IR Procedure
There’s an App For That
IR Services for the Inpatient and Ambulatory Practice

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Lines, Tubes, and Biopsies OH MY!

- PICC lines, Tunneled Lines, Ports
- Gastrostomy tubes, Suprapubic tubes
- US, CT, Fluro guided biopsies
- Para’s/Thora’s, and Tunneled drains
- Dialysis interventions
Friday 4:30pm consult: tunneled femoral dialysis catheter not functioning......

extensive thrombosis of the right superior vena cava

multiple collateral vessels
Central Venous Ports

IR Placed Ports

- IR placed ports are IJ 100%, Surgical are 57% subclavian, 43% IJ
- IR ports had lower complications (1.5% vs 5.6%)
- IR ports had less malposition (0 vs 2.1%)
- IR ports had less fibrin sheath formation (0.6 vs 3.8%)
- IR ports cost less ($8,700 vs $11,252)

Comparison of Complications and Costs related to IR vs. surgically placed central venous access ports in the hospital setting: a retrospective chart review. J. Schiavi, et al, JVIR 2014
Surgical G vs PEG vs PRG

- Success rate: 100, 95.7, 99.2%
- Procedure mortality: 2.5, 0.5, 0.3%
- Total complications: 29, 15, 13.3%
- Major complications: 19.9, 9.4, 5.9%

Radiologic, endoscopic, and surgical gastrostomy: a meta-analysis of the literature; Wollman et al., Radiology 1995

Gastrostomy tubes
Lions, Tigers, Bears....and Zebras?
Embolization Procedures

- Trauma
- GI Bleeds
- Epistaxis
- Carotid body tumors
- Pseudoaneurysm
- Pulmonary AVM
- Bronchial artery
- Portal HTN
- Pre-operative
  - AML
  - Etc....
Angiomyolipomas

- Account for 3% of all renal masses
- Sporadic 80%, Tuberous sclerosis 20%
- Benign, but have tendency to rupture and bleed
- Early data: 82-94% of lesions >4cm were symptomatic. 50% of those bled
- Lipid poor AML’s are more likely to bleed (84 vs 50%)
AML Treatment

- Prior to 1980’s, 90% treated w/total nephrectomy (couldn’t exclude RCC)
- Now often followed w/MRI
- Indications to treat:
  - >4 cm
  - Child bearing age female
  - Lipid Poor AML (<50% fat)
  - Intralesional aneurysms
  - Patients on anticoagulation
- Technical success rate: 100%
- Complications: no severe (no significant decrease in renal function)
- Mean tumor volume reduction: 66% for all AML’s (73% for TSC AMLs)
- Regrowth rate of 20% at 3 years (almost exclusively in TSC)
Interventional Oncology

- TACE
- Y90
- Cryoablation
  - Renal, liver, bone mets, nerve ablation
- Microwave ablation
  - Liver, lung
- Radiofrequency ablation
  - Liver, RCC, lung, spinal mets
- Hepatic deprivation
  - Induces remnant liver hypertrophy
- Immunotherapy
  - Melanoma
- Pain Interventions
  - RFA
  - Vertebral Augmentation
  - Nerve blocks
NCCN Guidelines

• All patients with HCC should be evaluated for potential curative therapies (resection, transplant, and for small lesions, ablative strategies).
• Locoregional therapy should be considered in patients who are not candidates for surgical curative treatments, or as a part of a strategy to bridge patients for other curative therapies.
Potentially Resectable HCC

Ablation
- RFA, MWA, Cryo, percutaneous EtOH
- “In-well selected patients with small, properly located tumors, ablation should be considered as definitive treatment in the context of multidisciplinary review.”
- ≤3 cm, location amenable to ablation
- 3-5 cm (combination of ablation and arterially directed therapy)
- >5 cm (ablation NOT recommended)
- Sorafenib should NOT be used as adjuvant post-ablation

Downstaging
- For tumor burden beyond accepted transplant criteria w/ the goal of future transplant
- Meta-analysis¹: Downstaging improved 1 and 5 year OS post OLT vs. OLT alone
  - Systematic review²: 48% success rate to transplant eligibility in 950 pts
  - Phase IIb/III³: downstaging with locoregional rx, surgery or systemic therapy prior to transplant vs. observation
    - 5-year OS: 78% vs. 31%

What about EBRT or SBRT?
- “Should be considered as an alternative to ablation and/or embolization techniques when these therapies have failed or are contraindicated”
- Palliative setting for symptom control and prevention of complications from metastatic disease (bone and brain)
- Encourages prospective trials to determine role of SBRT in pts with unresectable locally advanced disease
CONCLUSIONS

We found no beneficial effect of vertebroplasty as compared with a sham procedure in patients with painful osteoporotic vertebral fractures, at 1 week or at 1, 3, or 6 months after treatment. (Australian New Zealand Clinical Trials Registry number, ACTRN012605000079640.)
RCT comparing effects of Kyphoplasty vs medical management of osteoporotic and pathologic VCF’s

- Multicenter, multinational study, w/300 patients enrolled over 2 years
- Inclusion criteria based on MR findings, clinic exam

- Outcome measures: WOL, back function and mobility scores, back pain, narcotic analgesic use, and # of restricted activity days.
- Kypo was superior to non-op for all primary and secondary outcome measures at 6 and 12 months.
- No difference in adverse events

Lancet 2009; 373: 1016-24
Published Online
February 25, 2009
DOI:10.1016/S0140-6736(09)60010-6
RCT: 78 patients
38 vertebroplasty : 40 sham
All enrolled had edema on MRI
No demographic or fracture differences
No pain score, disability or QoL differences at
  T=0
  1 week (except favoring placebo)
  1, 3, and 6 months

RCT: 131 patients
68 vertebroplasty : 63 sham
No demographic or fracture differences
No pain score, disability or QoL differences at
  T=0 and 1 month
Higher crossover rates for sham to vertebroplasty
A closer look….

• Difficulty enrolling patients: 78 and 131 participants over 4 years
• Inclusion criteria did not use concordant PE findings, only relied on imaging
• Included both acute and chronic fractures
• Considerable number of patients were on chronic opioids, diluting treatment effect

• “Multicenter” - 68% of procedures performed at single institution by 1 radiologist.
• Only unilateral approaches w/small cement volume
Vertebroplasty vs Conservative treatment in acute osteoporotic vertebral compression fractures (Vertos II): an open-label randomised trial


Vertebroplasty vs Conservative
- Vertebroplasty: N=93
- Conservative: N=95
- All had edema on MRI

Results
- Mean treatment time at 5.9 weeks from injury
- Sig improvement in VAS, QUALEFFO and RMD scores at 1 day, 1 month
- Vertebroplasty had greater and quicker pain improvement (29.7 days vs 115.6 days)
Vertebral Body Augmentation for Malignancy
CAFE Trial 2011

Procedure in Oncology Patients versus Non-operative

- RCT: kyphoplasty vs conservative
- May 2005 — March 2008
- Enrolled
  - Kypho: N= 70
  - Conservative: N=64
- Completed follow up
  - Kypho: N=75
  - Conservative: N=52
- 38 patients in control group crossed over at 1 month (mean 47 days)
- ~50% had prior radiation
- Baseline characteristics similar

- Inclusion criteria
  - 1-3 pathologic vertebral compression fractures
  - NRS pain score ≥ 4
  - Roland-Morris disability questionnaire (RDQ) ≥ 10

- Exclusion criteria
  - Osteoblastic mets or Primary bone tumors
  - Concurrent phase 1 anticancer therapy study
  - Short life expectancy due to comorbidities
  - Loss of cortical integrity or posterior wall involvement
  - Epidural involvement
  - Required high-dose steroids, nerve blocks or PCA pumps to control baseline back pain not related to VCF

Balloon kyphoplasty versus non-surgical fracture management for treatment of painful vertebral body compression fractures in patients with cancer: a multicentre, randomised controlled trial

James Berenson, Robert Pflugmacher, Peter Jarzem, Jeffrey Zonder, Kenneth Schechterman, John B Tillman, Leonard Bassion, Talat Ashraf, Frank Vrionis, for the Cancer Patient Fracture Evaluation (CAFE) Investigators

Published Online
February 17, 2011
DOI:10.1016/S1470-2045(11)70088-0
Inland Imaging
Answers you can trust and care you can count on.
CAFE Trial Results

• Results—significant differences at 1 month between groups in:
  • Roland Morris disability questionnaire (functional status)
  • Karnofsky performance score (performance status)
  • SF-36 PCS score (quality of life – physical)
  • SF-36 MCS score (quality of life – mental)
  • Reduced activity days
  • Bed rest days
At 1 month, kyphoplasty group had:

- Decreased pain scores
- Decreased analgesics
At 1 month, kyphoplasty group had decreased:

- Walking aids
- Bracing
- Bed rest
- Any medication for pain
CAFE Trial Results

- At 6 months, kyphoplasty and cross-over group had persistent significantly different:
  1. Improvement in functional status on RDQ
  2. Improvement in quality of life on SF-36, on both physical and mental components
Radiofrequency Ablation Data

- Prospective, nonrandomized, single arm, multicenter trial from 2017-2019
- Evaluate effectiveness for rapid (<3 days) and sustained pain relief in bone mets
- 106 patients enrolled @ 14 centers

**Inclusion criteria:**
- >18 y.o.
- Metastatic disease in axial skeleton

**Exclusion criteria:**
- Pure osteoblastic tumors
- Worst pain < 4 on a scale of 1-10
- > 2 painful sites that would require treatment
- Karnofsky performance scale < 40
OPuS One Trial 2020

- Results:
  - Worst pain improved from mean of 7.8 to 3.6 at 3 months
  - For all ablations, all pain and QoL scores improved at all time points (3 d, 1 w, 1 m, 3 m, & 6 m)
Benefits of Vertebral Augmentation + RFA

- Pain relief in 3 days (many 24hrs) compared to 3-8 wks for multi-fraction radiation
  - Treating both cancer pain (cytokines, periosteal stretch) and bone instability pain
- Addition of cementoplasty allows stabilization of bones, whereas radiation increases risk of fractures (SBRT 11-39%)
- Doesn’t matter type of cancer (some cancers are not radiosensitive)

- Does not limit future therapies
  - RFA/VA followed by radiation increase response by 30% than either therapy alone
- Best intervention should be determined by multidisciplinary group of
  - Primary Team
  - Palliative
  - Radiation Oncology
  - Spinal Surgeons (Ortho spine or Neurosurgery)
• 13 gauge biopsy needle (Madison)

• 18 gauge biopsy needle (Temno)
Choosing Ablation Probes

- **RFA vs Cryoablation vs MWA**
  - Most will be RFA, some cryo, rarely MWA
  - RFA energy doesn’t go through cortical bone
  - Cryoablation – use CT, bigger lesions

- **Unipedicular vs Bipedicular**
  - Merit – Curved ablation probe
  - Osteocool – Linear ablation probes but can use as single (smaller) or double (larger)

- Measure lesion
- Note cortical integrity
Ablation
Kyphoplasty (Cavity creation)

- Compliant balloons
- Reach an endpoint (inferior endplate)
Lymphatic Interventions

- Thoracic duct embolization
- Sclerotherapy for low flow vascular malformations (lymphatic/venous)
Thoracic Duct

**Indications:** high output chylothorax, chylous ascites

**Outcomes:**
- Technical success 80%, clinical success following TDE 90%

**Complications:**
- No complications related to traversing visceral organs in literature
- No conversion of chylothorax to chylous ascites (dormant lymphovenous communications develop).
- ~10% develop lower extremity edema and ~10% develop diarrhea
Venous Disease

- DVT thrombolysis
- Pulmonary emboli
- IVC filters
- Iliocaval reconstruction

Venous Insufficiency
- EVLT/RFA venous insufficiency
- Sclerotherapy
- Spider veins
Case 1  37 y.o. F with 1yr hx of LLE swelling, heaviness, and pain p/w sudden worsening of LLE.

What is the diagnosis and how should this be managed?
Genitourinary Procedures

- Prostate artery embolization
- Fibroid embolization
- Post-partum uterine hemorrhage
- Varicocele embolization
- Pelvic congestion syndrome
### Embolization (UFE)
**Non-Surgical**

- **An Interventional Radiologist** occludes the blood vessels that feed the fibroids.

<table>
<thead>
<tr>
<th>Fibroid Symptom Relief:</th>
<th>As effective as other options</th>
</tr>
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<tbody>
<tr>
<td>Invasiveness:</td>
<td>Minimally invasive, performed with 1 small puncture</td>
</tr>
<tr>
<td>Hospital Stay:</td>
<td>0 to 1 day</td>
</tr>
<tr>
<td>Recovery Time:</td>
<td>1-2 Weeks</td>
</tr>
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<td>Safety:</td>
<td>Minor side effects &amp; complications more common</td>
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<td>Ability to Become Pregnant:</td>
<td>Pregnancy possible</td>
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<td>Risk of Fibroid Recurrence:</td>
<td>Less than 10% of cases at 2 years</td>
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<td>Risk of Reintervention:</td>
<td>~12% of cases at 2 years</td>
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### Myomectomy
**Surgical**

- A surgeon selectively cuts out the fibroids while keeping the uterus intact.

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<td>Invasiveness:</td>
<td>Major surgery, may require a blood transfusion</td>
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<tr>
<td>Hospital Stay:</td>
<td>1-3 days depending on surgical technique</td>
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<td>Recovery Time:</td>
<td>2-6 weeks depending on the surgical technique</td>
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<td>Risk of Reintervention:</td>
<td>~8% of cases at 2 years</td>
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### Hysterectomy
**Surgical**

- A surgeon completely removes part or all of the uterus, taking the fibroids with it.

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<td>No</td>
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<td>Risk of Fibroid Recurrence:</td>
<td>None</td>
</tr>
<tr>
<td>Risk of Reintervention:</td>
<td>~7% of cases at 2 years</td>
</tr>
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Future Directions

• Bariatric Embolization
  – Particle/coil embolization of left gastric artery -> suppression of the ghrelin-producing cells in the stomach
  – Trials: GET LEAN, BEAT, NCT02786108

• Painful MSK Conditions
  – Ostoarthritis, frozen shoulder, tendiopathy
  – Target inflammatory angiogenesis that contributions to chronic pain by enabling growth of new unmyelinated sensory nerves
  – Embo with imipenemcilastin and microspheres
Future Directions

- Percutaneous AVF creation
  - Uses RF catheter to create fusion channel between arterial/venous wall.
  - NEAT trial: 98% effective, 87% primary efficacy, 69% patency at 1 year

- HIFU
- Immune & Stem Cell Therapies
Thank You!

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