Pancreatic and duodenal trauma: daunting or simply confusing?

- 2-4% of abdominal injuries
- 40% morbidity (30 – 70%)
- 20% mortality (12 – 46%)
- 46-95% associated injuries
- Often missed
- Classification flawed

- Complex surgical decisions
- Confusing algorithms
# AAST Pancreatic Injury Grading

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>Small contusion without duct injury</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Small laceration without duct injury</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>Major contusion without duct injury</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Major laceration without duct injury</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>Distal parenchymal laceration with duct injury</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Proximal laceration with involvement of the ampulla</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>Extensive disruption of the pancreatic head</td>
</tr>
</tbody>
</table>

Pancreas neck / body / tail injury

Check for

• Likelihood of duct injury
• Central perforation
• Visible duct injury
• Spleen injury

Gr I, II  Drainage only

Gr III  Distal pancreatectomy +/- splenectomy
Pancreatic head injuries

Check
• IVC, SMV, PV, Duodenum
• CBD, Pancreatic duct, Ampulla
• Consider imaging via cystic duct

Gr I, II: Drain

Gr III – V
• Drainage & delayed surgery or
• Immediate definitive surgery
Assessment of likelihood of ductal injury

Intra op assessment
• Eyeball test
• Cholangio-pancreaticogram via CBD or cystic duct (needle)
• Pancreaticogram via ampulla if accessible
• Intra operative ERCP – logistically challenging

Staged surgery: drainage, temp closure & ERCP
• Prox injury : stent, drain or pancr-duodenectomy
• Distal injury: sphincterotomy/ distal pancreatectomy

EAST guidelines 2009: Pancreatic injury

Level III evidence

- CT suggestive but not diagnostic
- Amylase/Lipase suggestive, not diagnostic
- Grade I and II: drainage alone.
- Grade III: resection, and drainage.
- Closed suction is preferred to sump suction.
- Conflicting evidence on benefits of octreotide

Pancreatic injuries rarely require complex procedures

- Combined pancreas-duodenal injuries: consider pyloric exclusion

- Extensive tissue loss of pancreas head/neck: consider R-Y pancreatico-jejunostomy “central pancreatectomy” risks!

- Gr V pancreas & Gr 5 duodenal & ampulla/bile duct injury: Immediate or staged or delayed pancreaticoduodenectomy

- Severe pancreas head injuries: ducts difficult to assess, may be intact: drainage alone may be sufficient

Seamon et al. J Trauma 2007;62: 829-833
What about selective non-operative management?
Selective non-operative management

Stable patient with localised minor injury – expectant management

Fluid collections: ERCP
• Stent past duct injury or
• Sphincterotomy, or
• Stent over sphincter of Oddi, or
• Internal / external drainage, or
• Surgery

The benefits of ERCP have to be balanced with its numerous complications, such as bleeding, pancreatitis and perforation.

Ker-Kan Tan, Diana Xinhui Chan, Appasamy Vijayan, Ming-Terk Chiu. JOP. J Pancreas (Online) 2009 Nov 5; 10(6):657-663.
Western Trauma Association Management Algorithm for acute pancreatic injury.
Bifl et al  2013 J Trauma Acute Care Surg Vol 75, Nr 6
Complications, late diagnosis

Persistent leak: ERCP
- Duct continuity preserved - stent / spincterotomy

Pseudocysts:
- Transgastric or transduodenal endo drainage

Pancreatectomy better for distal duct injuries: prevents future stent exchanges and duct strictures

Funnell, Bornman, Krige, Beningfield Br J Surg 1994; 81
Overall complication rate was 74.5% and **16.4% mortality.**

5 Whipple procedures all survived

Only 2 of the 18 deaths were attributable to the pancreatic injury.

Shock on presentation was highly predictive of death

Mortality increased exponentially with number of associated injuries
### AAST Duodenal Injury Grading

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma, laceration</td>
<td>Involvement of a single portion of the duodenum</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma, laceration</td>
<td>Involvement of more than 1 portion, disruption of &lt;50% of the circumference</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>Disruption of 50%–75% of the circumference of D2; disruption of 50%–100% of the circumference of D1, D3, and D4</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Disruption of &gt;75% of the circumference of D2 or involvement of the ampulla or distal common bile duct</td>
</tr>
<tr>
<td>V</td>
<td>Laceration, vascular injury</td>
<td>Massive disruption of the duodenopancreatic complex or devascularization of the duodenum</td>
</tr>
</tbody>
</table>

*Note: The duodenum is divided into duodenal bulb (D1), descending part (D2), transverse part (D3), and ascending part (D4).*

Duodenal injury

Grade I, II, III
• Repair (75-85%), debride and drain
• Consider patch, feeding tube

Grade IV, V
Tissue loss with intact ampulla and bile duct
• Debride, close, drain, decompress
• Consider pyloric exclusion?

In addition, consider disrupted ampulla or bile duct?
• Anatomical variations
• Intra-op cholangiogram / pancreaticogram, or
• Close, drain, investigate: CT / ERCP / MRCP
• Delayed definitive surgery: pancreatico-duodenectomy?

Extreme duodenal injuries: options....

Duodenorrhaphy with

- Pyloric exclusion
- Triple ostomy (gastrostomy, antegrade and retrograde jejunostomies)
- Jejunal serosal patch
- Pedicled grafts (ileum, jejunum, stomach)

Segmental resection with

- Duodeno-duodenostomy
- Duodeno-jejunostomy R-Y
- Duodenal diverticulization

Pyloric exclusion debate: always controversial

Against

• Longer hospital stay (32.2 vs 22.2 days, P = 0.003)
• Confers no survival or outcome benefit
• greater overall complication rate, greater pancreatic fistula rate
• Simple repair without pyloric exclusion is both adequate and safe for most penetrating duodenal injuries

• Pyloric Exclusion in the Treatment of Severe Duodenal Injuries: Results from the National Trauma Data Bank. Dubose et al. The American Surgeon, Volume 74, Number 10, October 2008, pp. 925-929(5)
For:
Pyloric exclusion decreases fistula rate

Good for “high risk” cases
• Combined pancreas + duodenal injuries
• High grade duodenal injuries
• Gr IV pancreas head injuries

Post op fistula rate:
• 43% in primary repair and
• 12% in repair + pyloric exclusion

Combined injuries requiring definitive surgery: Pancreatico-duodenectomy

High morbidity and mortality in trauma patients
• Small duct
• Associated injuries
• Oedema of pancreas and jejunum

Indicated for severe combined injuries
• Destruction of Ampulla of Vater
• Isolated grade 5 pancreatic injury
• Isolated gr 5 duodenal injury

Consider risks and benefits:
Damage control, deferral to “more favourable conditions”, or Immediate definitive surgery
Pancreaticoduodenectomy: Outcomes

Thompson et al. J Trauma Acute Care Surgery 2013 August: 75(2): 225-228
- 15 patients over 14 years
- Whipple for penetrating and blunt trauma
- Most required damage control surgery
- 13% mortality

- Data Base review over 3 yrs, 39 pts had Whipple
- Mean ISS: 27+- 13, mortality 33%
- Non Whipple patients had similar outcome
- ISS was the only independent predictor of mortality

- 67% overall survival
Management of complex pancreaticoduodenal injuries: Conclusions

Optimal results require
Multidisciplinary treatment approach
• Trauma surgeons and pancreatic / hepato-biliary surgeons / endoscopic options
• Interventional radiologists and Intensivists

Choose simple solutions
• Decisive surgery for the tail of the pancreas
• Conservative approach to the head, unless imaging is conclusive of duct injury
• Simple repair & decompression for severe duodenal injuries
• Early diagnosis and repair for bile ducts

Extensive resections rarely required, if so, do “electively”
Always provide wide drainage
Mortality mostly related to concomitant injuries