I have no financial disclosures relevant to the educational content of this debate.

The University of Alabama at Birmingham has research agreements with:
- General Electric Healthcare
- Philips Medical Systems
- Siemens Healthcare

I work with a rsDECT scanner.
Objectives

• State of the art DECT for pancreatic ductal adenocarcinoma (PDAC) patients
• Imaging surveillance during neoadjuvant therapy
• Irreversible electroporation (IRE)
  • What is it?
  • When is it used?
  • What imaging is necessary to support it and when?
  • What are the complications and oncologic outcomes?
DECT and the Pancreas

- Use simulated monoenergetic images and iodine images for optimal visualization
  - Brook et al. Radiology 2013;269(1):139-48 (rsDECT)
70, 52 keV and Iodine 1.3 cm PDAC
Imaging Surveillance PDAC

- All but stage 4 → multiphasic
- Gemcitabine/Abraxane or FOLFIRINOX are combinations of choice for neoadjuvant SOC
- Some amazing results including resolution of LAPC to resectable tumors!
- Q 12 weeks surveillance, each time new surgical eval
51 year old woman with 2 mo abd pain

Ca19-9 = 51,001
12 weeks neoadj Rx PPP

Ca19-9 = 689
12 weeks neoadj Rx PVP
Irreversible electroporation (IRE)

- Standard local thermal ablation NOT ideal for pancreas
- Irreversible electroporation (IRE) is a nonthermal ablation technology
  - High voltage → plasma membrane defects → cell death
- Locally advanced pancreatic cancer (LAPC) patients have limited options for disease control
  - LAPC = greater than 180° encasement SMA or celiac, or unreconstructable vein – NOT borderline resectable
PDAC Irreversible electroporation (IRE)

- Multi institutional Phase 1 2009-2011
  - 27 pts with LAPC (AJCC stage 3), 19 in situ, 8 for +margins
  - 90 days f/u- ↑ amylase 100%, no fistula, tech success 100%
- IRE when combined with pre and/or post ablation chemo, matched to standard Rx for LAPC
  - ↑ local PFS (14 vs. 6 mo, p = 0.01)
  - ↑ distant PFS (15 vs. 9 mo, p = 0.02)
  - ↑ overall survival (20 vs. 13 mo, p = 0.03)

Irreversible electroporation (IRE)

- Multi Institutional Prospective Trial (2010-2014)
  - 200 patients (150 in situ LAPC) - all radiographic AJCC stage 3
  - 100% pre IRE chemo, median 6 months
  - 3% IRE failure at 3 months
  - 37% complication rate
  - 58 (29%) pts recurred: median (PFS) 12.4 mo and distant PFS 16.8 mo (mostly liver); median OS 24.9 mo (range 4.9-85 mo)
- Many others reporting technical success

(Ann Surg 2015;262:486–494)
IRE Planning and Assessment

- MDCT or DECT, MRI
- From Phase 2- Pre IRE Multiphasic with thin “cuts”
- During chemo with Gem Abraxane or FOLFIRINOX- same
- Q 12 weeks
- After IRE –initial 12 weeks for recurrence, sooner if periprocedural complications suspected
- Q 12-16 weeks thereafter
PDAC

53 year old woman, neoadj Rx

Presentation PPP 70 keV
Presentation PPP Iodine
Presentation PVP 120kVp

Post Rx PPP 70 keV
Post Rx PPP Iodine
Post Rx PVP 120kVp
**PDAC**

52 keV and Iodine MD - see margins

**PreTreatment PPP:** 70 keV, 52 keV, Iodine MD
Post Treatment PPP: 70 keV, 52 keV, Iodine MD- see margins
• Multi institutional prospective trial:
  • Resection with margin IRE: 20 of 50 pts had 49 complications
  • In situ IRE: 54 of 150 pts had 100 complications
    • GI = 38
    • Infection = 15
    • Liver = 13
    • 3 deaths, all in situ
    • No pancreatic-related comp; no evidence of a pancreatic leak or clinically significant pancreatitis 90-day post-IRE

(Ann Surg 2015;262:486–494)
PDAC

IRE Complications

• GI: anorexia, dehydration, gastritis, heartburn, nausea, vomiting
• Liver: ascites, biliary anastomotic stricture, liver dysfunction, failure
• Pancreatic: pancreatic leak, clinical pancreatitis, and pancreatic failure
• Vascular: deep venous thrombosis, PSA, HA thrombosis, and nonocclusive SMV/PV thrombosis
• Cardiovascular (a fib) and Neurological (altered mental status)

(Ann Surg 2015;262:486–494)
• Paiella et al. Dig Surg 2015 - panc abscess and fistula
• Mansson et al. Acta Radiologica 2014 - duo and colon perforation and SMA hemorrhage → death (metallic stent)
• Rombouts BJS 2014 (review) - overall comp rate 48% - panc, bile and duo leak (latter esp if transduo probe placement)
• Moir EJSO 2014 (review) - wound infection, bile and panc leak, pancreatitis, duo perf
IRE Complication- 72 yo F w LAPC

Presentation PPP

Presentation PVP

2 weeks post PPP

(Ann Surg 2015;262:486–494)
IRE Complication - 72 yo F w LAPC

2 weeks post PVP
IRE Outcomes- 72 yo F w LAPC

2 weeks post PPP

3 mo post PPP

3 mo post PVP
Objectives

• Multiphasic DECT- use lower energy (52 keV) simulated monoenergetic and Iodine MD images for optimum visualization

• Imaging surveillance during neoadjuvant therapy- for all but stage IV, same sequences as pretreatment

• Irreversible electroporation (IRE)- it’s here.................
Thank you