Participating in the Webinar

All attendees will be muted and will remain in Listen Only Mode.

Type your questions here so that the moderator can see them. Not all questions will be answered but we will get to as many as possible.

How to Receive CME and MOC Points

LIVE VIRTUAL GRAND ROUNDS WEBINAR
ACG will send a link to a CME & MOC evaluation to all attendees on the live webinar.

ABIM Board Certified physicians need to complete their MOC activities by December 31, 2021 in order for the MOC points to count toward any MOC requirements that are due by the end of the year. No MOC credit may be awarded after March 1, 2022 for this activity.
MOC QUESTION

If you plan to claim MOC Points for this activity, you will be asked to: Please list specific changes you will make in your practice as a result of the information you received from this activity.

Include specific strategies or changes that you plan to implement. THESE ANSWERS WILL BE REVIEWED.

ACG Virtual Grand Rounds

Join us for upcoming Virtual Grand Rounds!

Week 2, 2022
Chronic Constipation: More Than Just Bowel Movements
Kyle Staller, MD, MPH
January 13, 2022 at Noon Eastern

Week 3, 2022
Endoscopic Myotomy: Update on POEM and GPOEM
Mihir Wagh, MD
January 20, 2022 at Noon Eastern

Visit gi.org/ACGVGR to Register
Disclosures:

Speaker: Mohit Girotra, MD
Dr. Girotra, faculty for this educational event, has no relevant financial relationship(s) with ineligible companies to disclose.

Moderator: Monique Barakat, MD, PhD
Dr. Barakat, faculty for this educational event, has no relevant financial relationship(s) with ineligible companies to disclose.

*All of the relevant financial relationships listed for these individuals have been mitigated

Management of Pancreatic Fluid Collections

Mohit Girotra, MD FACG FACP

Section of Interventional Endoscopy, Digestive Health Institute, Swedish Medical Center, Seattle, WA
Pancreatic Fluid Collections (PFCs)

- Inflammatory PFCs = arise as an adverse event of acute and chronic pancreatitis, pancreatic trauma or pancreatic surgery.

- Often pancreatic cystic lesions (PCLs) are misclassified as PFCs, due to similarities in their radiographic appearance.

- Management options = Varied.

Pathophysiology of PFCs

- In AP:
  - Pancreatic inflammation and necrosis → small ductular disruption and leakage of proteolytic juice which accumulates in space adjacent to the pancreas
  - Inflammatory response → forms distinct cyst wall composed of granulation tissue, organizes with connective tissue and fibrosis

- In CP:
  - Chronic obstruction of PD → ongoing upstream pancreatic secretions leads to saccular dilation – true retention cysts
  - Micro-cysts can eventually coalesce and lose epithelial lining as they enlarge
Revised Atlanta Classification of AP (2012)

MRI/MRCP is superior to CT

- Detection of solid debris within fluid collection (Sen MRI 100% vs CT 25%)*
- Integrity of MPD: DPDS
- Choledocholithiasis/D debris


Imaging characteristics

Xiao B. Artif Intell Med Imaging 2020 (used with permission); Images courtesy of Dr. Bawazeer, Radiopaedia.org, rID: 78474
Pancreatic Pseudocyst (PC)

- Commonest pancreatic cystic lesion (75-80% of all)

- Location:
  - Lesser peritoneal sac (proximity to pancreas)
  - Larger PC → track into para-colic gutters, pelvis, mediastinum, scrotum, etc.

- Fluid – Similar electrolyte concentration as plasma
  - High concentration of Amylase, Lipase, Enterokinase (Trypsin)

- No solid debris

- Well-defined non-epithelialized wall (hence not a “true cyst”) – fibrous capsule

Clinical presentation of PC

- **Symptoms:**
  - Abdominal pain (80-90%)
  - Nausea/vomiting
  - Early Satiety
  - Bloating/Indigestion

- **Signs:**
  - Tenderness
  - Fullness/distension

- **Diagnosis:**
  - Clinical suspicion: Symptoms persistent and fail to resolve
  - Labs: Persistent elevation of serum Amylase/Lipase levels
  - USG → 75-90% sensitive
  - CT → Most accurate (sensitivity 90 - 100%)
Basic Management of PFC

- Similar as Acute Pancreatitis:
  - NPO, Pain and nausea management
  - Proximal bowel rest: TPN or post-LOT feeding
  - Octreotide

- Antibiotics (if infected)

- 33-50% will resolve/improve with this strategy

- If asymptomatic, uncomplicated or stable/decreasing in size, expectant management is preferred.

Issues?

- Pseudocyst/PFC or Tumor/cystic neoplasm?
  - Sterile vs. Infected PFC?

- Observation or Intervention?

- Management Strategy
  - Surgery or IR or Endoscopic
  - Complicated PFC
(I) Beware of a Mucinous Cystic Neoplasm/Tumor

- Reports of erroneous drainage by “cystgastrostomy”
- Look for “enhancing and thick walls, solid internal content, loculations or any solid component”
- Single compartment mucinous cyst – more likely to be mis-diagnosed as PP*

Scott J. Clin Radiol 2000

---

PC vs. MCN/Tumor

<table>
<thead>
<tr>
<th></th>
<th>Pseudocyst (PC)</th>
<th>Mucinous Cystic Neoplasm (MCN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H/o pancreatitis/trauma</td>
<td>Yes</td>
<td>Usually No</td>
</tr>
<tr>
<td>Imaging (CT, USG)</td>
<td>Single, non-loculated</td>
<td>Often multi-locular (MCN ~ unilocular)</td>
</tr>
<tr>
<td></td>
<td>No septae or solid component</td>
<td>Septae or solid component (+)</td>
</tr>
<tr>
<td></td>
<td>Thin wall (&lt; 4 mm)</td>
<td>Thick walled</td>
</tr>
<tr>
<td>Duct cyst connection</td>
<td>&gt; 65%</td>
<td>Usually No</td>
</tr>
<tr>
<td>Viscosity/Amylase</td>
<td>Low/High</td>
<td>High/Low</td>
</tr>
<tr>
<td>Cytology</td>
<td>Inflammatory cells +</td>
<td>40% +</td>
</tr>
<tr>
<td>CEA</td>
<td>Low</td>
<td>High (&gt; 192)</td>
</tr>
</tbody>
</table>

*Imaging or cyst fluid analysis are NOT infallible!*

*Better to resect a pseudocyst than to drain a tumor!*
Complications

- **Infection (~30%)**: 
  - Fever, worsening pain, SIRS 
  - CT = Increasing thickness of fibrous wall or air within cavity

- **GI obstruction**
- **Hemorrhage**
- **Perforation**
- **Thrombosis** (Spl. V = most common)
- **Pseudo-aneurysm** (Spl. A = most common, GDA, PDA, L gastric A)

Xiao B. *Artif Intell Med Imaging* 2020 (used with permission); Images courtesy of Dr. Bawazeer, Radiopaedia.org, riD: 78474

(II) PFC – Sterile vs. Infected

- Initially indistinguishable \(\rightarrow\) becomes more apparent at 2-4 weeks after onset (when incidence of infected necrosis peaks)

- Signs:
  - New-onset or persistent sepsis
  - No alternative sources of infection
  - Clinical deterioration despite adequate support
  - Gas bubbles within PFC (CT 56% sen, 97% sp)

- EUS-FNA not recommended to determine infection – high false negative rate, and risk of contamination

- Dutch Pancreatitis Group Study (NEJM 2010) \(\rightarrow\) surgical intervention vs. open necrosectomy \(\rightarrow\) intervened solely based on clinical suspicion of infected necrosis without using FNA was accurate in > 90% of cases
Treatment Considerations

- Majority of Acute PFC = resolve spontaneously → No intervention

- Consider PFC drainage = Treatment of corresponding symptoms or resolution of infected/enlarging collections

**THE 4 WEEK RULE:**

- If < 4 week duration → Lack of mature wall → Acute PFC/ANC do NOT undergo endoscopic drainage

- If > 4 week duration → Develop mature wall → Endoscopic drainage can be offered for sterile or infected PP/WON

Prior to Treatment

- Contrast enhanced CT, MRI/MRCP or EUS → Exclude a cystic neoplasm (PCL) or pseudo-aneurysm or duplication cyst or other non-inflammatory fluid collection.

- Exclude malignancy (solid-cystic lesions)

- Consider ERCP before percutaneous, transmural or surgical drainage to further delineate the anatomy, esp DPDS, but is not essential

- Distinguish sterile vs. infected collections.
(III) Indications for Interventions

- Pseudocysts > 6 cm, *if symptomatic*
- Sterile WON, *if symptomatic* (causing biliary obstruction or gastric outlet obstruction)
- Infected Pseudocysts or WON
- PD abnormalities (stricture, stone, DPDS)
- Complications
- Suspicion of malignancy

** Additional symptoms > 6 weeks: Refractory abdominal pain, Anorexia, Weight loss lasting beyond 6-8 weeks after onset of AP, systemic illness

(IV) Interventions Options

- Select according to local expertise and severity of patient’s comorbidities.
- IR & surgical back-up in case of complications (severe bleeding or perforation).

A) Endoscopic
  - Trans-papillary
  - Trans-mural (Conventional or EUS guided)
  - Combination

A) Percutaneous
B) Surgical
Percutaneous drainage

- Can be used for unstable patients (not surgical candidates)
- Infected collections < 4 weeks (non-mature)

Downside: Persistent fistula

Surgical options

- **Excision**
  - Tail of gland with proximal strictures → Distal pancreatectomy and splenectomy
  - Head of gland with MPD/CBD strictures → Pancreaticoduodenectomy

- **External drainage**
Surgical options

- **Internal drainage**
  - Cysto-gastrostomy
  - Cysto-jejunostomy (Permanent resolution 91-97%)
  - Cysto-duodenostomy (Cx = Duodenal fistula and bleeding at anastomosis site)

- **VARD** (video-assisted retroperitoneal debridement)

Endoscopic Management

- **Pre-endoscopic Checklist:**
  - Necessary equipment
  - Anesthesia: Propofol or GA
  - D/c anticoagulant/antiplatelet agents
  - Trained RN and technician staff
  - CO2 to minimize risk of gas embolism
  - Use Antibiotics

- **Consider Endoscopic Drainage:**
  - Bulge into stomach or duodenum
  - No solid lesion (EUS)
  - No large blood vessels in path (EUS)
  - Wall distance 0.5-1 cm (EUS)
  - Technical expertise available

- **Contraindications:**
  - Bleeding dyscrasias
  - Gastric varices
  - Acute inflammatory changes that may prevent cyst from adhering to the enteric wall
  - CT – Multi-loculated PFC
Conventional Transmural drainage (CTD)

- Cyst-gastrostomy using double pigtailed plastic stents
  - Size & number of plastic stents = no impact on drainage if uncomplicated PFC*

EUS-Transmural drainage (EUS-TD)

- New method: using FC-SEMS or LAMS
  - Needs single stent – shorter procedure time
  - Larger stent (10 mm) – better drainage, reduced stent occlusion, ability to perform interventions in cyst cavity (necrosectomy)
  - Non superior to plastic stents for resolution of uncomplicated PFC
  - Risk of migration** (mitigated by double pigtail within FC-SEMS)

- Technique has evolved: EC-LAMS; Solely accomplished using therapeutic linear array EUS scope

*Bang JY. Surg Endosc. 2014; **Penn DE. GIE 2014
Transmural drainage

- Continuous drainage until output < 50 ml/day + amylase activity decreases.
  -- Failure rate ~ 16%
  -- Recurrence rate ~ 7%

- Complications:
  - Conversion into infected pseudocyst (~ 10%)
  - Catheter-site cellulitis
  - Damage to adjacent organs
  - GI hemorrhage
  - Pancreatoco-cutaneous fistula

*Bang JY. Surg Endosc. 2014; **Penn DE. GIE 2014

CTD vs. EUS-TD

  - CTD only for patients with visible gastric bulge, while EUS-TD for patients with and without, and on smaller collections.

- Varadarajulu S (2008) GIE \(\rightarrow\) prospective trial (n=30) \(\rightarrow\) clinical success 100% for EUS-TD vs. 33% for CTD.

- Park D (2009) Endoscopy \(\rightarrow\) EUS-TD had fewer complications and higher success rate in non-bulging cysts, hence preferred approach over CTD.

Types of stents – Transmural Drainage

- Old approach = Plastic stents → time consuming and challenging.

- New = Metal stents → FC-SEMS (large diameter and ease of placement) → complications = infection, bleeding and stent migration*. Also injury to opposing luminal wall.

- LAMS
  - EC-LAMS→ single step placement of without need for guidewires/dilation → reduces procedure time.
  - Larger diameter (10 – 15 mm): Improved drainage
  - Bleeding (p < 0.001) → friction against blood vessels.

*Talreja et al. GIE 2008; Penn et al. GIE 2012; Sarkaria et al. JCG 2014.

Plastic vs. LAMS for EUS-TD

Clinical Success

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>LAMS Events</th>
<th>Plastic events</th>
<th>Weight</th>
<th>Risk ratio</th>
<th>Risk ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Weight</td>
<td>Total</td>
<td>Weight</td>
<td>95% CI</td>
</tr>
<tr>
<td></td>
<td>M &amp; F</td>
<td>M &amp; F</td>
<td>M &amp; F</td>
<td>M &amp; F</td>
<td></td>
</tr>
<tr>
<td>Benagiano 2016</td>
<td>41</td>
<td>0.05</td>
<td>37</td>
<td>0.05</td>
<td>1.09 (0.91, 1.32)</td>
</tr>
<tr>
<td>Benagiano 2018</td>
<td>96</td>
<td>0.13</td>
<td>77</td>
<td>0.13</td>
<td>1.18 (0.91, 1.52)</td>
</tr>
<tr>
<td>Cooney 2013</td>
<td>12</td>
<td>0.07</td>
<td>11</td>
<td>0.07</td>
<td>1.13 (0.90, 1.41)</td>
</tr>
<tr>
<td>Cui 2017</td>
<td>10</td>
<td>0.05</td>
<td>11</td>
<td>0.05</td>
<td>1.13 (0.89, 1.42)</td>
</tr>
<tr>
<td>Han 2016</td>
<td>30</td>
<td>0.05</td>
<td>35</td>
<td>0.05</td>
<td>1.03 (0.79, 1.33)</td>
</tr>
<tr>
<td>Liu 2016</td>
<td>147</td>
<td>0.20</td>
<td>141</td>
<td>0.20</td>
<td>1.13 (0.93, 1.37)</td>
</tr>
<tr>
<td>Wang 2019</td>
<td>53</td>
<td>0.10</td>
<td>54</td>
<td>0.10</td>
<td>1.09 (0.81, 1.45)</td>
</tr>
</tbody>
</table>

Overall

- Overall events (95% CI)
- Test for overall effect: Z = 2.34 (p = 0.02)
- Forrest Plastics vs. Forrest LAMS

Adverse events (overall)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>LAMS Events</th>
<th>Plastic events</th>
<th>Weight</th>
<th>Risk ratio</th>
<th>Risk ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Weight</td>
<td>Total</td>
<td>Weight</td>
<td>95% CI</td>
</tr>
<tr>
<td></td>
<td>M &amp; F</td>
<td>M &amp; F</td>
<td>M &amp; F</td>
<td>M &amp; F</td>
<td></td>
</tr>
<tr>
<td>Benagiano 2016</td>
<td>4</td>
<td>0.05</td>
<td>4</td>
<td>0.05</td>
<td>1.00 (0.78, 1.25)</td>
</tr>
<tr>
<td>Benagiano 2018</td>
<td>10</td>
<td>0.06</td>
<td>9</td>
<td>0.06</td>
<td>1.00 (0.80, 1.25)</td>
</tr>
<tr>
<td>Cooney 2013</td>
<td>12</td>
<td>0.07</td>
<td>10</td>
<td>0.07</td>
<td>1.00 (0.81, 1.25)</td>
</tr>
<tr>
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</table>

Overall

- Overall events (95% CI)
- Test for overall effect: Z = 2.34 (p = 0.02)
- Forrest plastic stent vs. Forrest LAMS

Tan et al. Meta-analysis. GRP 2020;
Hammad et al. DDS 2018; Fugazza et al. GIE 2020
EC-LAMS for PC

Video Courtesy: Girotra and Friedland

LAMS for PP

- Yang and Khashab et al (Endoscopy 2019) → multicenter, retrospective → 205 PP patients (80 LAMS, 125 DPPS)

  - Clinical success: LAMS (96%) >> DPPS (87%) (P = 0.03)
  - Need for percutaneous approach: DPPS >> LAMS
  - Adverse events: DPPS (17.6%) >> LAMS (7.5%) (P = 0.04)
  - Similar technical success, post procedure LOS, 6 month recurrence rates

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Cost</th>
<th>IC</th>
<th>Effectiveness</th>
<th>IE</th>
<th>CER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS</td>
<td>10087</td>
<td>6937</td>
<td>0.9698</td>
<td>-0.0306</td>
<td>10403</td>
</tr>
<tr>
<td>LAMS</td>
<td>17024</td>
<td>6937</td>
<td>0.939</td>
<td>-0.0306</td>
<td>18129</td>
</tr>
</tbody>
</table>

1 Costs are expressed in 2016 US$. Effectiveness is expressed as rate of successfully drained patient. CER, cost-effectiveness ratio; IC, incremental cost; CER, incremental cost-effectiveness ratio; IE, Incremental effectiveness; LAMS, lumen-apposing metal stent; PS, plastic stent

LAMS with/without DPS

Dua et al. GIE 2018

LAMS for WON

- 313 patients → 106 DP (10.3), 121 FC-SEMS (10.6) and 86 LAMS

  - No difference in technical success (P = 0.37)
  - Early adverse events: FC-SEMS (1.6%) << DP (7.5%) and LAMS (9.3%) (P < 0.01)
  - 6-month F/U: Resolution of WOPN: DP (81%) << LAMS (90%) and FC-SEMS (95%) (P = 0.001)
LAMS for WON

- No difference in clinical success, number of procedures performed to achieve WOPN resolution, adverse events, readmissions, LOS or treatment costs.

- Significantly higher adverse events if LAMS not removed within 3 wks.

- Choose approach based on clinical status, MPD integrity and patient compliance.

---

Direct Endoscopic Necrosectomy (DEN)

- 93 patients with endoscopic access to cavity
- 75 success
- 18 failure
- Initial results
- 11 recurrence
- 83 success
- 3 success recurrence
- 63 death**
- 1 death**
- 11 surgery
- Long-term follow-up
- 6 death*

*GEPARD Trial. Rosch et al. Gut 2009*
Treat PFC but don’t forget the duct!

Disconnected Pancreatic Duct Syndrome:
• Acute Pancreatitis – Necrosis
• Chronic Pancreatitis – Elevated PD pressure from stones/strictures
• Trauma
• Ductal obstruction from neoplasms

DPDS Management

Bang JY et al. CGH. 2021
Multiple Trans-luminal Gateway Technique (MTGT)

**TABLE 3. Clinical outcomes of patients with walled-off pancreatic necrosis**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Conventional drainage</th>
<th>MTGT N = 12</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment success, no. (%)</td>
<td>25 (52.1)</td>
<td>11 (91.7)</td>
<td>.018*</td>
</tr>
<tr>
<td>Complications, no. (%)</td>
<td>5 (10.4)</td>
<td>0 (0)</td>
<td>.573*</td>
</tr>
<tr>
<td>Reintervention, no. (%)</td>
<td>12 (25)</td>
<td>6 (50)</td>
<td>.156*</td>
</tr>
<tr>
<td>Hospital stay, median (IQR), d</td>
<td>4.5 (2-16.5)</td>
<td>16.5 (4-45)</td>
<td>.079</td>
</tr>
<tr>
<td>Follow-up time, median (IQR), d</td>
<td>169 (60-228)</td>
<td>159.5 (112-228)</td>
<td>.539</td>
</tr>
</tbody>
</table>

Varadarajulu et al. GIE 2011.

MTGT with EC-LAMS

<table>
<thead>
<tr>
<th>Case</th>
<th>Sex</th>
<th>Age</th>
<th>Pancreatitis etiology</th>
<th>WON location</th>
<th>WON size (mm)</th>
<th>Indication for drainage</th>
<th>stent size (mm)</th>
<th>Drainage approach</th>
<th>Procedure time (min)</th>
<th>No. of DEN</th>
<th>Adverse events</th>
<th>Hospital stay (days)</th>
<th>Recurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>55</td>
<td>Idiopathic</td>
<td>Body-tail</td>
<td>100 + 60</td>
<td>Early satiety</td>
<td>15 x 10</td>
<td>Transgastric</td>
<td>30</td>
<td>2</td>
<td>No</td>
<td>24</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Male</td>
<td>82</td>
<td>Trauma</td>
<td>Head-body</td>
<td>Head-body</td>
<td>150 + 80 Jaundice and loss of appetite satiety</td>
<td>15 x 10</td>
<td>Transgastric</td>
<td>25</td>
<td>1</td>
<td>Bleeding (moderate)</td>
<td>25</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Male</td>
<td>42</td>
<td>Alcohol</td>
<td>Head-body</td>
<td>Head-body</td>
<td>&gt;150 Gastric compression</td>
<td>15 x 10</td>
<td>Transgastric</td>
<td>30</td>
<td>3</td>
<td>Bleeding (severe)</td>
<td>180</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>75</td>
<td>Post-ERCP</td>
<td>Head-body</td>
<td>Head-body</td>
<td>&gt;150 Systemic infection</td>
<td>15 x 10</td>
<td>Transduodenal</td>
<td>30</td>
<td>1</td>
<td>No</td>
<td>51</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>Male</td>
<td>70</td>
<td>Gallstone</td>
<td>Head-body</td>
<td>Head-body</td>
<td>130 Systemic infection/gastric compression</td>
<td>15 x 10</td>
<td>Transduodenal</td>
<td>28</td>
<td>3</td>
<td>No</td>
<td>21</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>64</td>
<td>Gallstone</td>
<td>Head-body-tail</td>
<td>Head-body-tail</td>
<td>&gt;150 Abdominal pain and gastric compression</td>
<td>15 x 10</td>
<td>Transgastric</td>
<td>30</td>
<td>3</td>
<td>No</td>
<td>14</td>
<td>No</td>
</tr>
</tbody>
</table>

Bang JY. Dig Endosc 2016; Binda C et al. Eur J Gastroenterol Hepatol. 2020
Dual modality drainage (DMD)

<table>
<thead>
<tr>
<th>TABLE 2. Additional procedure-related data for patients treated with DMD for infected and symptomatic WOPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of percutaneous drainage, median, d</td>
</tr>
<tr>
<td>No. percutaneous drains, mean (SD)</td>
</tr>
<tr>
<td>No. CT scans, mean (SD)</td>
</tr>
<tr>
<td>No. tube checks, mean (SD)</td>
</tr>
<tr>
<td>No. ERCPs, mean (SD)</td>
</tr>
<tr>
<td>% of patients with pancreatic ducts placed at some point in treatment</td>
</tr>
<tr>
<td>Immediate procedure-related adverse events</td>
</tr>
<tr>
<td>Self-limited bleeding</td>
</tr>
<tr>
<td>Asymptomatic pneumoperitoneum</td>
</tr>
<tr>
<td>Infection</td>
</tr>
</tbody>
</table>

DMD, Dual-modality drainage; WOPN, walled-off pancreatic necrosis; SD, standard deviation.

Endoscopic Step-Up Therapy

- Mayo retrospective
- N = 136 → 69 (51%) Step-up Rx

- Predictors*:
  - PFC size ≥ 10 cm
  - Paracolic extension of PFC
  - Solid necrosis ≥ 30%

- WOPN: 51/81 (63%) → Step-up

*For both PFC and WOPN

V. Chandrashekhara et al.
Infected PFC Management Approach

- **PANTER Trial 2010**: NEJM
  Open vs. Step-up Approach

- **PENGUIN Trial 2012**: JAMA
  Endoscopic vs. Surgical Necrosectomy

- **TENSION Trial 2017**: Lancet
  Surgical Step-up vs. Endoscopic Step-up

- **POINTER Trial 2021**: NEJM
  Immediate drainage (within 24 hrs) vs. current SOC approach

**PANTER Trial 2010: Open vs. Step-up Approach**

Dutch Pancreatitis Study Group

- Infected PFCs $\rightarrow$ Randomized for open necrosectomy vs. step-up approach.

![Diagram of PANTER Trial](NEJM 2010)
PANTER Trial 2010

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Minimally Invasive Step-up Approach (N=43)</th>
<th>Primary Open Necrosectomy (N=45)</th>
<th>Risk Ratio (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary composite end point: major complications or death — no. (%)†</td>
<td>17 (40)</td>
<td>31 (69)</td>
<td>0.57 (0.38–0.87)</td>
<td>0.006</td>
</tr>
<tr>
<td>Secondary end points</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major complication — no. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New-onset multiple-organ failure or systemic complications‡</td>
<td>5 (12)</td>
<td>19 (42)</td>
<td>0.28 (0.11–0.67)</td>
<td>0.001</td>
</tr>
<tr>
<td>Multiple-organ failure</td>
<td>5 (12)</td>
<td>18 (40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple systemic complications</td>
<td>0</td>
<td>1 (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intraabdominal bleeding requiring intervention</td>
<td>7 (16)</td>
<td>10 (22)</td>
<td>0.73 (0.31–1.75)</td>
<td>0.48</td>
</tr>
<tr>
<td>Enterocutaneous fistula or perforation of a visceral organ requiring intervention</td>
<td>6 (14)</td>
<td>10 (22)</td>
<td>0.63 (0.25–1.58)</td>
<td>0.32</td>
</tr>
<tr>
<td>Death — no. (%)</td>
<td>8 (19)</td>
<td>7 (16)</td>
<td>1.20 (0.48–3.01)</td>
<td>0.70</td>
</tr>
<tr>
<td>Other outcome — no. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pancreatic fistula</td>
<td>12 (28)</td>
<td>17 (38)</td>
<td>0.74 (0.40–1.36)</td>
<td>0.33</td>
</tr>
<tr>
<td>Incisional hernia§</td>
<td>3 (7)</td>
<td>11 (24)</td>
<td>0.29 (0.09–0.95)</td>
<td>0.03</td>
</tr>
<tr>
<td>New-onset diabetes§</td>
<td>7 (16)</td>
<td>17 (38)</td>
<td>0.43 (0.20–0.94)</td>
<td>0.02</td>
</tr>
<tr>
<td>Use of pancreatic enzymes§</td>
<td>3 (7)</td>
<td>15 (33)</td>
<td>0.21 (0.07–0.67)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

47

PENGUIN Trial 2012: Endo vs. Sx Necrosectomy

Dutch Pancreatitis Study Group

JAMA 2012

American College of Gastroenterology
## POINTER Trial: Immediate drainage vs. SOC

**Dutch Pancreatitis Study Group**

<table>
<thead>
<tr>
<th>End Point</th>
<th>Immediate Catheter Drainage (N = 55)</th>
<th>Postponed Catheter Drainage (N = 49)</th>
<th>Relative Risk or Mean Difference (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary end point</td>
<td>57 (50 to 65)</td>
<td>58 (50 to 67)</td>
<td>-1 (-12 to 10)†</td>
</tr>
<tr>
<td>Comprehensive Complication Index score = mean (95% CI):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death within 6 months</td>
<td>7 (13)</td>
<td>5 (10)</td>
<td>1.25 (0.42 to 3.68)</td>
</tr>
<tr>
<td>New-onset organ failure§</td>
<td>14 (25)</td>
<td>11 (22)</td>
<td>1.13 (0.57 to 2.26)</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>3 (9)</td>
<td>8 (16)</td>
<td>0.56 (0.20 to 1.59)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>31 (20)</td>
<td>9 (18)</td>
<td>1.09 (0.49 to 2.40)</td>
</tr>
<tr>
<td>Renal</td>
<td>3 (5)</td>
<td>4 (8)</td>
<td>0.67 (0.16 to 2.84)</td>
</tr>
<tr>
<td>New-onset multiple organ failure</td>
<td>4 (7)</td>
<td>8 (16)</td>
<td>0.45 (0.14 to 1.39)</td>
</tr>
<tr>
<td>Bleeding</td>
<td>8 (15)</td>
<td>10 (20)</td>
<td>0.71 (0.31 to 1.66)</td>
</tr>
<tr>
<td>Perforation of a viscer al organ or enterocutaneous fistula</td>
<td>5 (9)</td>
<td>4 (8)</td>
<td>1.11 (0.32 to 3.91)</td>
</tr>
<tr>
<td>Pancreaticocutaneous fistula</td>
<td>6 (11)</td>
<td>4 (8)</td>
<td>1.34 (0.40 to 4.46)</td>
</tr>
<tr>
<td>Incisional hernia</td>
<td>0</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>Wound infection</td>
<td>0</td>
<td>1 (2)</td>
<td>—</td>
</tr>
<tr>
<td>Exocrine insufficiency</td>
<td>20 (36)</td>
<td>19 (39)</td>
<td>0.94 (0.57 to 1.54)</td>
</tr>
<tr>
<td>Use of enzymes</td>
<td>25 (48)</td>
<td>14 (32)</td>
<td>1.51 (0.90 to 2.53)</td>
</tr>
<tr>
<td>Fecal elastase &lt;200 mg/dl</td>
<td>11 (20)</td>
<td>10 (20)</td>
<td>0.98 (0.46 to 2.11)</td>
</tr>
<tr>
<td>Endocrine insufficiency</td>
<td>42 (76)</td>
<td>40 (82)</td>
<td>0.94 (0.77 to 1.14)</td>
</tr>
</tbody>
</table>

- Comprehensive Complication Index (CCI): No difference in mortality, new onset organ failure or other complications.
- Median number of interventions significantly higher in immediate catheter drainage group (p<0.001)

## Summary

- Revised Atlanta classification is still relevant and good guide for management algorithm of PFC
- Over 50% of PFCs improve without interventions, especially if asymptomatic
- Early PFC (< 4 weeks) are not amenable to endoscopic therapy
- Indications for drainage include size, symptoms and infection
- Choice of intervention depends on availability of expertise and tools
- Endoscopic options (using LAMS) are preferred over percutaneous or surgical options
- > 50% patients drained with LAMS will need step-up therapy
- Endoscopic step-up therapy (DEN) is preferred over percutaneous or surgical
- Adverse events and complications are possible
Conclusions

- **Mother Teresa:** I can do things you cannot, you can do things I cannot; together we can do great things

- PFC Management:
  - Challenging
  - Multi-disciplinary approach: IR, surgery, ID
  - Communication
  - Long-road for patient and family

Thank you!

Questions?

**Speaker:**
Mohit Girotra, MD

**Moderator:**
Monique Barakat, MD, PhD
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