The Operative Management of Liver Trauma

Jonathan B. Koea MD; FRACS
Hepatic Trauma

- Large (2.6 kg)
- RUQ Position
- Partially protected
- Blood flow (1.5 l/min)
- Extraordinary regenerative capacity
- Huge redundancy
- Dual blood supply
The Fear Factor

- Training in hepatic surgery difficult to obtain
- Controlled, elective cases rare
- Appreciation of segmental anatomy recent

“....the operative records described in brief and controlled terms what were apparently uneventful lobectomies for patients whose anaesthesia records, in contrast document transfusion of enormous quantities of blood—with several episodes of cardiac arrest and massive resuscitation efforts.”

Foster & Berman 1977.
Liver Trauma

Non-operative to Operative transition over time:

- Major Resections
- Complications
- Transfused
- Deaths

1989: 100%
1993: 75%
1997: 50%

330 consecutive hepatic resections

Ann Surg 1999;229:322
Segmental Anatomy

Liver Trauma
Liver Trauma

Hepatic Resection & In Flow Control.

General Principles
Mechanism of Hepatic Injury

- **Blunt:** Rapid deceleration
  - falls, RTC
  - Rupture of Glissons capsule
  - Parenchymal fractures
  - Venous and/or arterial bleeding, bile duct disruption, devitalised liver.

- **Penetrating:** Direct trauma
  - Gunshot, stab or impalement injuries.
  - Minimal parenchymal disruption, venous and/or arterial bleeding, bile duct division. Devitalised liver rare.
<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Hematoma</td>
<td>Subcapsular, non-expanding, &lt;10% surface area</td>
</tr>
<tr>
<td>Laceration</td>
<td>Capsular tear, non-bleeding, &lt;1cm parenchymal depth</td>
</tr>
<tr>
<td>II. Hematoma</td>
<td>Subcapsular, non-expanding, 10-50% surface area</td>
</tr>
<tr>
<td>Laceration</td>
<td>Capsular tear, active bleeding; 1-3cm parenchymal depth, &lt;10cm in length</td>
</tr>
<tr>
<td>III. Hematoma</td>
<td>Subcapsular, &gt;50% surface area or expanding; ruptured subcapsular hematoma with active bleeding; intraparenchymal hematoma &gt;2cm or expanding</td>
</tr>
<tr>
<td>Laceration</td>
<td>&gt;3cm parenchymal depth</td>
</tr>
<tr>
<td>IV. Hematoma</td>
<td>Ruptured intraparenchymal haematoma with active bleeding</td>
</tr>
<tr>
<td>Laceration</td>
<td>Parenchymal disruption involving 25-50% of hepatic lobe</td>
</tr>
<tr>
<td>V. Laceration</td>
<td>Parenchymal disruption involving &gt;50% of hepatic lobe</td>
</tr>
<tr>
<td>Vascular</td>
<td>Juxtahepatic venous injuries; i.e retrohepatic vena cava/major hepatic veins</td>
</tr>
<tr>
<td>VI. Vascular</td>
<td>Hepatic avulsion</td>
</tr>
</tbody>
</table>
Investigations

- Primary/Secondary survey
- FBC, U&E, LFTs, Coags, amylase
- X match blood, possible products.
- Trauma films
- CT Scan
Liver Trauma

Indications for Operation

**Blunt**
- Hemodynamic instability
- Transfusion > 1 blood volume
- Devitalised parenchyma
- Sepsis / biloma

**Penetrating**
- Penetration beneath peritoneum
- Selective exploration
  - Instability
  - Guarding
  - Evisceration

Arch Surg 1988;123:1141

Liver Trauma

Auckland Operation vs Conservative

- 1998 - 2002 8 operative cases versus 37 conservatively.
- Indications for operation:
  - Instability (n=3)
  - Parenchyma (n=4)
  - Hepatic ischemia (n=1)
Liver Trauma

Raised Intrahepatic Pressure.
Operative Management

- Summon help?
- Set up
- Incision
- Hepatic mobilisation and exposure
- In flow ± outflow control
- Specific problems
  - Parenchymal tears and devascularization
  - Retrohepatic venous injury
  - Hilar injury and disruption
Liver Trauma

Surgical Technique
Hepatic Mobilisation

Liver Trauma
Liver Trauma

Right Lobar Mobilization
Liver Trauma

Cut-Away View Hilar Plate

- Cystic plate
- Bile duct
- Umbilical plate
- Hilar plate
- Hepatic artery
- Portal vein
Liver Trauma

Right main sheath
Left main sheath

Tape
Caudate process
Portal vein
Lesser omentum
IVC
Liver Trauma

Mass Ligation of In Flow Pedicle
Liver Trauma

Parenchymal Tears

- Mobilise the liver
- Direct compression
- Inflow Control
- Explore fracture
- Suture bleeding sites
- Mattress sutures
- Packing
Liver Trauma

Mattress & Buttress
Liver Trauma

Hepatic Packing
Liver Trauma

Venous and Caval Injuries
Liver Trauma

Caval Exposure
Liver Trauma

Retrohepatic Caval Injuries.
### Hilar Injury and Disruption

<table>
<thead>
<tr>
<th>Structure</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatic Artery</td>
<td>Repair, Ligation</td>
</tr>
<tr>
<td>Portal vein</td>
<td>Repair, Ligation</td>
</tr>
<tr>
<td>Bile duct</td>
<td>Drainage, Repair</td>
</tr>
</tbody>
</table>
Liver Trauma

Emergent Parenchymal Division
Liver Trauma

Elective Parenchymal Division
Liver Trauma

Prognosis

- Overall mortality 10% for operatively managed trauma
  - Grade III/IV injury 10%
  - Grade V/VI injury > 75%
- Blunt trauma mortality 27%
- Penetrating trauma mortality 11%

Surgery 1997;35:10-15
Liver Trauma