Iatrogenic Duodenal Injuries

Downstate Medical Center
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History

• 71 y/o female who was seen by her PMD c/o 2 h/o RUQ pain radiated to the back. Patient denied fevers, nausea or vomiting. Was found to have elevated LFT’s and was referred to the ED.

• Patient was admitted to our service for further work up.

• PMH: Depression, Thalassemia, Reynaud’s

• PSH: Myomectomy

• NKDA
Case

Physical Exam

- Patient in NAD, AAOx3
- Mild jaundice
- C-V: RRR, S1-S2
- Pulm: CTA b/l
- Abdomen: Non distended, soft, tender to palpation in RUQ, neg Murphy’s sign. No masses.
Case

Labs:

- CBC: 10.45>10.0/30.2<469
- BMP: 140/4.7/103/25/38/1.53<81
- LFT: 7.0/3.7/315/498/558/2.9
- Coags: 14.2/30.4/1.2
Case HD #1

- Patient had significant improvement in pain. No fevers, nausea or vomiting

- Started on clear liquid diet

- Patient was assessed by GI
  - MRCP
  - Trend LFT’s
  - Abx
  - Plan for possible ERCP
Case

HD #2

- Patient denied abdominal pain
- Tolerating clear liquid diet
- Plan for ERCP next day
- LFT’s trending down
Case

HD #3

- ERCP:
  - Unsuccessful
  - Incidental perforation of duodenum diverticulum opposite to ampulla during difficult small bowel intubation
  - 2 unsuccessful attempts for Hemoclip placement
Case

HD #3

- Patient transferred to PACU in stable condition
- NGT in place
- Surgery notified of complication
- On initial assessment:
  - In NAD
  - AVSS
  - Abdomen soft, non tender
Case

HD #3

• Plan:
  • CT abdomen with PO/IV contrast
  • Transfer to Step-down surgical unit
  • NGT/NPO
  • IV Abx
  • Serial abdominal exams
Case

HD #3

- Patient was transferred to Step Down unit
- Multiple assessments during the following hours
  - Patient in NAD, denied abdominal pain
  - AVSS
  - Abdomen soft, non tender
Case

HD #3

- Approximately 9 hrs. post attempted ERCP:
  - Patient now complains of RUQ abdominal pain
- On physical exam:
  - AVSS
  - Abdomen diffusely tender, particularly in RUQ
- Decision was made to proceed with emergent surgical exploration
Case

HD #3

- Exploratory laparotomy
  - Gush of air
  - Large infiltration of air in the retroperitoneum, colonic mesentery and small bowel
  - Transverse colon intermittently adherent to duodenum without distinctive demarcation between the 2 structures
Case

HD #3

- Exploratory laparotomy
  - 5 mm perforation lateral aspect of 2\textsuperscript{nd} portion of duodenum with active leak of bile and air
  - GB appeared thickened and inflamed
  - Primary closure and omentoplasty
  - JP drain
Case

POD #1-4

• Patient NPO
• NGT to LCS
• Abx
• Patient with no major complaints, afebrile, VSS
Case

POD #5

- Afebrile
- NGT with min output discontinued
- + Gas
- No abdominal pain,
- JP drain cont serous output

POD #6

- Patient started on clear liquids diet
- Tolerated well
Case

POD #8
• Advanced to low fat diet
• Tolerated

POD #9
• Patient discharged home
Questions?
Iatrogenic Duodenal Injuries

- ERCP was first introduced in 1968 by McCune et al and has evolved over the decades.
- Currently, it is a valuable, widely used diagnostic and therapeutic tool in hepato-biliary-pancreas diseases.
- ERCP has a relatively high complication rate of nearly 10% and a mortality rate of 0.1 to 1%.
Iatrogenic Duodenal Injuries

- Therapeutic aspects of ERCP are becoming more important.
- Endoscopists take on increasingly more complex cases; the risk of complication is increasing.
- Pancreatitis, cholangitis, and hemorrhage are more frequent ERCP complications.
- ERCP-related perforation is one of the most feared due to its potentially lethal nature.
Iatrogenic Duodenal Injuries Classification

- Retroperitoneal duodenal perforation
  - The most common
  - Usually occur as a result of a sphincterotomy that extends beyond the intramural portion of bile duct

- Perforation of the bile ducts
  - Usually occurs following dilation of strictures, forceful cannulation, guidewire insertion, or stent migration

- Free bowel-wall perforation:
  - Rare, usually occurring in patients with a stricture or anomalous anatomy, such as Billroth II gastrectomy
Iatrogenic Duodenal Injuries Classification

- Also reported, but rare following ERCP and sphincterotomy:
  - Gastric and esophageal perforations
  - Pneumomediastinum without evidence of perforation
  - Intestinal perforation related to biliary stents
Incidence of Retrodouodenal Perforation

• Retrodouodenal perforation was reported in 0.5 to 2.1% of sphincterotomies in older large series.

• More recently, the incidence of perforation has appeared to decrease to less than 0.5%, probably because of improvement in experience and skill of the endoscopists.

• Severe and fatal cases continue to occur.
Risk Factors for Duodenal Perforation

- Risk factors for overall perforation:
  - Patient related
    - Sphincter of Oddi dysfunction
    - Common bile duct dilation
  - Procedure related
    - Performance of a sphincterotomy
    - Longer duration of the procedure
    - Biliary stricture dilation
Risk Factors for Duodenal Perforation

- Risk factors for bowel wall perforation:
  - Stenosis in the upper GI tract or bile ducts
  - Abnormal GI anatomy (s/p gastrectomy, s/p pancreaticoduodenectomy and situs inversus)
  - Particular caution required with use of side-viewing scope in patients with Billroth II reconstruction
Risk Factors for Duodenal Perforation

- Risk factors for retroperitoneal perforation:
  - Precut and larger sphincterotomies (particularly if cuts created outside the usual landmarks)
  - Small caliber bile duct
  - Presence of periampullary diverticulum
  - Intramural injection of contrast
Clinical Manifestations and Diagnosis

• Perforation is rarely evident endoscopically

• Free abdominal perforation:
  • Almost always recognized immediately based upon clinical symptoms, physical signs and fluoro findings

• Retroduodenal perforation:
  • Usually determined by the presence of air or contrast in the retroperitoneal space outside the confines of the bile ducts and duodenum during CT ordered for post ERCP pain
Clinical Manifestations and Diagnosis

- Patients with undetected leaks can present hours after the procedure with pain, fever and leukocytosis

- Other findings:
  - Gas in the portal system
  - Pneumothorax
  - Pneumomediastinum
  - Pneumoretroperitoneum
  - Pneumoperitoneum
  - Subcutaneous emphysema
Diagnosis - Abdominal CT

- Should be obtained in patients suspected of having a perforation even if no evidence of retroperitoneal air on plain films

- CT is the **most sensitive** means of detecting perforation
The clinical or radiographic amount of air:
- Not always indicates the size of the perforation
- Not always correlates with the severity of the complication

The amount of air reflects the degree of manipulation after the perforation occurred
Retroperitoneal Air

• Typically associated with perforation

• However, may develop in clinically asymptomatic patients following sphincterotomy
  • These patients may not require intervention
Retroperitoneal Air

- Origin of retroperitoneal air in asymptomatic patients:
  - Related to dissection through an injured or intact bowel (similar to that described after colonoscopy)
  - Sealed microperforations

- Presence of retroperitoneal air in the absence of symptoms should warrant careful observation but may not require intervention
Grading Post-ERCP Perforation

- **Mild**: Possible, or only very slight leak of fluid or contrast, treatable by fluids and suction for three days or less

- **Moderate**: Any definite perforation treated medically for 4 to 10 days

- **Severe**: Medical treatment for more than 10 days or intervention (percutaneous or surgical)

Clasification Post-ERCP Perforation

- Coded in descending order of injury severity
- Correlates with the mechanism of injury and the anatomic location of damage
- Used as a predictor for the need for surgical intervention
- Graded from Type I-IV

Classification Post-ERCP Perforation

- **Type I:**
  - Lateral or the medial duodenal wall remote from the ampulla
  - Caused by acute angulation of the endoscope
  - Typically large with extensive contrast leakage
  - Requires immediate surgery

- **Type II:**
  - Peri-Vaterian
  - Variable in their severity
  - Consequent to a precut sphincterotomy or occurring near a periampullary diverticulum
  - Minimal or moderate contrast leakage
  - Some may be able to be managed conservatively

Clasification Post-ERCP
Perforation

- Type III
  - Distal CBD
  - Secondary to wire manipulation or basket instrumentation during stone retrieval
  - Often small and localized and may frequently be managed conservatively

- Type IV
  - Reveal retroperitoneal air and result from insufflation during ERCP
  - Typically managed nonoperatively

Post-ERCP Perforation Management

- Free abdominal duodenal perforations usually require surgery.
- Conservative approach to retroperitoneal perforation following sphincterotomy has been adopted.
- Early surgical consultation and careful observation is mandatory.
  - Outcome poor in patients who do not receive prompt and appropriate treatment.
Post-ERCP Perforation Management

• Endoscopic Therapy:
  • Endoclips
  • Over the scope clips
  • Fibrin glue
  • Covered stents
  • Nasobiliary tube

• Percutaneous transhepatic drainage
Post-ERCP Perforation Management

- NPO, IV hydration, NG or nasoduodenal suction, IV antibiotics

- Consider percutaneous drainage as alternative to surgical drainage of retroperitoneal collections

- TPN if NPO status expected for more than one week
Post-ERCP Perforation Management

- Surgery if:
  - Persistent biliary obstruction, cholangitis, and if no improvement after brief nonoperative management

- Overall surgery is required in 20 to 40 percent of patients with perforation

- Type of surgical intervention depends upon clinicopathological condition
Post-ERCP Perforation Management

- Simple Repair
- Tube decompression
  - Gastrostomy
  - Duodenostomy
  - Feeding Jejunostomy
- Serosal Patch
- Duodenal Diverticulization
- Pyloric exclusion
Post-ERCP Perforation Management

- Prognosis of patients with a perforation depends upon
  - Rapidity of diagnosis
  - Clinical setting
  - Patient comorbidities
• Overall mortality has decreased from 16% percent in older reports to 8% in a review that considered major studies from the year 2000

• Lower mortality noted in recent years may reflect benefits related to a conservative team approach to the management of small retroperitoneal perforations
A retrospective review of ERCP-related perforations to the duodenum (April 1999 to February 2008)

Incidence, Clinical outcomes

Data included: ERCP indication, Clinical presentation, Diagnostic methods, Time to diagnosis and treatment, Type of injury, Management
4,358 ERCP

15 (0.34%) resulted in perforation to the duodenum

4 of the perforations were discovered during ERCP

8 required CT abdomen or abdominal radiography

Surgery was performed for 13 (87%) patients

2 patients died (15%)
One patient was managed conservatively with a successful outcome.

9 patients underwent surgery within 24 h after the ERCP.

1 patient underwent surgery after 24 h.

The overall mortality rate was 20% (3 of 15 patients).
The interval between the perforation and the operation is of great significance.

The mortality rate increases dramatically with late surgical management (>24 hours).

Clinical and radiographic features can be used to determine the surgical or conservative treatment of ERCP-related duodenal perforations.

Patient age and intraoperative findings can determine the final outcome and morbidity or mortality.
Management of endoscopic retrograde cholangiopancreatography: related duodenal perforations
Dimitrios V. Avgerinos, Omar H. Llaguna, Andrew Y. Lo, Joseph Voli, I. Michael Leitman
Records of patients undergoing ERCP 16-year period (1995-2011)
Types of injuries, diagnosis, management, and patient outcome
Injuries classified from I to IV
1,638 ERCP
27 perforations (1.6%)
Nearly 50% of the procedures were regarded as difficult
• 70% performed for therapeutic indications.
• 5 type I, 12 type II, 5 type III, 5 type IV perforations
• 18 cases diagnosed at the time of ERCP
• Delayed diagnosis of type I perforations were fatal
• Most type II perforations required immediate surgery with pyloric exclusion
• Delayed surgery with simple drainage had a high mortality rate
• Most type III and type IV injuries can successfully be managed conservatively
• The mechanism of injury during ERCP predicts the need for surgical management

• Type I and type II injuries require early diagnosis and aggressive surgery

• Type III and type IV injuries may be managed conservatively
Perforations following endoscopic retrograde cholangiopancreatography: a single institution experience and surgical recommendations

Rafi Miller, M.D., Andrew Zbar, M.D., Yoram Klein, M.D., Victor Buyeviz, M.D., Ehud Melzer, M.D., Bruce N. Mosenkis, M.D., Eli Mavor, M.D.
• Retroduodenal perforation has decreased from up to 2.1 percent of sphincterotomies to less than 0.5 percent in recent series.

• Free abdominal perforation is almost always recognized immediately based upon clinical symptoms, physical signs, and fluoroscopic findings.
• Retroduodenal perforation is usually determined by the radiologic evidence of air or contrast in the retroperitoneal space.

• Retroperitoneal air may also develop following sphincterotomy in patients who are clinically asymptomatic. Such patients may not require intervention.
• Abdominal CT scan should be obtained in patients who are suspected of having a perforation. CT scan is the most sensitive means for detecting perforation

• Patients with free abdominal duodenal perforation usually require surgery
• By contrast, a conservative approach to small retroperitoneal perforation may be appropriate.

• Early surgical consultation and careful observation is mandatory since the outcome may be poor in patients who do not receive prompt and appropriate treatment.


5. Loperfido S et al. Post-ERCP perforation. In: UpToDate, Basow, DS (Ed), UpToDate, Waltham, MA, 2013