

Objectives

Indications – General

› Anatomy!!!

Equipment

Basics of Ultrasound Imaging

Indications

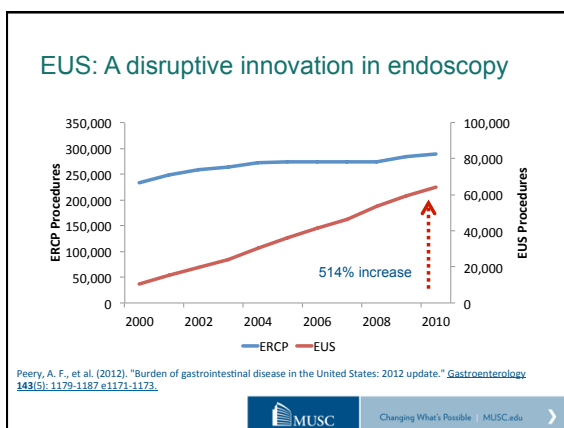
Staging

Diagnosis

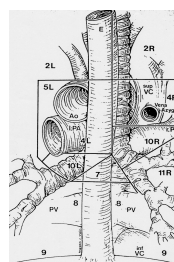
Therapy



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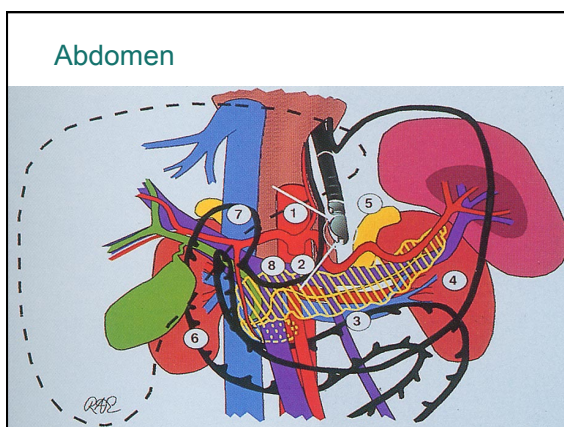
Mediastinum



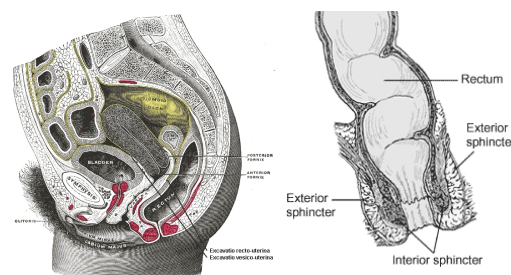
- Tracheobronchial (4)
- Subcarinal (7)
- Aortopulmonary window (5)
- Main bronchial (10)
- Paraesophageal (8)
- Pulmonary ligament (9)



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Rectum



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Instruments

Electronic radial echoendoscope

Linear array echoendoscope

High frequency catheter probe

- › 2-3mm catheter that fits through the working channel of a therapeutic gastroscope
- › Adjustable frequency from 12 to 30 MHz



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Radial echoendoscope

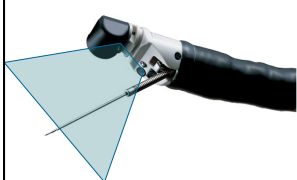


- › 360° field of view
- › Adjustable frequency 5-12 MHz



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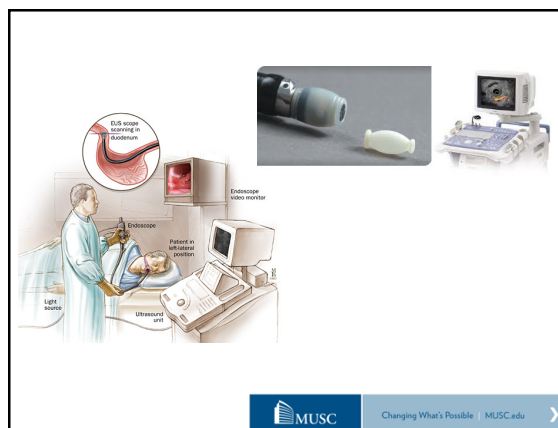
Linear echoendoscope



- 150 - 180° field of view, scanning along the long axis of the endoscope
- Elevator to assist needle guidance

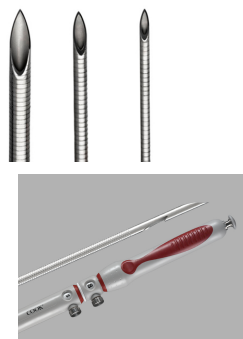


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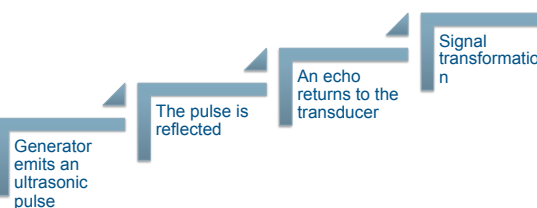
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Needles



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Imaging Process



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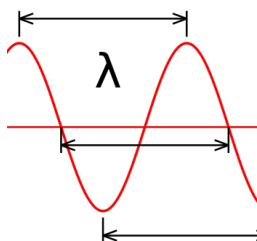
Ultrasound Frequencies (MHz)

The higher the frequency, the shorter the wavelength

- › Higher frequency, lower depth

Higher frequencies for bowel wall

Lower frequencies for deeper tissues



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Gain

The signal is amplified in accordance with its transit time

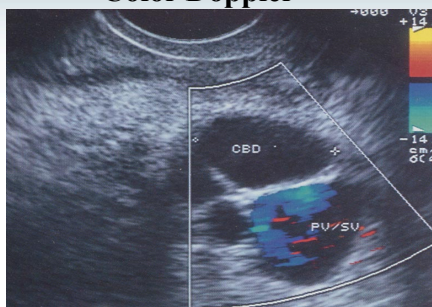
The greater the distance the signal travels, the more it is amplified

Signals are amplified to compensate for the attenuation of sound in tissue



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Color Doppler



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US-specific characteristics

Echogenicity

- › Anechoic (cysts/fluid)
- › Hypoechoic (tumors, scar tissue)
- › Isoechoic (normal structures)
- › Hyperechoic (fat, calcifications)

Shadowing

- › Acoustic (calcifications)
- › Through transmission (beyond cysts/vessels)
- › Reflection (air interference)



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Risks

Baseline risk of diagnostic EUS similar to upper endoscopy

Fine needle aspiration (FNA)

Overall complication rate 1.1%

- › 0.5% for solid lesions
- › <1-14% for cystic lesions with/without antibiotics
- › 1.2% pancreatitis
- › 1% of severe bleeding
- › <1% death

Bleeding -- 1:1,000

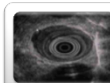
Perforation -- 1:1,000

Tumor tracking -- ?



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Indications for EUS



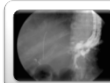
Staging

- Best: Esophagus, Pancreas, Rectum, Lung
- Others: Gastric, Duodenal



Diagnosis

- Unexplained abdominal pain
- Intramural/Extramural lesions



Therapies

- Celiac block/neurolysis
- Drainage procedures



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> Staging

TNM classification (general)

T: tumor

- › T1-T4

N: node/nodal

- › N0: no nodes
- › N1: nodes

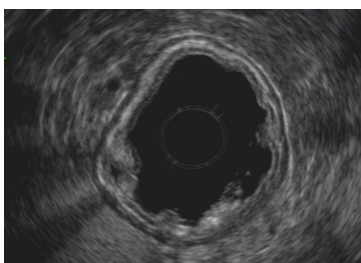
M: metastases

- › M0: metastasis not present
- › M1: metastasis present



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GI tract histology

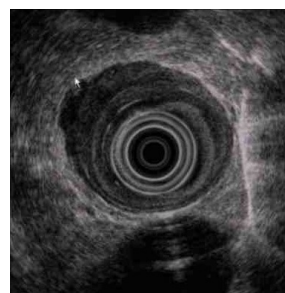


- 1st: bright = interface
- 2nd: dark = deep mucosa
- 3rd: bright = submucosa
- 4th: dark = inner MP
- 5th: bright = connective tissue
- 6th: dark = outer MP
- 7th: bright = adventitia/serosa



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T3 esophageal cancer



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Esophageal Leiomyomatosis



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Accuracy of EUS for locoregional staging

EUS vs. spiral CT

- › EUS superior

EUS vs. PET

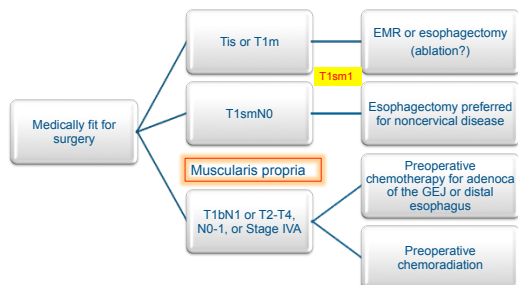
- › PET superior for liver or other distant metastasis

Modality	EUS	PET	CT
T staging	✓		
Celiac node involvement	✓		
Regional lymph node involvement	✓		
Liver or other distant metastasis		✓	✓



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Esophageal cancer



NCCN Clinical Practice Guidelines v.1.2009



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Malignant lymph nodes

Round
Greater than 1 cm
Hypoechoic
Sharply demarcated

The more features, the
 more predictive of
 malignancy

Any celiac lymph node
 identified has > 90%
 malignant potential
 Celiac LN > 1cm →
 100% malignant
 potential

Chen VK, Eloubeidi MA, American Journal of Gastroenterology 2004
Eloubeidi MA, et al., Gastrointestinal Endoscopy 2001

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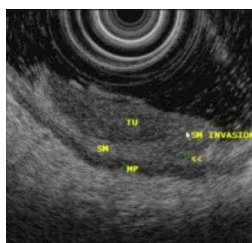
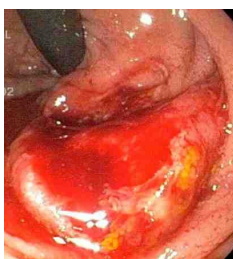
Celiac lymph node



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➤ Rectal cancer

T1 Rectal Cancer



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TNM staging of rectal cancer

Adjuvant chemoradiation is recommended for those
 with advanced locoregional cancers

- › Extension into perirectal fat: T3N0/T4N0
- › Involvement of mesorectal/pelvic LN: TxN1/TxN2

Diminished local recurrence, possible survival
 benefit with preoperative radiation

National Institutes of Health consensus conference. Adjuvant therapy for patients with colon and rectal cancer. JAMA 1990; 264:1444-1450.



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EUS-FNA for Pancreatic Adenocarcinoma: Limitations

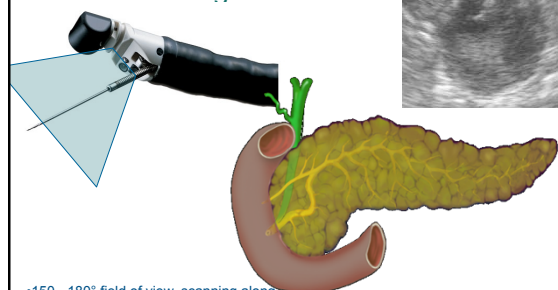
- › Sensitivity 80-90% (10-20% false negative)
 - › Chronic pancreatitis, 55-75% sensitivity
 - › Diffusely infiltrating tumor
 - › Recent acute pancreatitis
- Specimen related issues: necrosis, blood, handling of specimen
- Cytopathologist: on-site and experience
- Cost and availability
- Operator dependent
- Needle track seeding***

Buthany et al. Endoscopy 2004
Wallace et al. GCNA 2012



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Tumor tracking with EUS-FNA



- 150 - 180° field of view, scanning along the long axis of the endoscope
- Elevator to assist needle guidance



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EUS-FNA prior to distal pancreatectomy

230 patients with PDAC (28%), IPMN (20%), and endocrine neoplasms (17%), among others
EUS-FNA performed in 179, no EUS-FNA in 51
Higher prevalence of PDAC in EUS-FNA group (32% vs. 12%)

No differences in:
Overall or recurrence-free survival
Patterns of tumor recurrence were not associated with EUS-FNA.

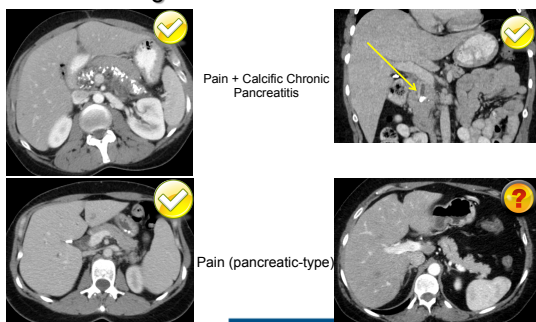
Beane J. et al., Surgery 2011



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› Diagnostic applications

Chronic Recurrent Abdominal Pain (CRAP): The Challenge



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Alternative tests for "early" CP

Endoscopic ultrasound

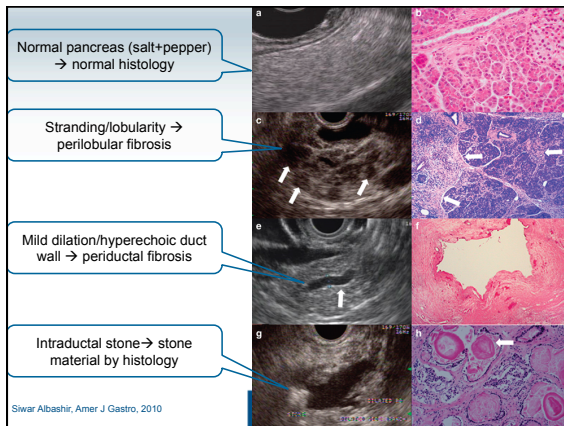
- › High sensitivity (80%)
- › Low interobserver reliability

Pancreatic function testing

- › CCK (acinar cell function) or Secretin (ductal cell)
- › High sensitivity
- › Time consuming



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Gallbladder pathology

Gallbladder stones



Gallbladder sludge



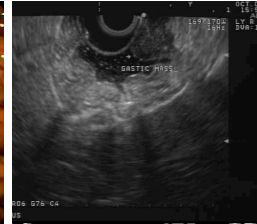
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Gastric lesions

Endoscopy



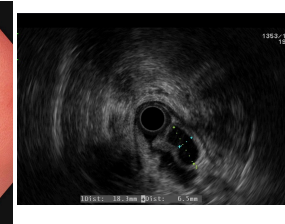
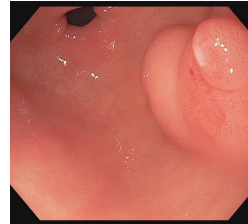
Metastatic meningioma



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Intramural lesions

Gastric duplication cyst



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Pancreatic tumors

Portosplenic confluence

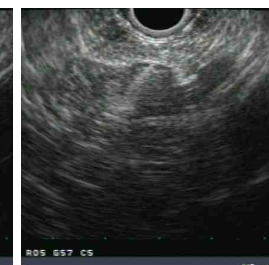


Side branch IPMN



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Left adrenal "incidentaloma"



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Stones

Common bile duct stones

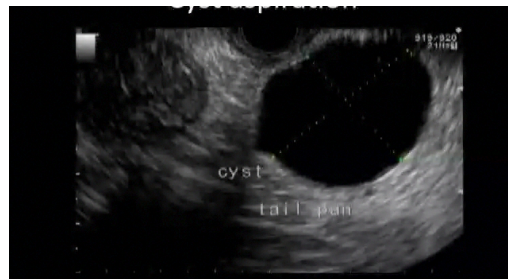


Pancreatic duct stones



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Pancreatic cysts

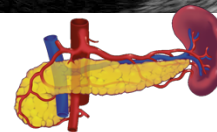


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Therapeutic EUS

EUS-guided celiac plexus neurolysis

- Injection of combination local anesthetic (e.g., bupivacaine) and highly concentrated alcohol facilitates pain management with fewer side effects than opiates.
- Minor, self-limited common complications
 - Hypotension
 - Diarrhea
 - Pain flare
- Rare severe complications may include
 - Hemorrhage
 - Spinal cord infarction
- Pain reduction can be expected in 75-85% of patients within two weeks of the procedure, and a minority of patients can stop opiates altogether.

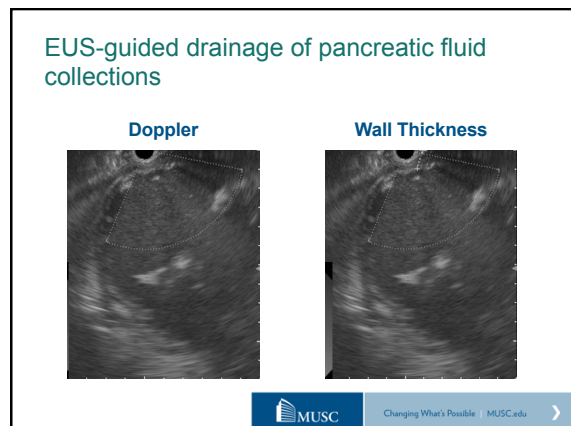
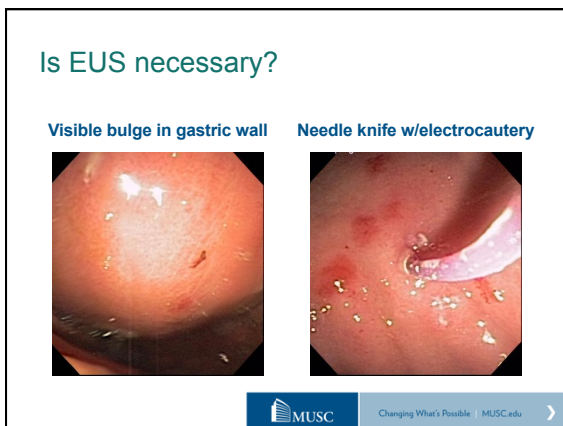
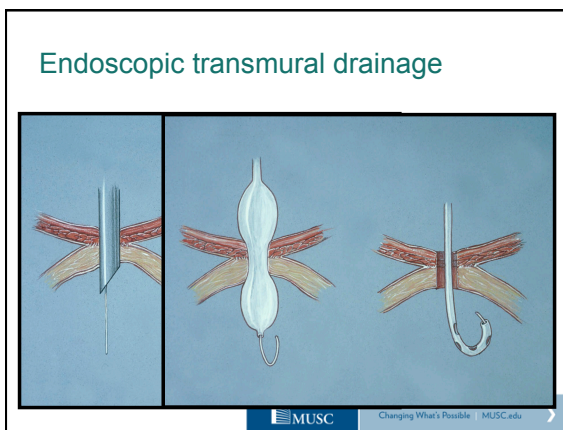
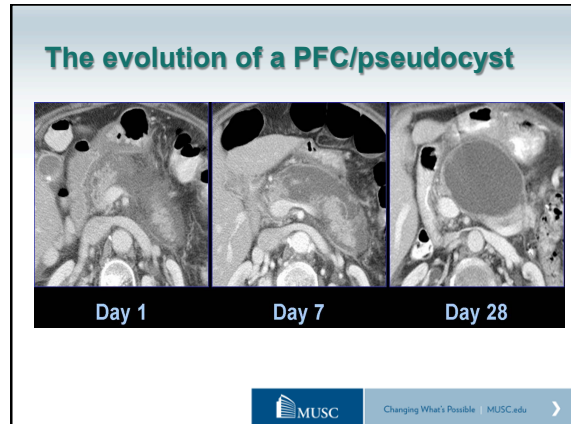
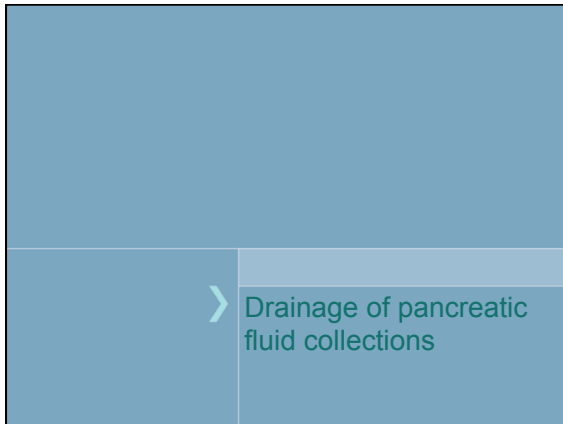


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EUS-guided celiac neurolysis



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Avoiding the urgent page...

GDA overlying the PFC



EUS-guided access



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New Directions: Stent Technology

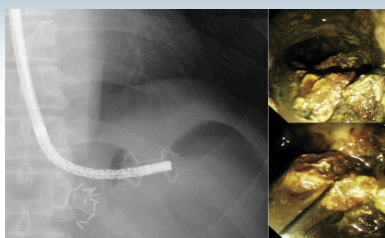
Fully Covered Metallic Stents with Anchoring Flanges



Gornella JB, et al. Endoscopy 2012
Itoi T, et al. GIE 2012
AXIOS stent, Boston Scientific Corp.



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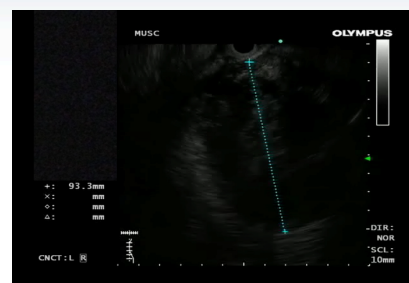


Transgastric Debridement through indwelling stent



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Cystduodenostomy



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Pre-procedure



Post-deployment



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Resolution



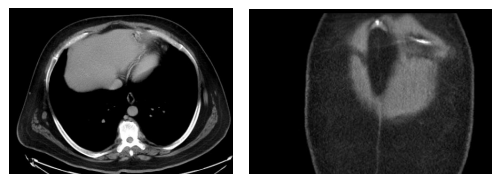
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Endoscopic necrosectomy



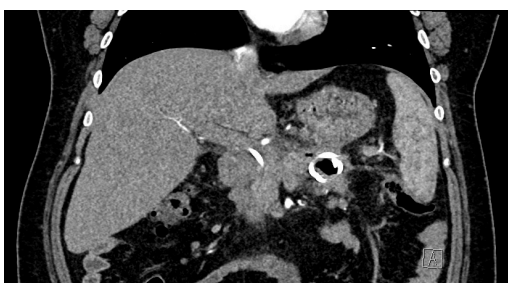
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Endoscopic treatment



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Resolution

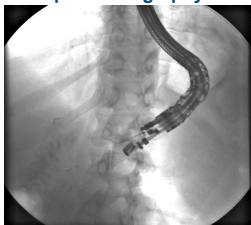


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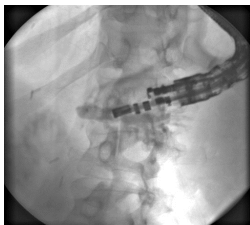
> Future directions:
EUS rendezvous

Acute recurrent pancreatitis post-Whipple

EUS-pancreatography



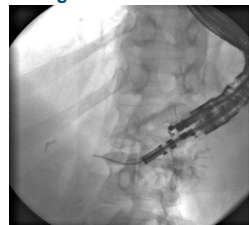
Anastomotic stricture



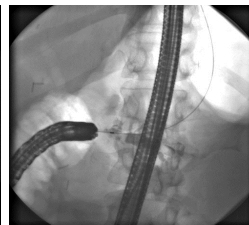
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EUS-directed access

Antegrade wire access

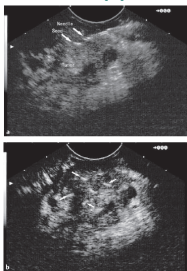


Rendezvous



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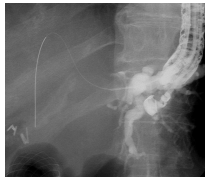
Novel applications



Brachytherapy
Sun et al. Endoscopy 2006



Fiducial placement



EUS-guided biliary drainage



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Conclusions

Expanding indications for diagnostic and therapeutic EUS

Most lesions adjacent to or involving the upper GI tract and rectosigmoid colon can be accessed via EUS

Excellence requires a team

- › Anesthesia
- › Nursing
- › Technician
- › Physician



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Thank you

