess formation.

Retrohepatic/Suprahepatic IVC:
Due to massive hemorrhage and a difficult operative approach, injuries to the retrohepatic and suprahepatic IVC carry the highest mortality rates even in high volume trauma centers. Surgical control can be achieved by complete liver mobilization and visualization of the retrohepatic IVC. The use of atrio-caval shunts has been described as a temporizing
measure to bypass the area of injury while adequate mobilization and repair is undertaken. Atrio-caval shunts are rarely used, and are associated with very high mortality. Another option is total hepatic isolation in which the suprahepatic IVC below the diaphragm or within the pericardium, the infrahepatic IVC and the descending aorta are clamped while a Pringle is performed. This allows identification of the injury for repair or shunting in a theoretically bloodless field.

SMV/Portal Vein
Injuries to the Portal (PV) and Superior Mesenteric Veins (SMV) are rare, highly lethal injuries occurring in less than 1% of all traumas. Most injuries occur as a result of penetrating trauma. Because the PV and SMV are centrally located, nearly all patients have associated injuries, averaging 3 or more per patient. PV mortality ranges from 40-70%, and SMV mortality ranges from 0-83%.
Vascular control of PV and SMV injuries begins with performing a Pringle maneuver. Once the hematoma and areolar tissue in the hepatoduodenal ligament have been dissected vascular clamps or vessel loops should be placed above and below the injury. The ability to gain proximal and distal control may be limited by the short length of the Porta, if this is the case, extra length and access to more distal SMV injuries can be gained by dividing the neck of the pancreas.
It is essential to obtain good exposure of the injury prior to any attempt at repair or ligation due to the close proximity of the bile duct and hepatic artery. PV injuries can be addressed by repair, re-anastamosis, interposition graft, porto-systemic shunt, or ligation. Ligation can be tolerated as long as the hepatic artery is patent, with mortality ranging from 20-90%. SMV injuries can be treated with ligation or repair. Damage control laparotomy is particularly suited to PV and SMV ligation as a second look to assess bowel viability is mandatory and the risks of development of the abdominal compartment syndrome may be decreased with temporary abdominal closure techniques.