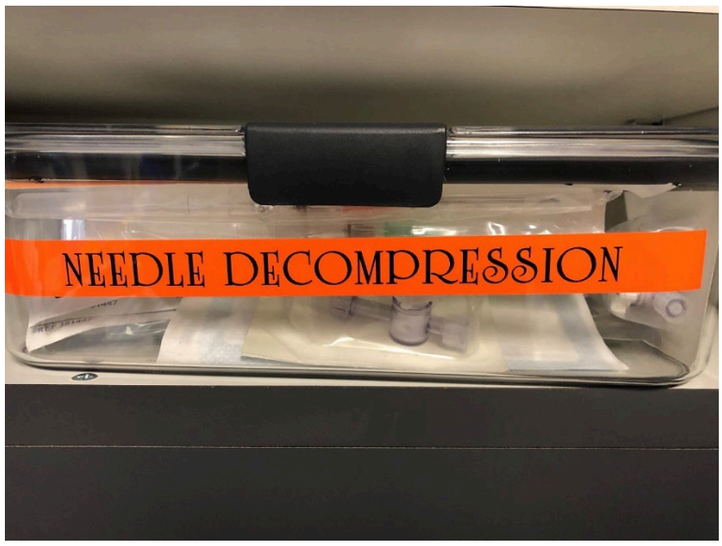
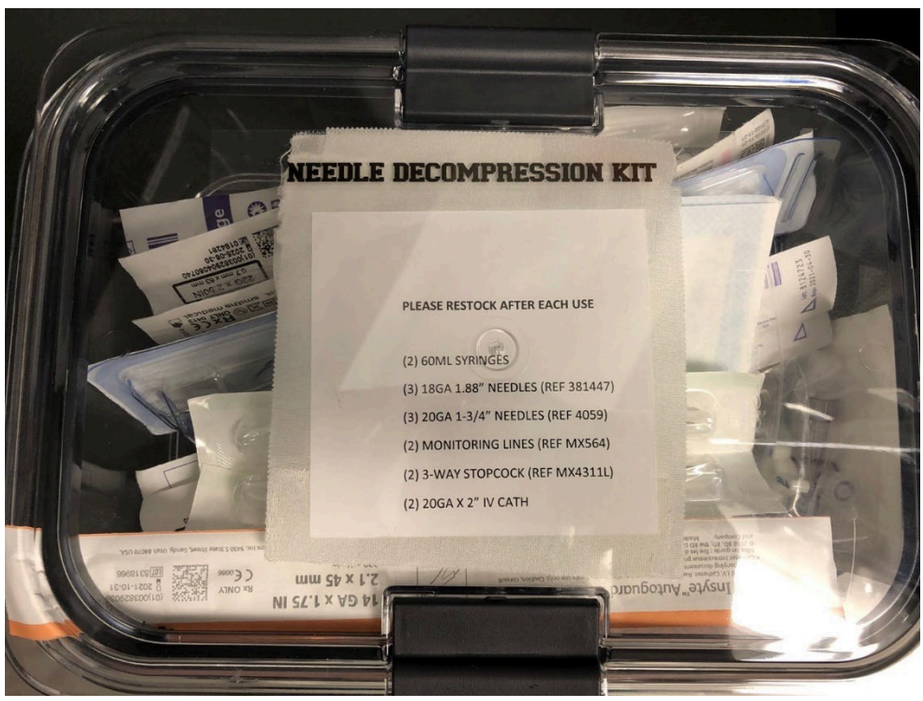
Supplementary material

Supplementary Figure 1. Needle decompression kit located in the supply room in a cabinet labelled “Emergency Supply”.

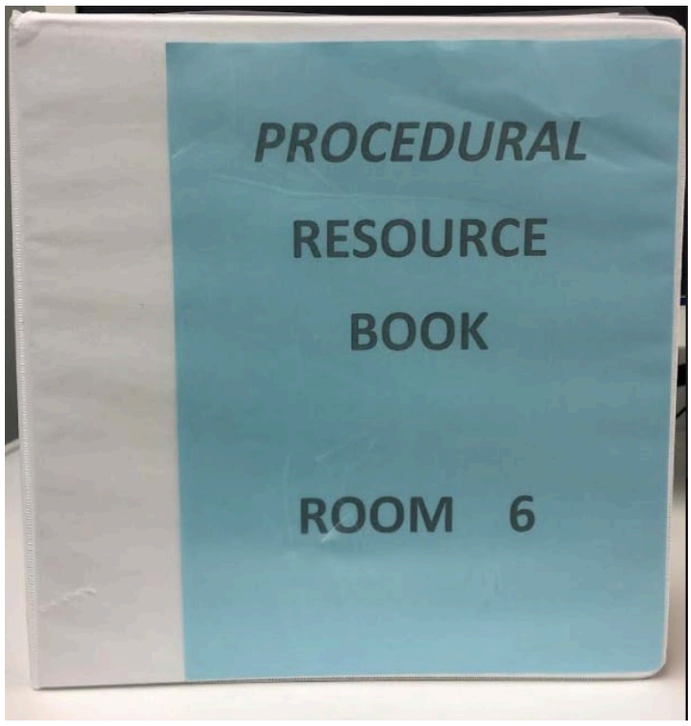


Supplementary Figure 2. Contents of the needle decompression kit.



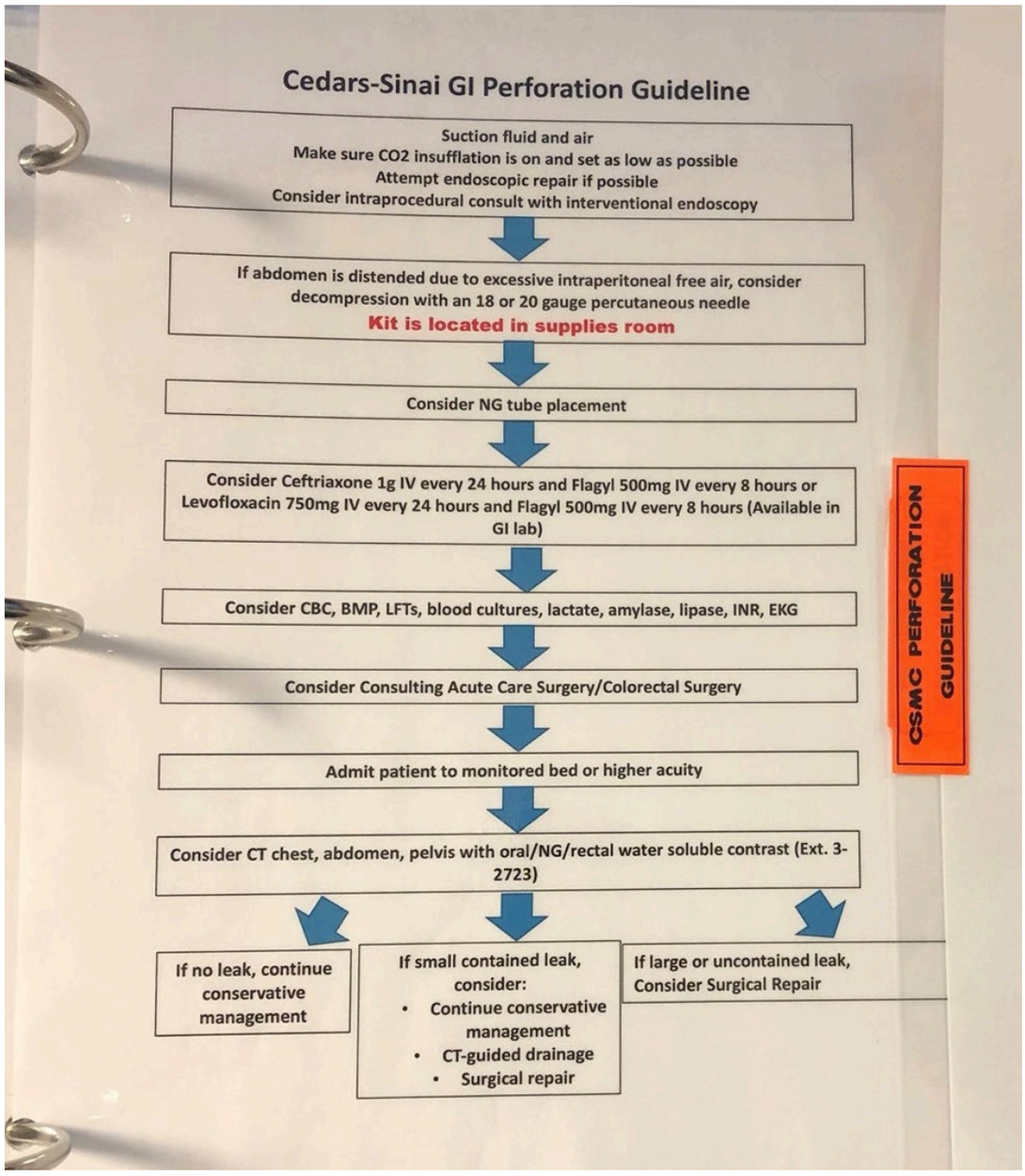
Supplementary material

Supplementary Figure 3. Procedural resource binder is found in each of our procedure rooms and contains important information for easy reference.



Supplementary material

Supplementary Figure 4. The AIEP management algorithm is now located in the procedure binder and labelled with an orange tab for easy reference.



Supplementary material

Supplementary Figure 5. Standardized one-page material given after pre-test.

Detailed Information on Iatrogenic Perforations

- **Early signs** of endoscopic perforation includes subcutaneous air/crepitus, abdominal distension, difficulty maintaining insufflation,
- **Late signs** of perforation include hemodynamic instability
- In a **colonoscopy**,
  - the most common site of perforation is in the sigmoid colon (53-65%) from mechanical trauma (i.e. direct trauma from scope, torque, retroflexion)
  - The second most common site of perforation is the cecum (14-24%) from endoscopic resection or dissection.
  - Look for the "target sign" after EMR, which is a white-gray center consisting of the muscularis propria surrounded by blue (indigo carmine/methylene blue stained submucosa), indicating partial/full thickness resection
- In **upper endoscopy**, ASGE recognizes the following as risk factors for perforation: anterior cervical osteophytes, Zenker's diverticulum, esophageal strictures, malignancies, and duodenal diverticula
- The highest risk for perforation in **therapeutic upper endoscopy** is
  - dilation of complex strictures (caustic, radiation, malignancy), up to 17% risk of perforation
  - Risk of perforation for other therapeutic maneuvers: EMR 5%, ESD 6%, dilation of peptic ulcer strictures 0.1-.4%, foreign body removal 0.8%, variceal sclerotherapy 5%
  - variceal band ligation is rare (usually associated with overtube placement)
- The use of **carbon dioxide insufflation** rather than air insufflation may minimize the amount of extraluminal air because carbon dioxide is rapidly absorbed
- Extraluminal air can dissect into distant spaces and can lead to a medical emergency (i.e. tension pneumothorax, tension pneumomediastinum, abdominal compartment syndrome)
  - Immediate treatment with **decompression needle** is recommended
- Extraluminal air can persist for a few days to a week despite successful closure of a perforation. Correlate with the patient's clinical condition.
- **CT scan with oral soluble contrast** has the highest sensitivity for diagnosing perforations
  - If there is oral contrast extravasation on CT scan, then the perforation persists, and requires immediate management
- When a perforation is diagnosed during an endoscopic procedure, suction the area avoiding leakage of fluid into the peritoneum, ensure CO2 insufflation, and try to close the perforation endoscopically
  - ESGE recommends through the scope (TTS) clips for perforation defects < 10mm. Those over 10mm, ESGE recommends over the scope (OTS) clips, omental patching, or combined technique of endoloop and TTS clips
  - A 2015 meta-analysis of 24 studies published in GIE revealed **89.9% successful endoscopic closure of an iatrogenic perforation**
- **NG tube placement** is recommended in patients with upper GI perforations to reduce the volume of gastric contents
  - For esophageal perforations, especially recommend NG tube placement endoscopically rather than blind insertion
- Antibiotics are recommended after a perforation occurs. Antibiotics should cover gram negative organisms, anaerobes, and gram positive streptococci. At Cedars-Sinai, the recommended antibiotic regimen is **ceftriaxone and flagyl**. In patients with penicillin allergy, levofloxacin can be used instead of ceftriaxone. In high-risk patients (advanced age, poor nutritional status, presence of organ failure, immunocompromised), Zosyn is recommended.
  - Duration of antibiotics should be for 3-5 days if clinically stable

