Penetrating Duodenal Trauma

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Case History

• 20M s/p multiple GSW to RUQ, R groin, legs
• Presented as a trauma code, tachycardic
• Pt became agitated, hypotensive, vomited
• Intubated in ED, CXR obtained, no PTX
• Taken emergently to OR for exploration
Perioperative Course

139/3.5/102/20/15/1.73<162

20.1>15.2/48.6<284

7.34/40.7/278/21.2/-3.8/99.3%
Intraoperative Findings

- Foley catheter placed, gross hematuria
- Midline laparotomy, moderate blood
  - Bilious spillage noted in RUQ, D3 injury
  - Zone 2 hematoma
  - Ant. rectal injury, hematoma @ mesorectum
  - Through & through intraperitoneal bladder injury
  - Jejunal and ileal through & through injuries
Intraoperative Findings

- **Cattell-Braasch, no aortic/IVC injuries**
  - Right ureter intact, +right psoas bullet tract
- **Rectal injury 1 repair, diverting colostomy**
- **Bowel resections x 2**
- **Grade II duodenal injury**
  - Repaired primarily in two layers, JP drains placed
  - Nasogastric decompression
  - Witzel feeding jejunostomy
Postoperative Care

- EBL: 800mL
- Infused 10L crystalloid, 2 U PRBCs
- Taken to SICU postoperatively
- CT Angiography negative for lower ext injury
- Remained intubated in SICU, not on pressors
Postoperative Care

• Extubated POD#5

• Minimal NGT & JP drainage, ostomy functional

• POD# 7 Started on clears and tolerated

• POD#10 Febrile, WBC 25K, CT performed

• Started empirically on antibiotics
Hospital Course

• 6.5 x 2.5cm presacral abscess drained by IR

• POD#19: CT cystogram no extravasation
  – foley removed, voided freely

• Discharged home POD#20

• For barium enema prior to colostomy reversal
Questions?
Background

- Traumatic duodenal injury is uncommon
  - 6% of blunt injuries
  - 10-11% of GSW & 1.6% of SWs undergoing laparotomy

- Associated injuries are numerous

- Relative lack of experience → no mgmt consensus
Challenges

• Highly vascular territory (IVC, SMA/V, Renal)
• Retroperitoneal location → exposure difficult
• Anatomic location of injuries (D2 33%)
• Between 6-10L of secretions pass daily
  – High morbidity with leaks
Clinical Presentation

- In penetrating trauma, found on laparotomy
- Blunt trauma, highly suspect duodenal injury
- Vague symptoms, flank/back pain
- May not develop peritonitis
- Timely diagnosis is key
Radiographic Findings

- Scoliosis, partial obliteration of psoas shadow
- Air outlining upper pole of right kidney
- Retroperitoneal air
- Air around the right psoas/retrocecal region
- L1/L2 transverse process/vertebral body fx

- CT is modality of choice in blunt trauma
  - Can still miss injuries (21.7% in one series)
Intraoperative Findings

• Severe edema of duodenal wall
• Crepitus along duodenal sweep
• Bile staining of surrounding tissues
• Right sided retroperitoneal hematoma
Injury Classification

- Hirshberg/Mattox: deep, middle & superficial
- Frey et al: pancreatic/duodenal/combined
- American Association for Surgery of Trauma
An 8-year-old child hits a curb with his bicycle, which causes him to flip over the handlebars. He had no initial sequelae and was monitored at home by his parents. However, 2 days after the incident, he begins having non-bilious emesis. He is brought to the emergency department and undergoes CT of the abdomen and pelvis, which demonstrates a duodenal hematoma. What is the next step in management?

A  NPO and gastric decompression with a nasogastric tube  
B  Esophagogastroduodenoscopy to assess for luminal compromise  
C  Drainage of the hematoma via laparoscopy  
D  Drainage of the hematoma via laparotomy  
E  Resection of the injured portion of the duodenum with primary anastomoses
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C. Drainage of the hematoma via laparoscopy
D. Drainage of the hematoma via laparotomy
E. Resection of the injured portion of the duodenum with primary anastomoses
Grade I Injuries

• Hematoma at a single portion of duodenum

• Partial thickness laceration

“Be Patient”
Grade II Injuries

- Hematoma at more than one portion
- Laceration <50% of circumference

“Simple repair”
Severe Injuries

Grade III
- Laceration >50% D1, D3, D4
- Laceration 50-75% of D2

Grade IV
- Laceration >75% of D2
- Involving ampulla/distal CBD

Grade V
- Massive disruption of PDC
- Devascularized duodenum

"All or nothing"

Repair is controversial
Operative Strategies

• Damage Control
• Primary Repair
• Reconstruction
Simple Repair

- Debridement and primary repair
- Not advised in injuries >3cm in length
- Close transversely to avoid luminal stenosis
- In complete transection, primary anastomosis
- Best in D1/D3/D4, not possible in D2
Tube Decompression

- Stone & Fabian (1979): triple tube therapy
  - Gastrostomy
  - Duodenostomy
  - Feeding Jejunostomy

- With drainage: 1 in 237 with leak
- Without drainage: 8% leak; extrinsic (JP) 23%

Benefits of tube drainage not replicated
Serosal Patch

- To deal with large injuries to D2
- Introduced in canine model by Thal in 1963
- Jejunal serosal patch to close duodenal injury
- Serosa mucosal resurfacing @ 8 wks
- Also for reinforcing suture lines

High failure and leak rate
The Survey Says...

- **Primary repair vs tube decompression**
  - No difference in duodenal fistula rate

- **Jejunal serosal patch**
  - High leak rate; better side-to-side anastomosis

**Primary repair is a safe option**
At operation after blunt trauma, a 50-year-old man has a 75% circumferential duodenal tear proximal to the ampulla of Vater with 2 cm of devitalization to the anterior duodenal wall. The most appropriate treatment would be:

A. debridement, side to side duodenojejunostomy
B. primary closure and tube decompression
C. primary closure with tube decompression and bile duct drainage
D. antrectomy, gastrojejunostomy, and tube duodenostomy (duodenal diverticulization)
E. Pancreaticoduodenectomy
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‘To Whipple or not to Whipple, that is the question. In the massively destructive lesions involving the pancreas, duodenum, and common bile duct, the decision to do a pancreaticoduodenectomy is unavoidable; [...] In a few patients, when the call is [...] close, the overall physiologic status of the patient and the extent of damage become the determining factors in the decision. Though few in gross numbers, more patients are eventually salvaged by drainage, TPN and meticulous overall care than by a desperate pancreaticoduodenectomy in a marginal patient.’

-AJ Walt, 1996
When to Whipple?

- Fewer than 300 cases reported altogether
- Mortality rates between 31-36%
- Significant morbidity rates
- Consider only in:
  - Major devascularization of D2/D3
  - Destructive injury of pancreatic head, duodenum
  - Injuries to pancreaticoduodenal complex +/- CBD
Duodenal Diverticulization

- Truncal Vagotomy
- Antrectomy with gastrojejunostomy
- Duodenal closure
- Tube duodeno-stomy
- Drainage of CBD
- External drainage
Pyloric Exclusion

- Devised by Lewisohn in 1918; revised in 1977
- Diverts gastric fluid, avoids enzyme activation
- Duodenal repair, oversew pylorus via gastrostomy
- Gastrojejunostomy
Why Not Pyloric Exclusion?

- Increased operative time
- Permanent change in anatomy
- Marginal ulcer rates up to 30%
- No evidence that it decreases fistula rates
Pyloric Exclusion in the Treatment of Severe Duodenal Injuries: Results from the National Trauma Data Bank

Dubose, Joseph J.; Inaba, Kenji; Teixeira, Pedro G.R.; Shiflett, Anthony; Putty, Bradley; Green, D.J.; Plurad, David; Demetriades, Demetrios

The American Surgeon, Volume 74, Number 10, October 2008, pp. 925-929(5)
Study

- N= 147 adult trauma patients over 5 years
- AAST grade III-V; survival > 24h; no Whipple
- Pyloric exclusion (28) vs Primary repair (119)
- No improvement in morbidity/mortality
- Longer hospital stay
- Trend toward high-grade injuries tx’ed by PE
Critiques

• Large database yet small study population
• Study population is not equally distributed
• Retrospective, sicker pts preferably tx by PE
• NTDB lacks data on pancreatic injury stage
Summary

• Every trauma ex-lap should involve a look at the duodenum
• Primary repair & wide drainage beats a complex reconstruction
• Consider pt status prior to repair, “When it doubt, get out!”
• Triple drain therapy & serosal patch do not improve outcomes
• The indication for a trauma Whipple is rarer than hen’s teeth!*
  — NEVER DO A SINGLE STAGE TRAUMA WHIPPLE. EVER.

* Tommy Brown, Chief of Surgery Combat Support Hospital, Iraq
Thank You
References

- Degiannis, E et al. Duodenal Injuries British Journal of Surgery 2000
- Dubose et al. Pyloric Exclusion in the Treatment of Severe Duodenal Injuries: Results from the National Trauma Data Bank The American Surgeon 2008
- Cameron, J et al. Current Surgical Therapy, 10th Edition 2010
- Asensio, J et al. Current Therapy of Trauma and Surgical Critical Care, 1st Edition 2008
Complications

• Duodenal fistulae 2-14%
• Mortality (1968-1990): 17%
• Mortality (present day) 0.7-4%