



Image-Guided Interventions for Pain Palliation

Interventional Radiology's role in cancer-related pain

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Disclaimers:

None

Objectives:

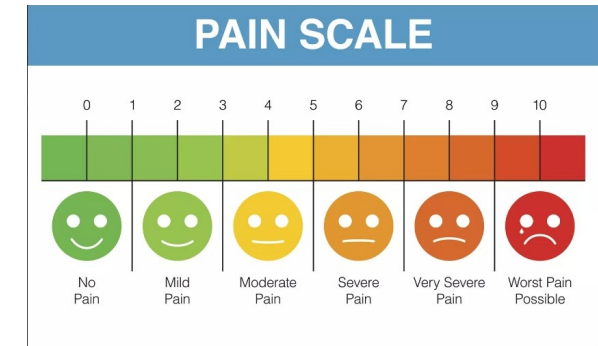
- Define Interventional Radiology
- Gain a basic understanding of image-guided interventions for cancer-related pain including:
 - Nerve block/neurolysis
 - Percutaneous ablation
 - Vertebral augmentation/Cementoplasty
 - Bone stabilizing/fixation
 - Tunneled drainage catheter
- Gain knowledge necessary to improve patient selection for IR procedures
- Understand the importance of multi-disciplinary collaboration for symptom management



What causes pain in people with cancer?

1. Visceral pain
2. Somatic pain
3. Neuropathic pain

- Tumor growth
- Bone damage
- Nerve involvement
- Inflammation and obstruction
- Treatments



18.1 CASES MILLION of cancer/year
9.6 DEATHS MILLION from cancer/year
1/6 DEATHS is due to cancer

PAIN is an unpleasant sensory and emotional experience associated with actual or potential damage of tissues. Individuals experience and express pain differently.



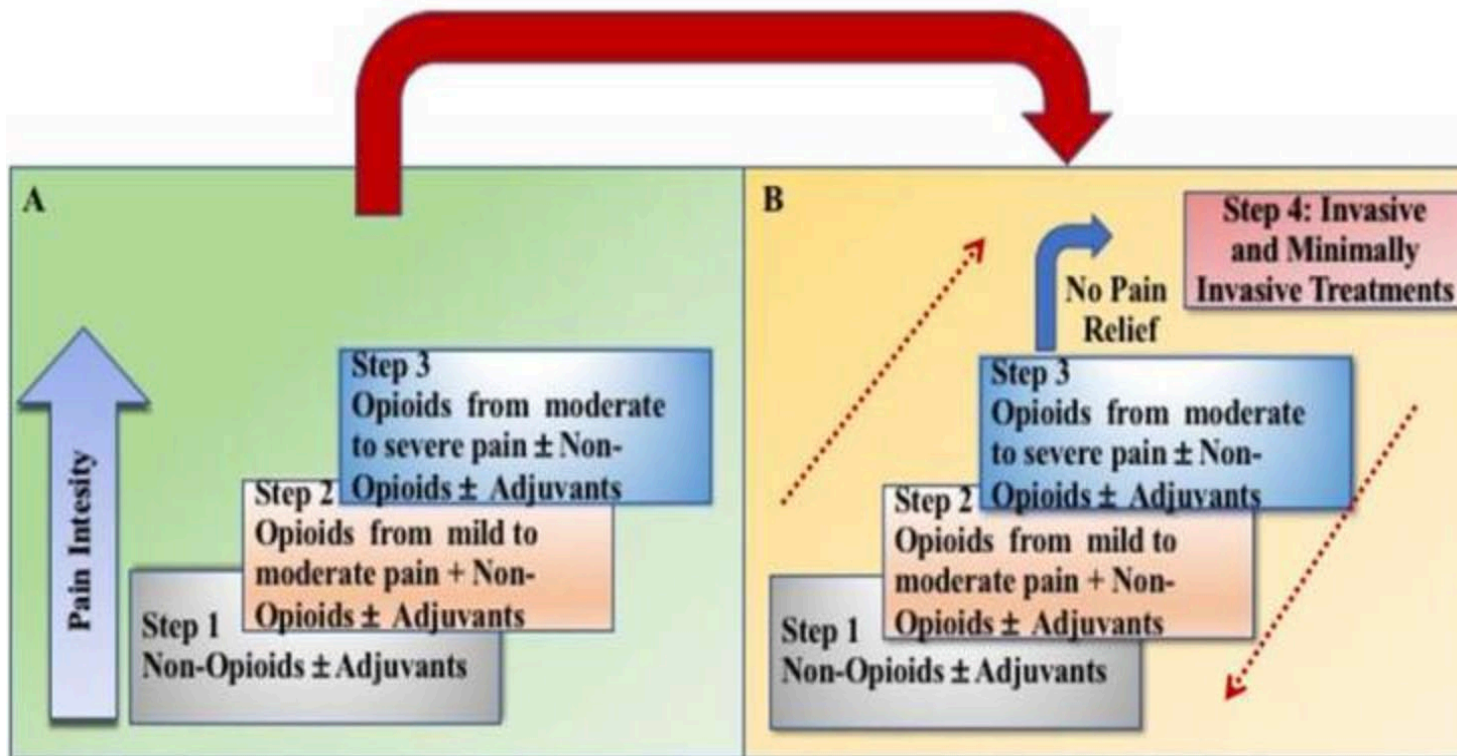
PAIN RELIEF improves the quality of life of patients with cancer.

The goal of pain management is to relieve pain to a level that allows for an **acceptable quality of life**.

Patients with cancer may require pain relief **at all stages of their disease** and not only at the end of life.

Better results in terms of pain and symptom management can be achieved when:
- palliative care is introduced **early** in the course of illness;
- an approach **tailored to each individual** is adopted together with disease-modifying therapies.

Revised 4-Step WHO Pain Ladder

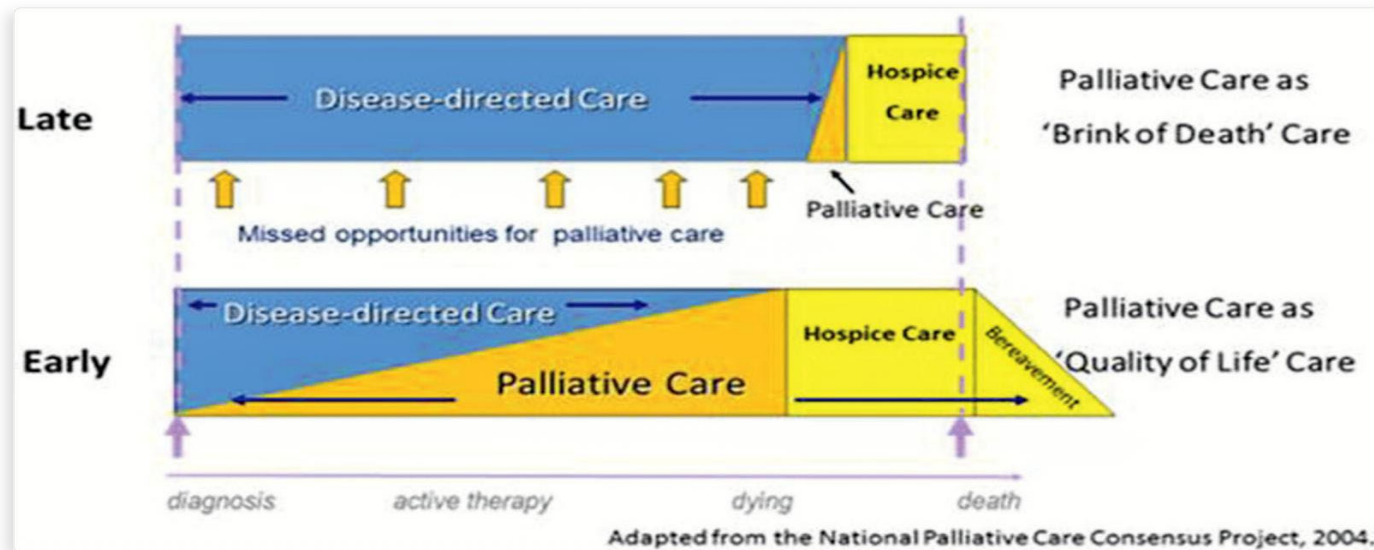


Transition from the original WHO three-step analgesic ladder (A) to the revised WHO fourth-step form (B). The additional step 4 is an “interventional” step and includes invasive and minimally invasive techniques. This updated WHO ladder provides a bidirectional approach.

Benefits from pain ladder:

- Improves patient outcomes
- Reduce hospital stays
- Improve quality of life
- Reduce opioid misuse

Integrating Palliative Early



Strong evidence of the benefits of integrating palliative care earlier in the course of serious illness.

Three factors contribute to delayed referral to palliative

1. Providers perceive palliative care as appropriate after all disease-modifying therapies have been exhausted
2. Patients and families equate palliative care and hospice
3. Shortage of palliative care specialists making access limited

Palliative Care and Interventional Radiology



► [Semin Intervent Radiol.](#) 2017 Jun 1;34(2):140–144. doi: [10.1055/s-0037-1602756](#)

<https://www.mypcnow.org>

The Intersection of Palliative Care and Interventional Radiology: Enhancing Understanding and Collaboration

[Mary K Buss](#) ^{1,2,3,8}

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Palliative Interventional Radiology Procedures

Symptom or issue	Examples of IR approach
Pain	Vertebroplasty Thermal ablation Nerve block/neurolysis
Dyspnea	Thoracentesis with or without tunneled catheter Bronchial stent
Nausea/vomiting	Venting gastrostomy Paracentesis with or without tunneled catheter Duodenal stent
Constipation	Colonic stent
Delirium	Percutaneous biliary drainage with or without stent Percutaneous nephrostomy with or without stent

“What matters to you most?”

Buss, 2017

Treatment for nerve pain

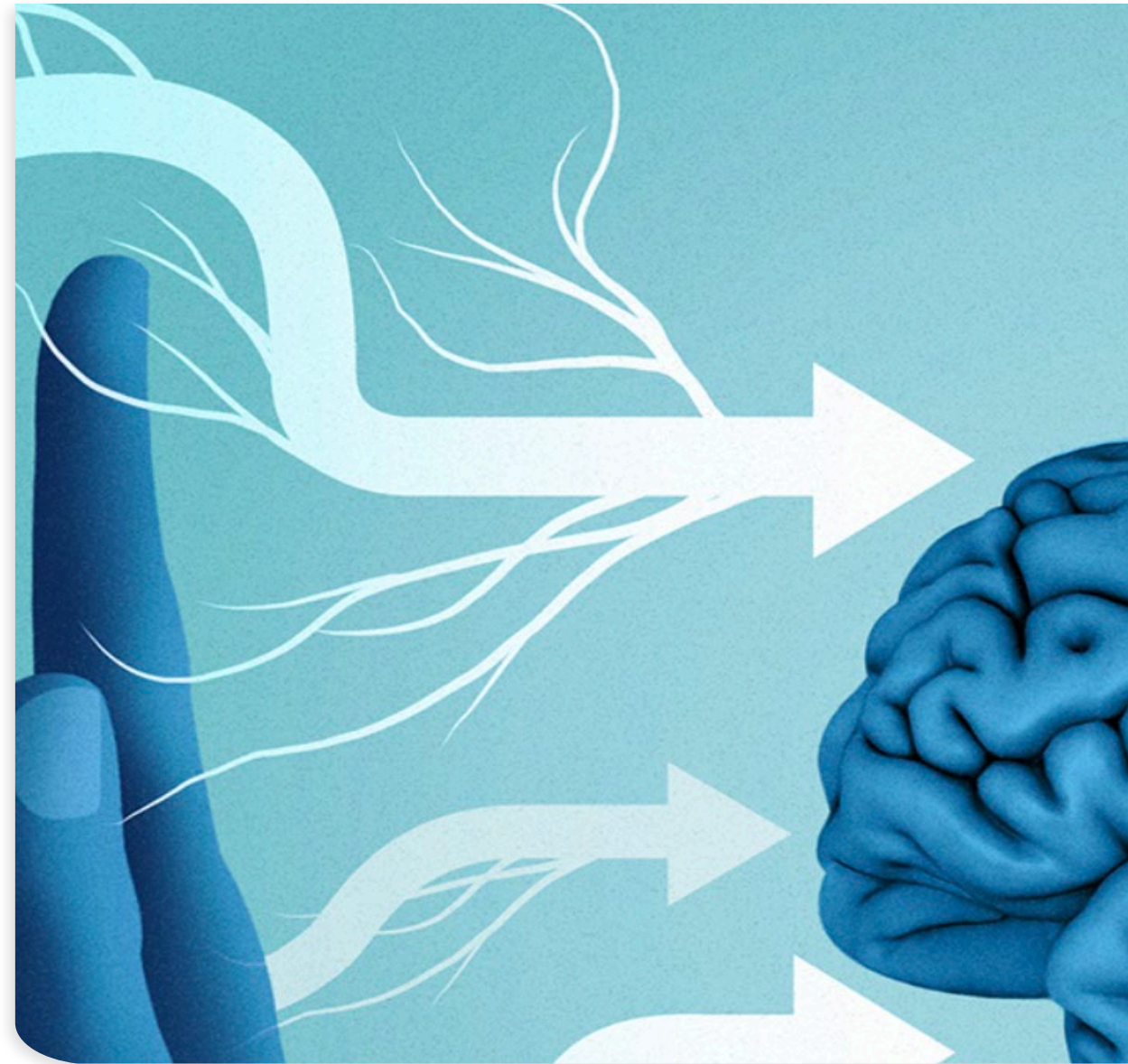
Disrupting pain feedback loop by:

Block

- Diagnostic and therapeutic
- Temporary pain relief

Thermal ablation or chemical neurolysis

- Therapeutic
- Long term pain relief

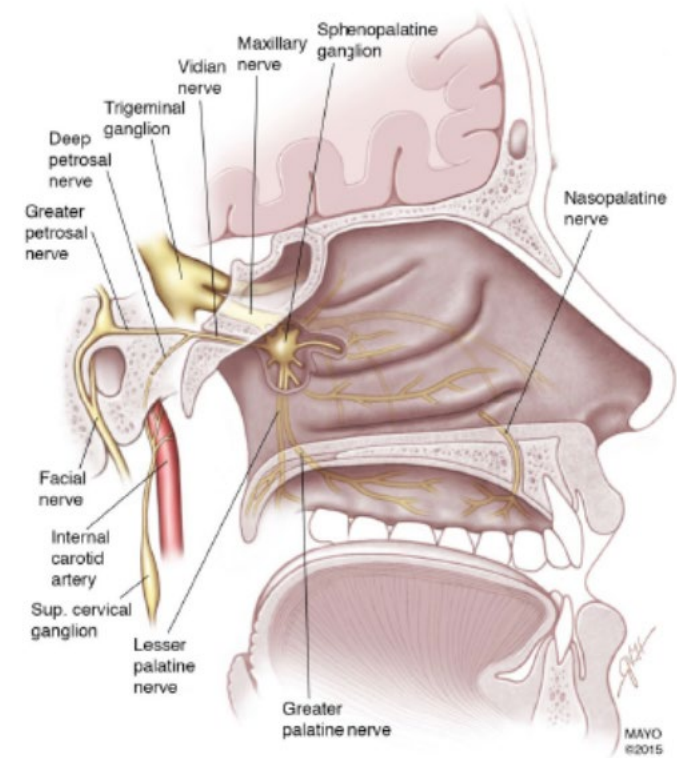


Sphenopalatine Ganglion (SPG)

SPG is associated with the trigeminal nerve, the major nerve involved in headaches and facial pain.

Parasympathetic symptoms during migraines or facial pain:

- Nausea
- Emesis
- Sweating
- lacrimation



When Should Sphenopalatine Ganglion Block (SPG) Be Used?

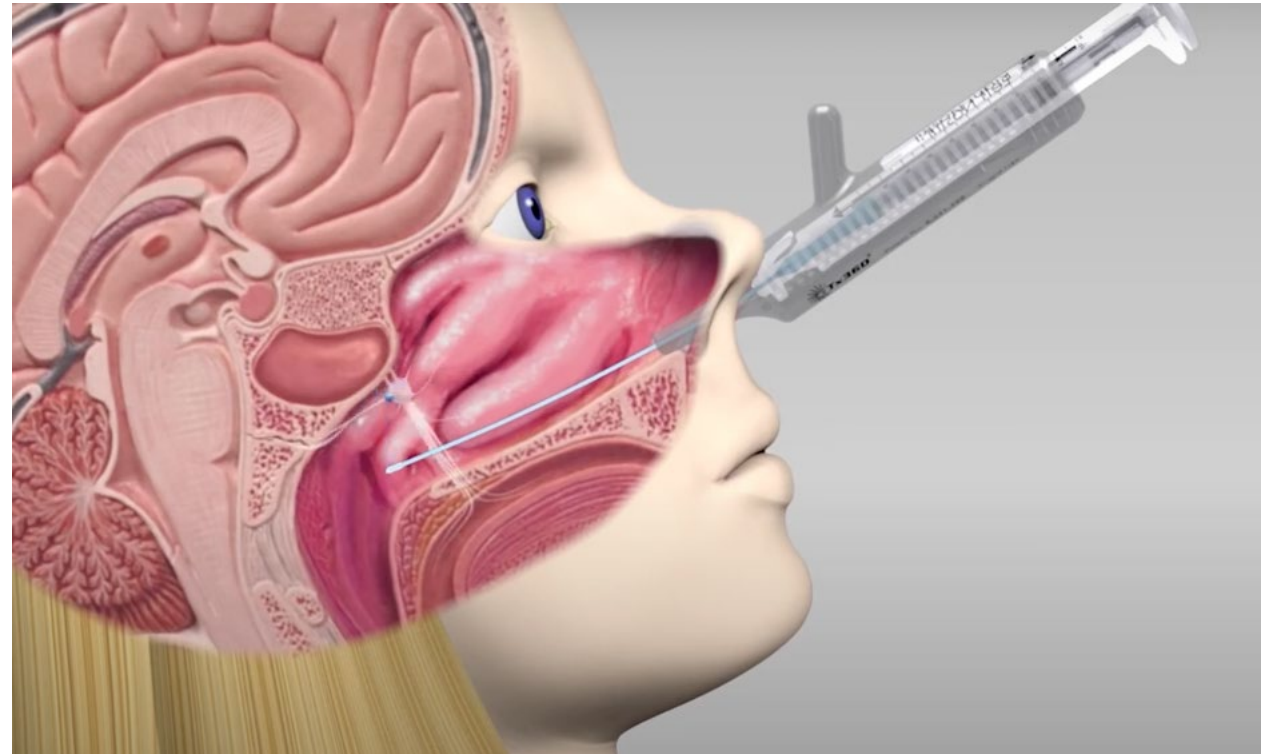
SPG block has been primarily used for acute and chronic migraines

Other indications:

- Facial pain
- Trigeminal neuralgia
- Intractable hiccups
- Post dural puncture headaches

Head and neck cancer can be painful, debilitating, and refractory to oral medications.

- Pena et al. *A&A Pract.* performed SPG blocks to treat head and neck cancer-related pain.
- Pain scores reduced by 38-80% with an average pain relief duration of 23 days



Is SPG right for our patients?

Low risk with possible great benefits

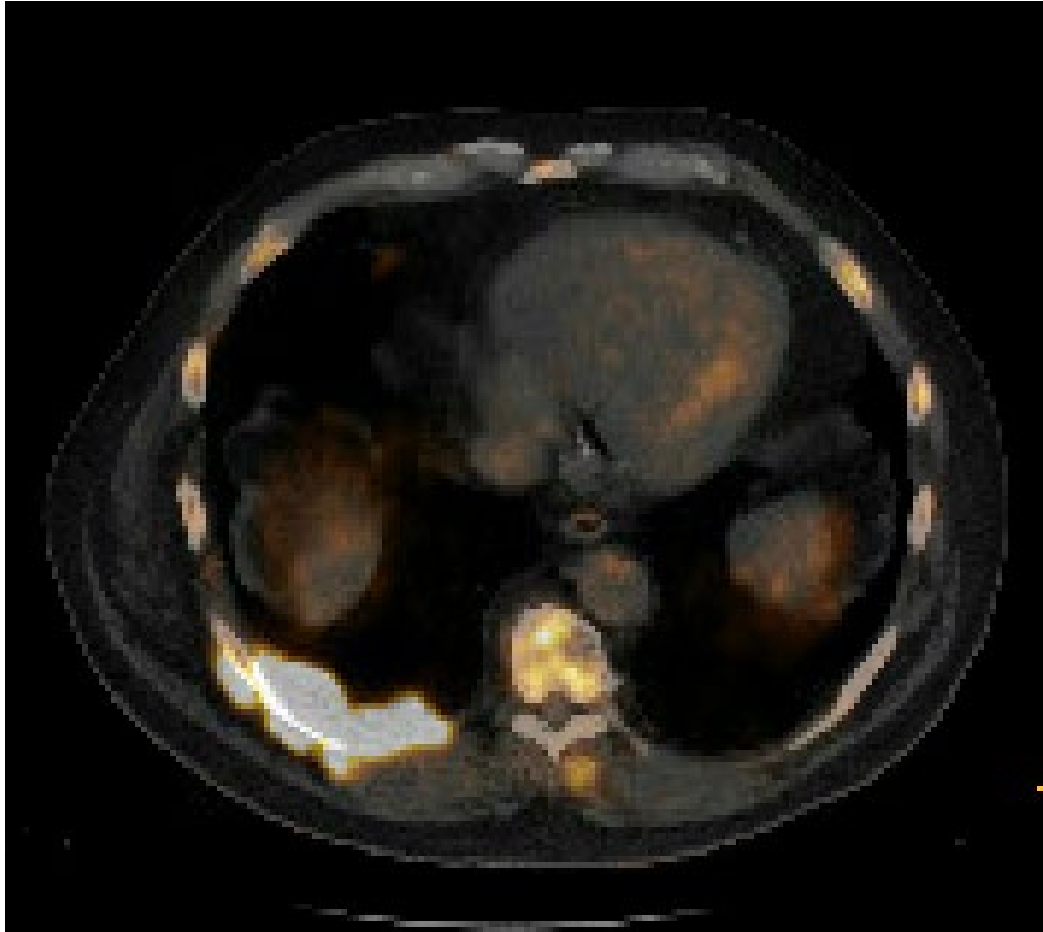
- Immediate pain relief
- Increase in functionality
- Reduction in opioid use
- No radiation
- Performed at bedside/clinic

Institution case review at MCW/Froedtert with oncologic history

- Most common populations
 - Oropharyngeal cancer
 - Multiple myeloma (calvarial lesions)
 - Post IT chemotherapy due to spinal headaches



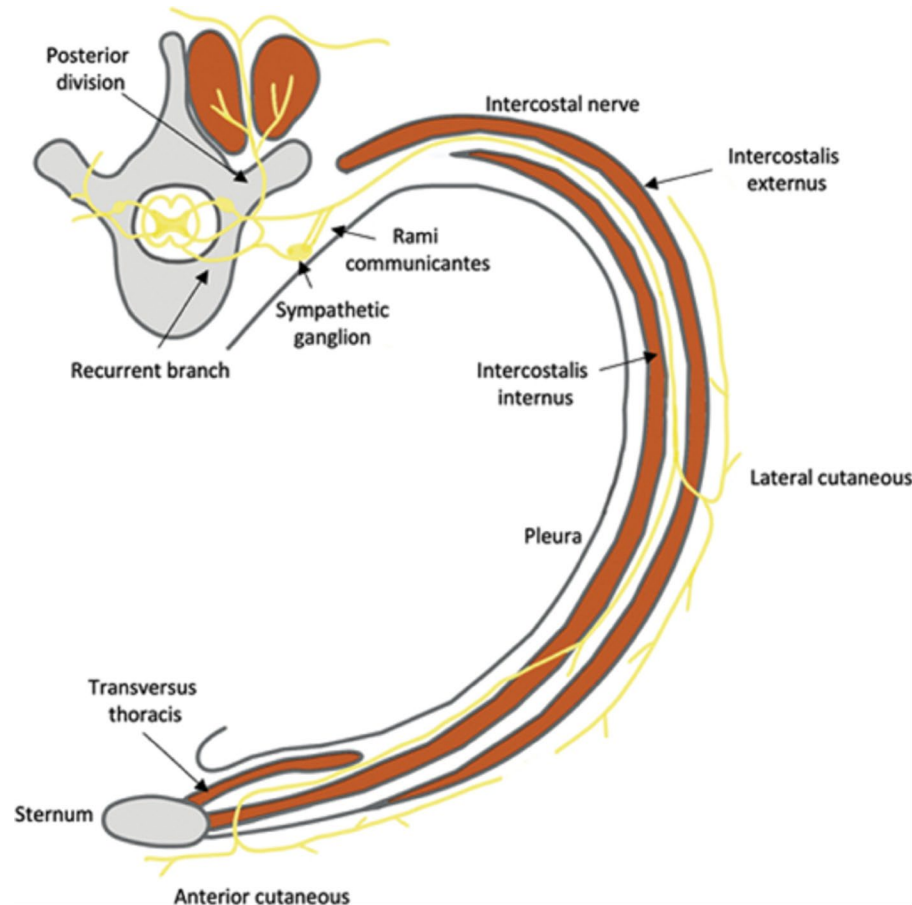
Intercostal/Paravertebral Pain Management



Patient with a history of DLBCL with large right pleural mass status post chemo/IT chemo/CAR-T

- Pain rated at a 9/10.
- Medications
 - MS contin 30 mg BID
 - Morphine IR 15-30 mg q4hr PRN
 - Gabapentin 600 mg BID
 - Methocarbamol 250 mg BID
 - Consideration for methadone pending IR ablation results

Intercostal/Paravertebral Pain



Thoracic malignancy, whether primary or metastatic, can cause chest wall pain by involving:

- Pleura
- Musculature
- Osseous structures

Breast and Lung cancer patients face additional pain and morbidity after treatment

- Post mastectomy pain syndrome affects 25-60% of people after breast surgery
- Post thoracotomy incidence of chronic pain at 3 and 6 months is 57%

Intercostal/Paravertebral Pain Management

History, Physical Exam, and Imaging

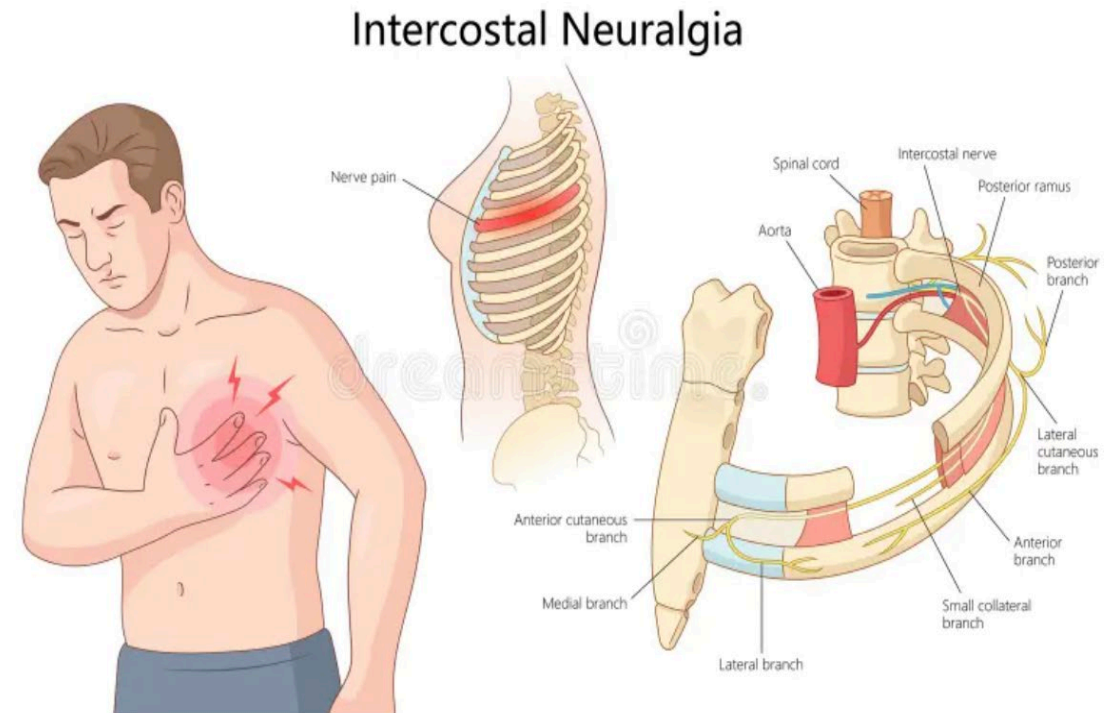
- Known malignancy, trauma, surgery, radiation etc.
- Point tenderness

Image Guided Block

- Diagnostic and therapeutic
 - Confirms targeting appropriate nerves
 - Short term pain relief

Image Guided Ablation

- Therapeutic
 - Long term pain relief

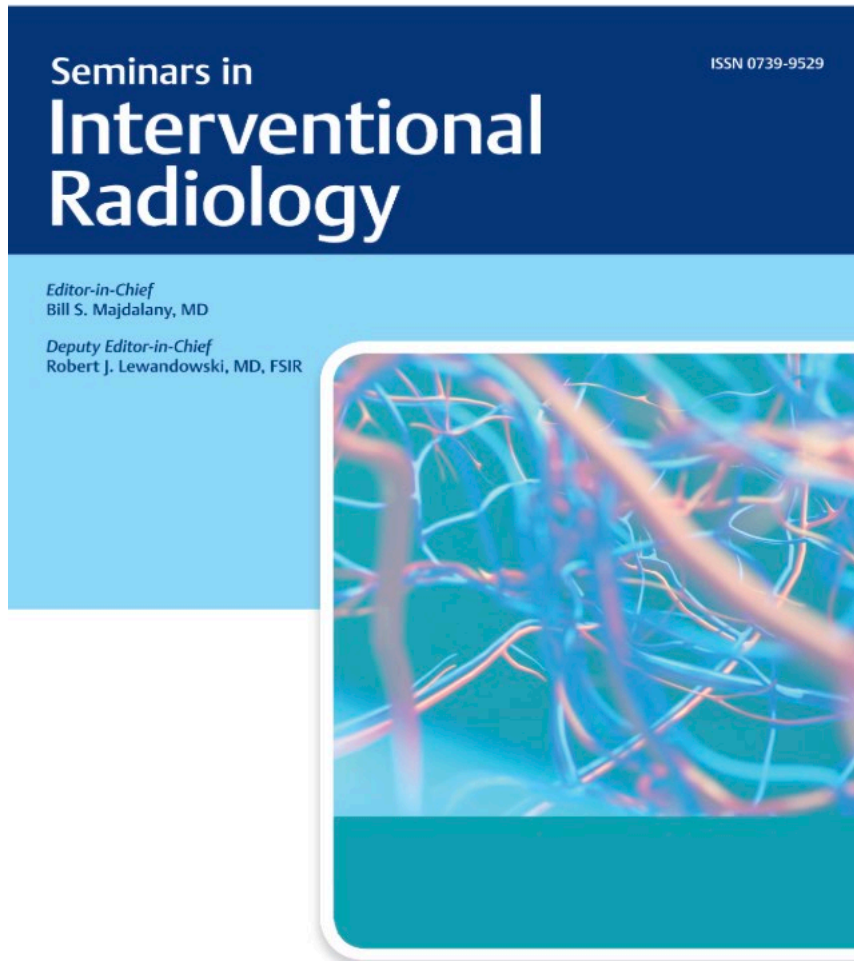


Intercostal/Paravertebral Pain Management



Post thermal ablation

- Pain rated at a 3-4/10
- Reduction in frequency and dose for medications
- Improved quality of life



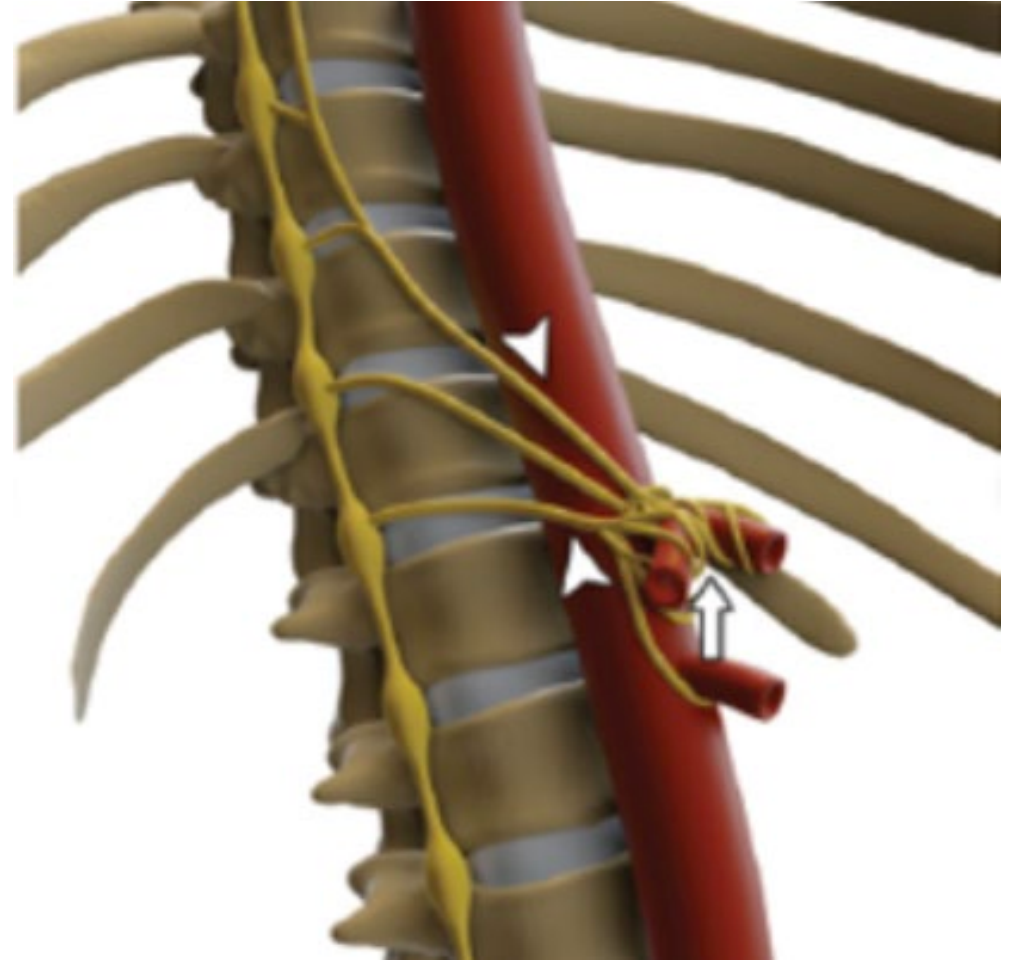
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There has been great data demonstrating thermal ablation by improving pain and narcotic utilization. Article in *Seminars of Interventional Radiology* demonstrated a reduction in pain by 3-4 points and lasting on average of 45 days.

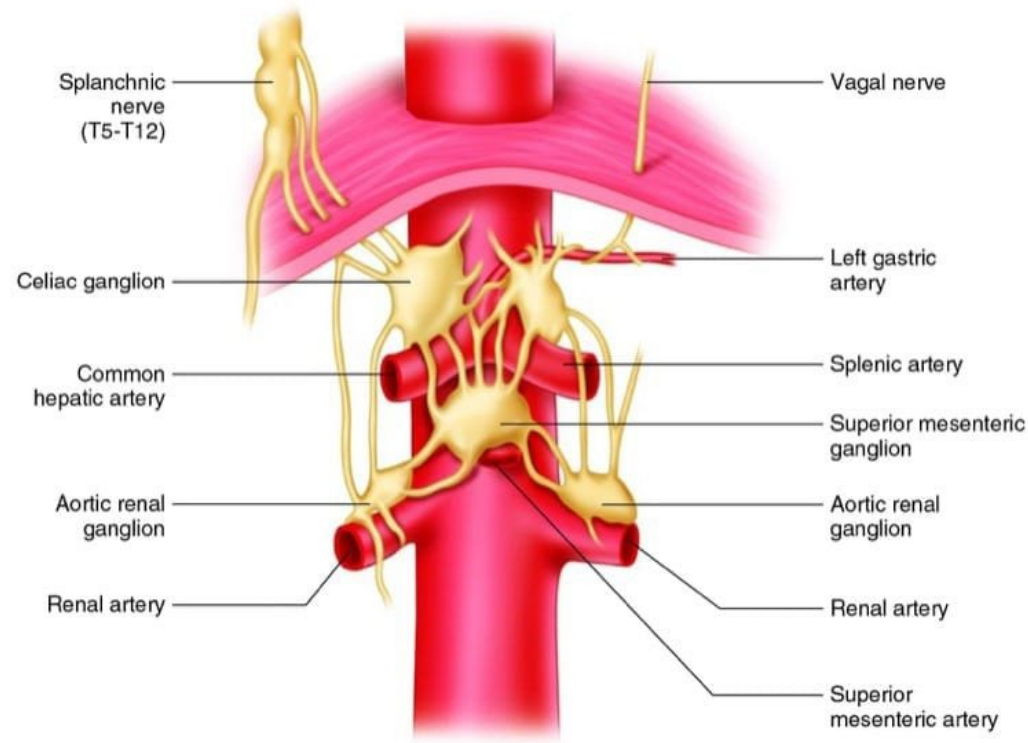
Celiac Plexus Neurolysis

Patient with history of metastatic leiomyosarcoma involving the pancreas on chemotherapy.

- Abdominal pain that is constant at 5/10
- Pain worsens post prandial
 - Initial weight was 150 pounds
 - Lost 60 pounds, and at the lowest weight of 90 pounds
- Pain management:
 - MS Contin 15 mg BID
 - Oxycodone 5-10 mg q4 hours PRN



Celiac Ganglia



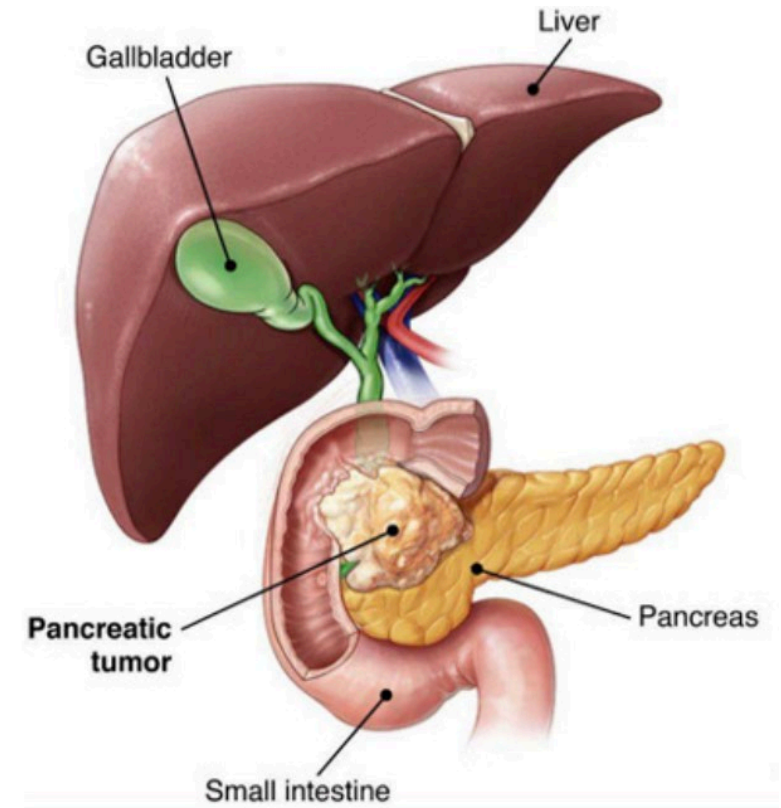
- Primarily sympathetic fibers via splanchnic nerves (T5-T12) with parasympathetic input from vagus nerve.
- Function:
 - Autonomic control of upper abdominal organs
 - Visceral regulation: motility and secretion in stomach, bowel and liver
 - Conduction of afferent visceral pain signals

When Should Celiac Plexus Block/Neurolysis be used?

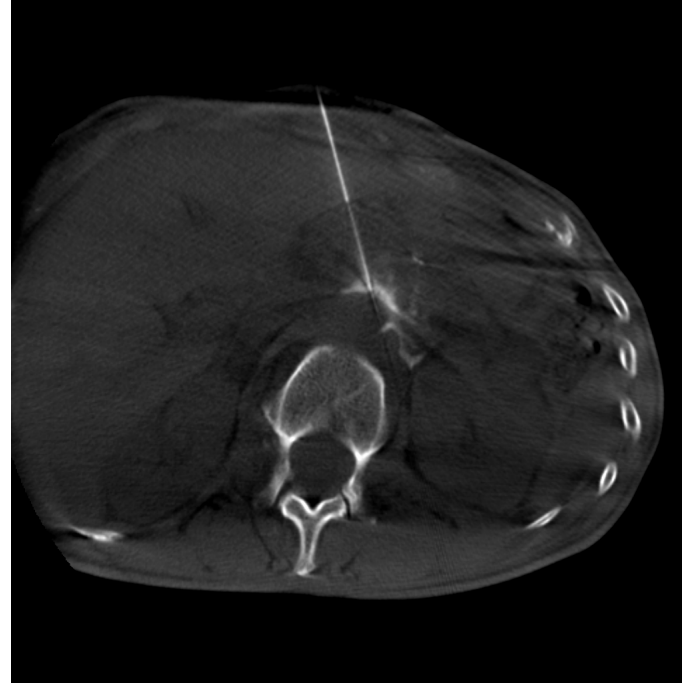
Most performed in liver peritoneal metastasis and pancreatitis

Indications

- Intractable abdominal pain
- Reduce side effects from narcotic/opioid use
 - Constipation
 - Altered mental status
 - Decreased alertness



Celiac Plexus Neurolysis



Significant improvement from symptoms post injection

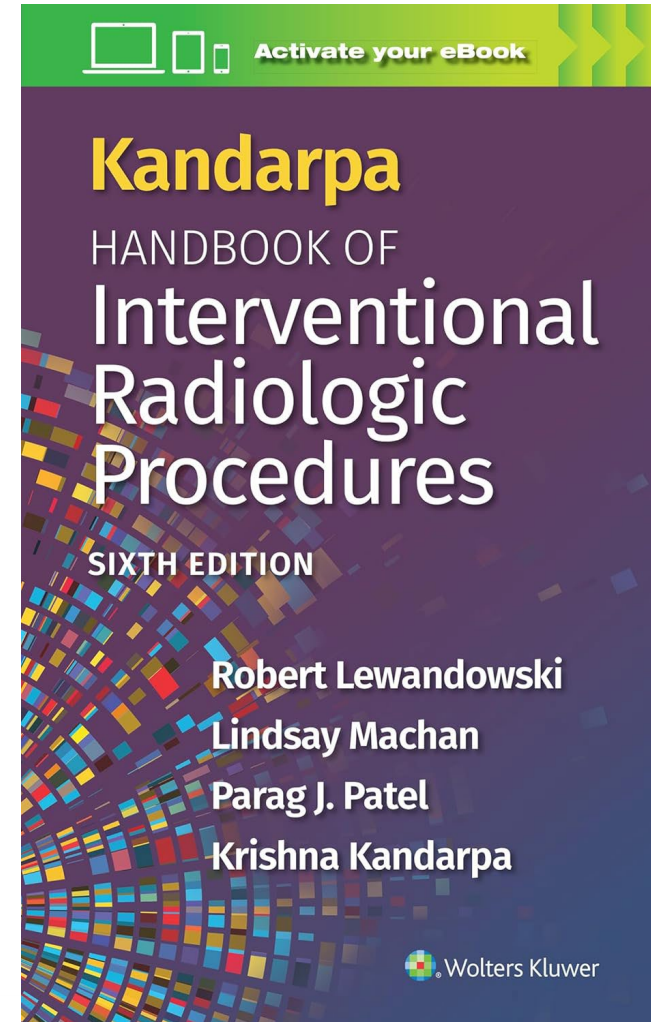
- Gained 8 pounds in first week
- No longer required oxycodone for break through pain

Is Celiac Plexus Neurolysis right for our patients?

Clinical success: 70-90%

- Immediate and long-term pain relief
- Improved pain control and/or reduction in narcotic usage, **NOT** complete pain relief
- Possible modest improvement in cancer survival, attributed to effects of decreased narcotic usage

Ambai et al. *Pain Report* noted decrease in pain, quality of life, sleep improved and general activity improved with walking and working



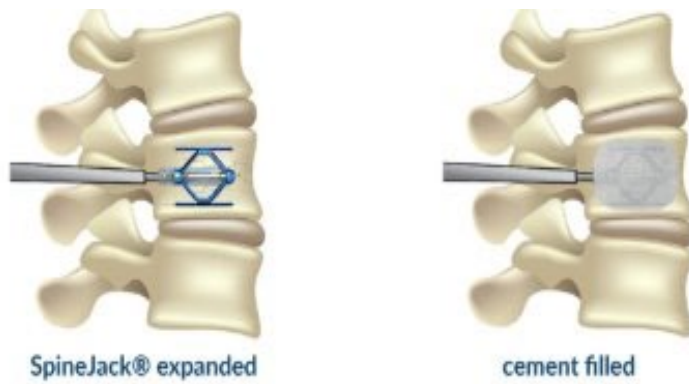
Vertebral Augmentation

Definition

- Minimally invasive procedure, performed under fluoroscopic guidance, used to treat painful vertebral compression fractures
 - Fragility fractures (osteoporosis)
 - Pathologic fractures (cancer)
- Injection of specialized bone cement (PMMA) into the collapsed vertebra to stabilize the fracture & relieve pain

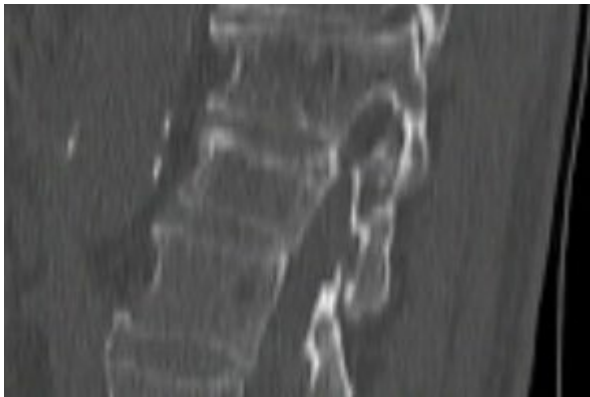
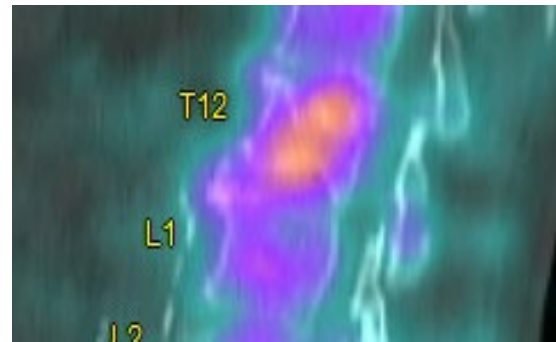
Types:

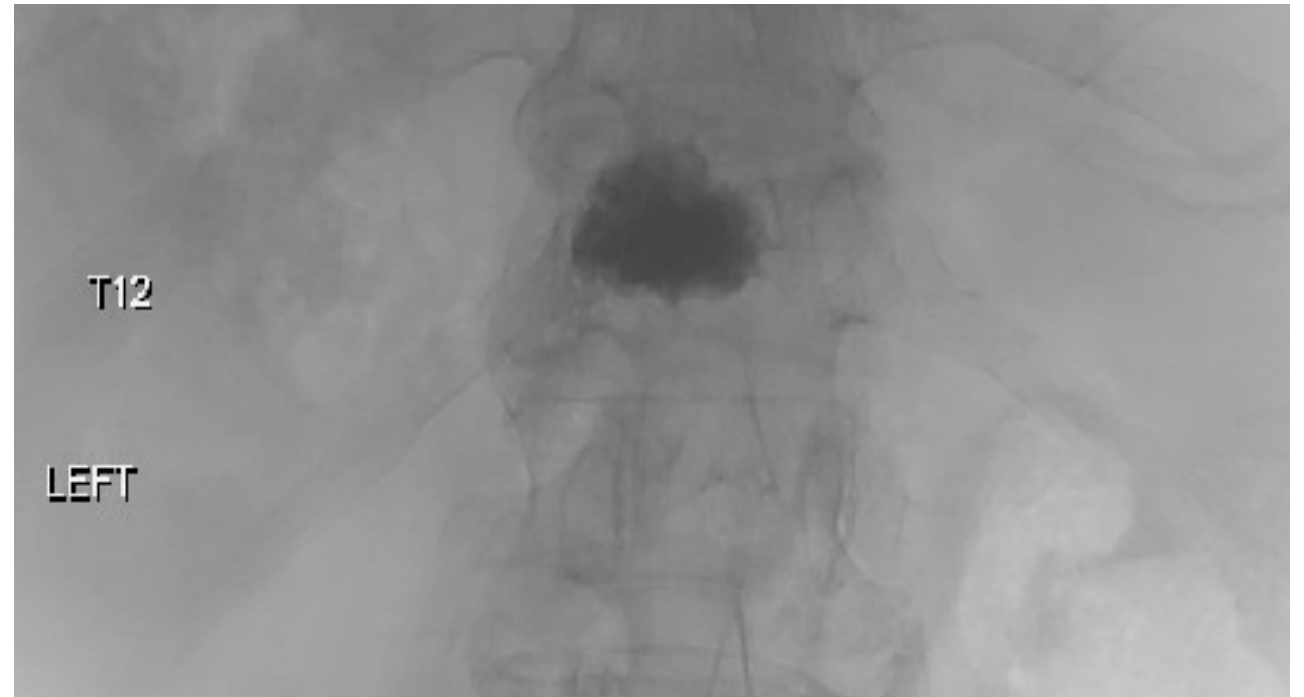
- Vertebroplasty: bone cement injected directly into the fractured, collapsed vertebra
 - Sacroplasty: bone cement injected into sacral insufficiency fractures
- Kyphoplasty: balloon inserted into the vertebra to create a cavity for cement injection
- Spine Jack: titanium implant used to restore vertebral height prior to cement injection



Case study: EM

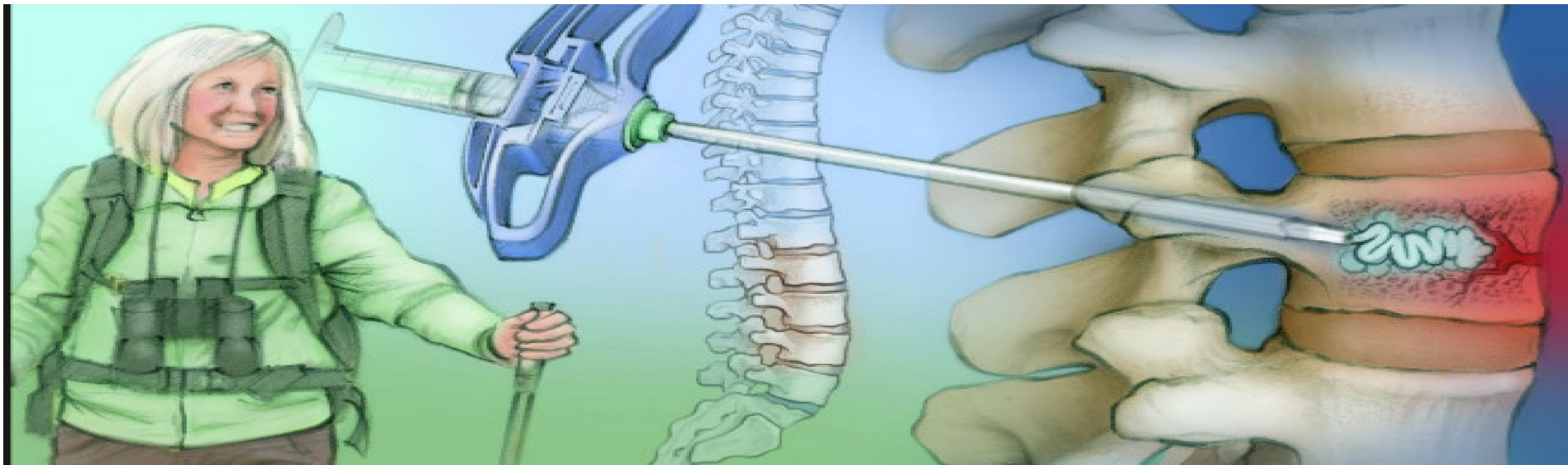
EM is a 78 Y male with PMHx significant for CAD, PAF s/p Watchman, HFrEF, OSA on CPAP, who was referred to IR for back pain 2/2 T12 pathologic compression fracture in the setting of multiple myeloma. On presentation, EM complained of several-month history of lifestyle-limiting pain. Worse with position changes including hyperextension/flexion. Rates pain 8/10 on Numeric Rating Scale.





EM cont'd

- 2 week follow up: RN phone call
 - EM reports improvement in subjective pain, reduced to 3/10 on Numeric Rating Scale
 - Improvement in functional capacity
 - Performing all ADLs independently
 - Able to do housework & grocery shopping independently



- Studies show success rates of 73-90% in reducing numeric pain score
- Provides fast pain relief and reduces long-term complications
- Vertebral compression fractures (VCF) contribute to mortality and lower survival rate of patients
- Hospitalization burden and cost of VCFs management exceed that of myocardial infarction, cerebrovascular accident, or breast cancer (Hirsch, et.al)



Percutaneous Thermal Ablation

Radiofrequency Ablation: uses electrical current to generate heat to destroy cells and tissue (temperatures between 60°C - 90°C/140°F - 194°F)

- Commonly used to treat painful vertebral body metastases
- Often used with concomitant vertebral augmentation*
 - When solid tumor present. Not used for marrow-based metastases such as multiple myeloma
- Done under CT or fluoroscopic guidance

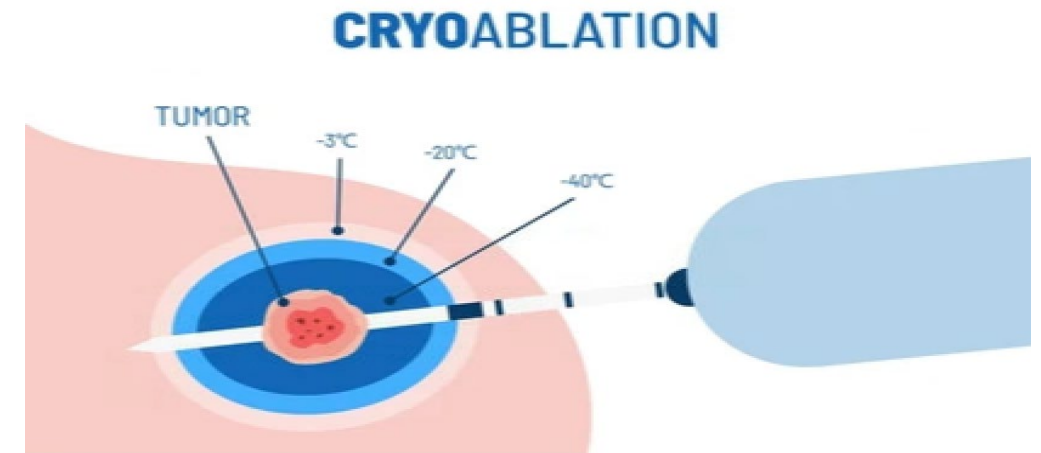
Microwave ablation: uses electromagnetic microwaves to generate intense heat to destroy cells (temperatures between 60°C-150°C/140°F-302°F)

- Typically used for solid organ tumors, most commonly in the liver, kidneys, and lungs
- Done under CT or US guidance

Percutaneous Thermal Ablation Cont'd

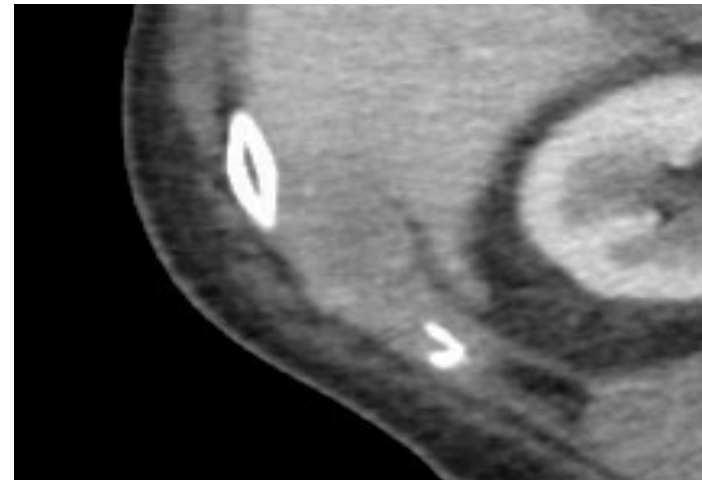
Cryoablation: uses extreme cold (argon gas) to freeze and destroy cells/abnormal tissue (temperatures between -20°C and -40°C)

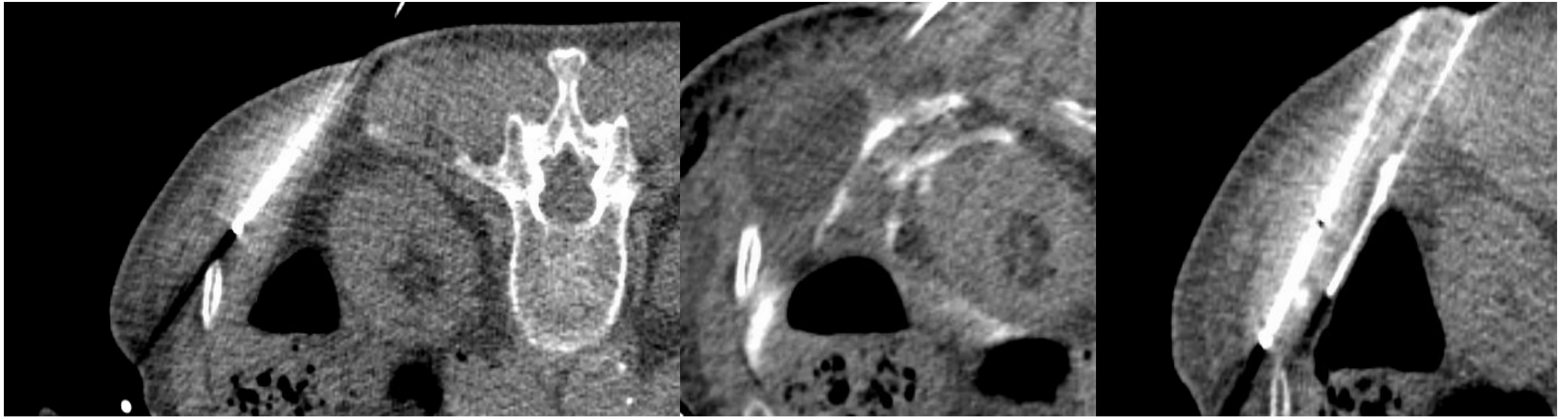
- Used for painful bony metastases outside of the vertebral column as well as soft tissue lesions and solid organ (kidney, lung)
- Done under CT or US guidance
- Advantages of using cryoablation over heat-based modalities:
 - Ability to visualize the ice ball/ablation zone during ablation
 - Reduced intra- and post-procedural pain based on natural anesthetic effects of freezing nerves/tissue
 - Ability to monitor motor nerves close to the ablation zone
 - Emerging evidence that cryoablation provides an excellent scaffold for new bone growth (Hawkins, 2024)



Case study: JM

JM is a 69 Y male with PMHx of CAD s/p CBAG x2, PAD s/p PVI on dual antiplatelet therapy, who was referred to IR for metastatic NSCLC with painful right posterior 11th rib lesion. On presentation, patient complained of moderate right low back pain at the site of a palpable lesion. Pain worse with deep breathing or coughing. Requires opioid analgesics for management of pain, including Oxycodone ER 9 mg BID and Oxycodone 5 mg every 4 hours for breakthrough pain. Without medication he rates his pain 8-9/10 on Numeric Rating Scale, 4-5/10 with medication.





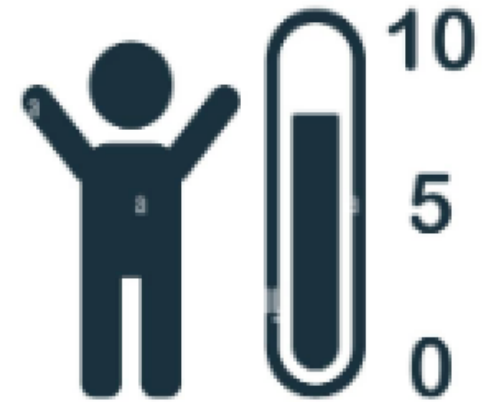
JM cont'd

Follow up visit:

- 1-month post-procedure Telemedicine visit
- JM reports significant pain relief. Pain score decreased to 2-3/10 without analgesics

Benefits of Cryoablation:

- Significant subjective improvement in pain
- Minimally invasive technique allows for minimal post-procedure recovery
- Reduced dose/discontinuation of opioids

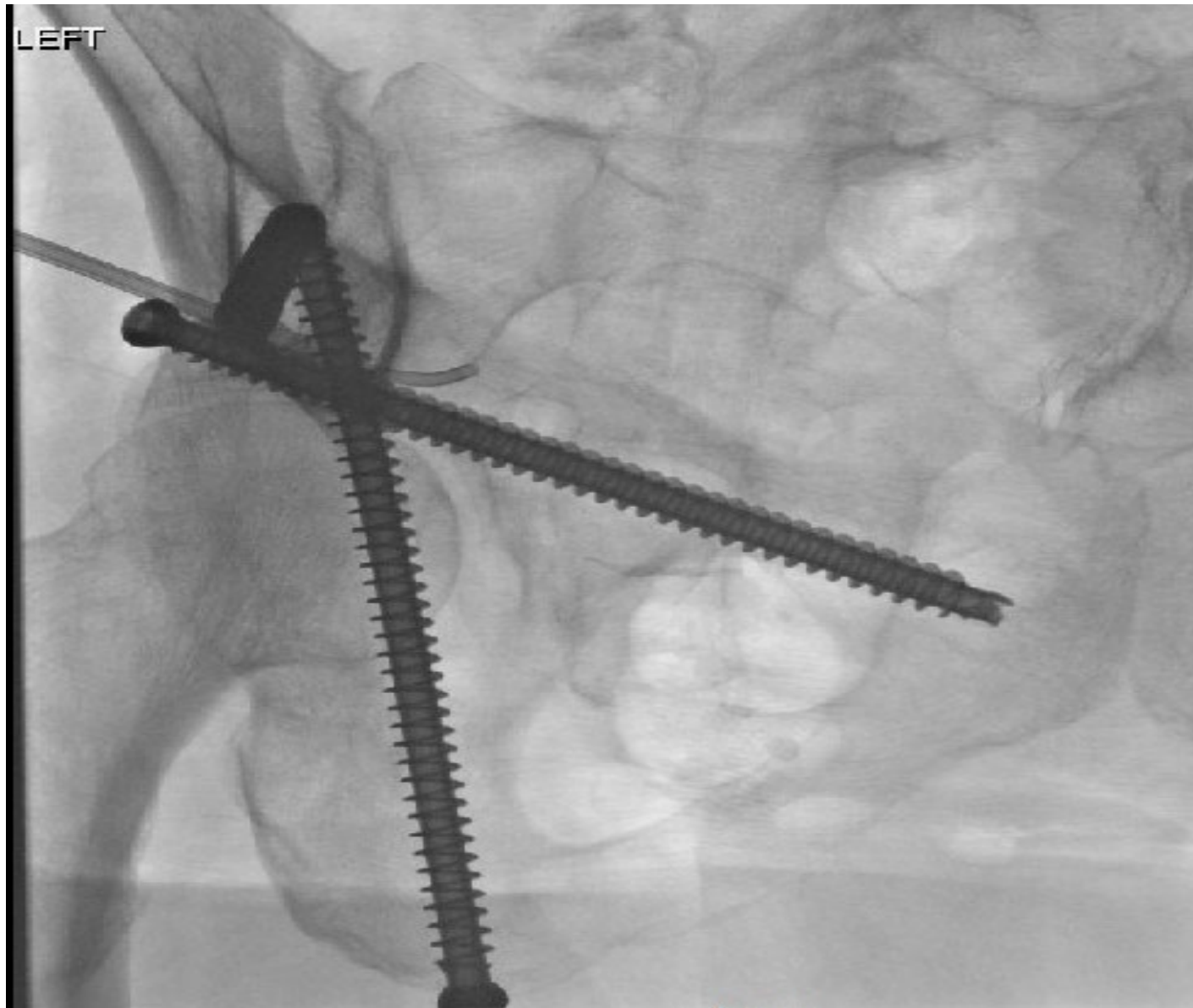


QUALITY OF LIFE

Case study: the kitchen sink

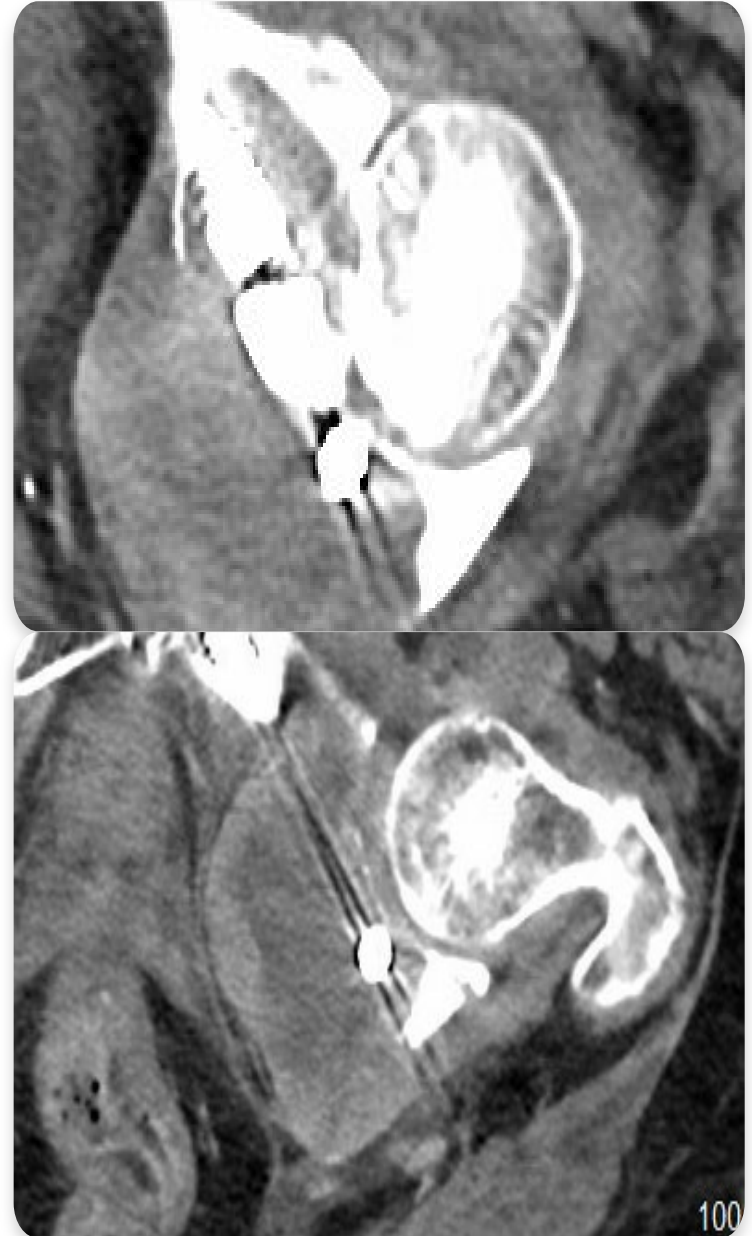
KW is a 65 Y F with metastatic endometrial cancer with osseous involvement including painful left acetabular lesion. The site was irradiated, but her pain progressively worsened. She presented to IR to discuss palliative options. Given the location of the lesion, it was decided to proceed with RFA, screw fixation, and cement osteoplasty.

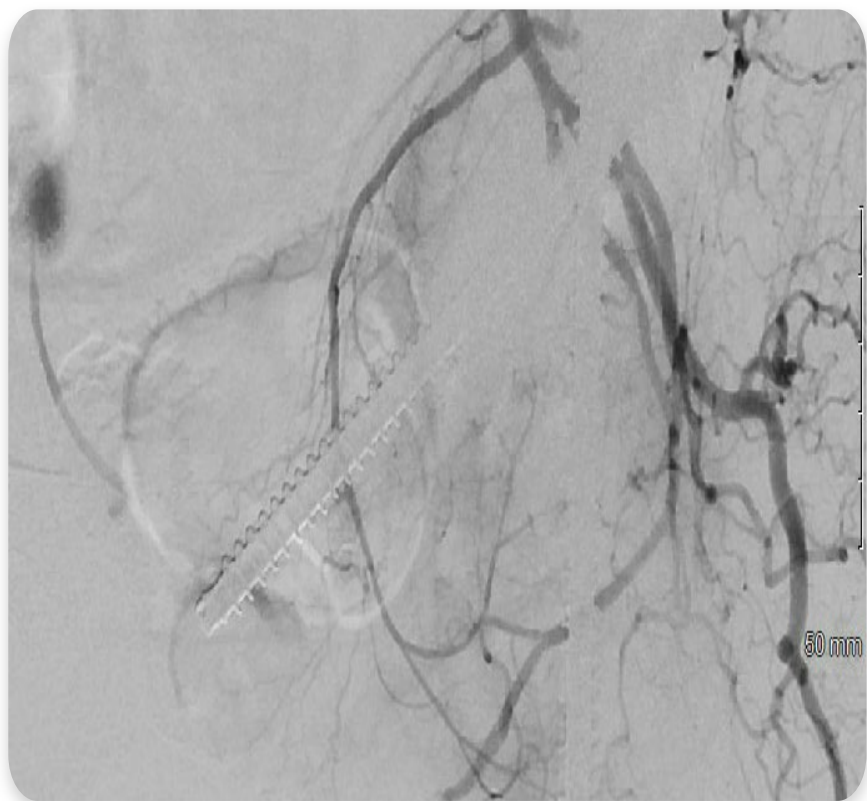
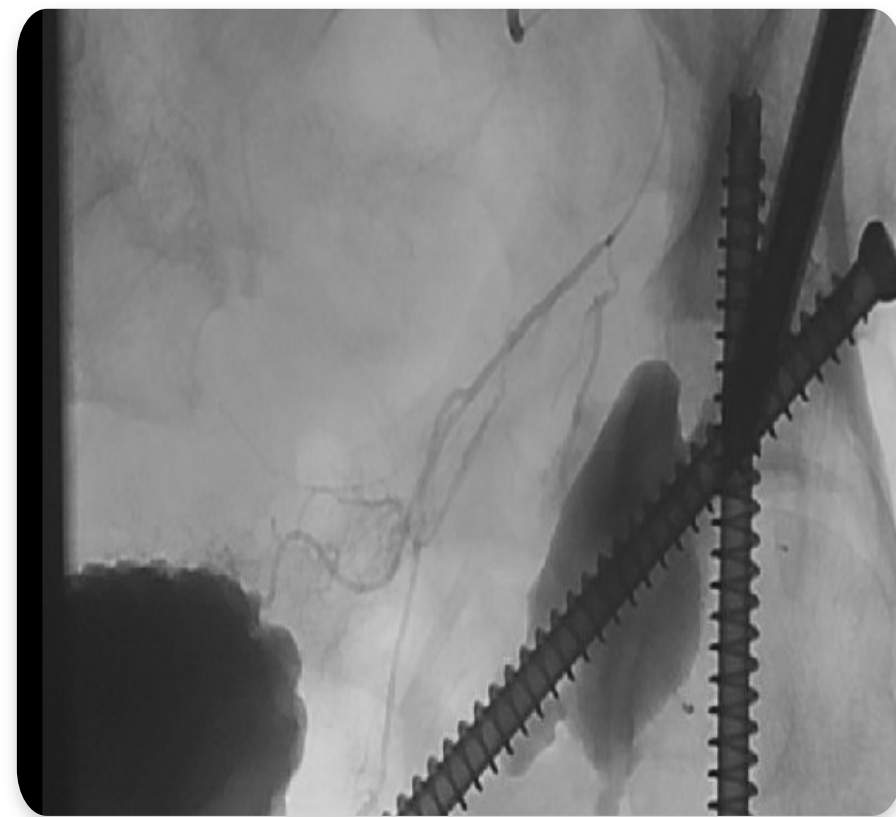




KW cont'd

Patient did well for several months with near complete resolution of her pain. Unfortunately developed recurrent pain about 6 months post-procedure. Imaging revealed recurrent left acetabular lesion. Presented to local ED for pain control due to progressively worsening lifestyle-limiting pain. Numeric pain score in ED reported at 10/10 with activity. Required IV analgesics to manage, discharged home on PO ER-opioids and prn Hydromorphone for breakthrough pain. Returned to IR to discuss additional options. Her case was also discussed at the multi-disciplinary MSK tumor board with recommendation to consider bland embolization.



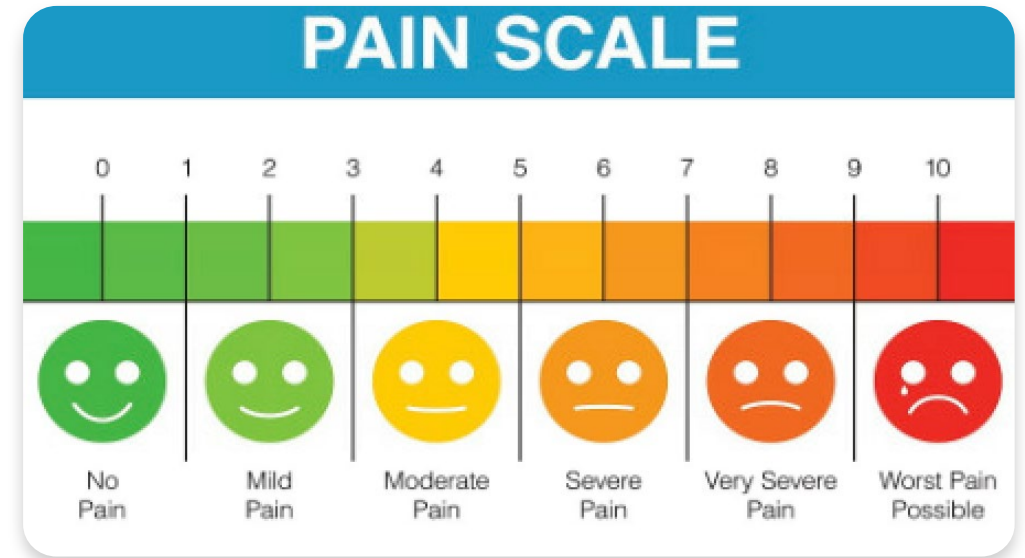


KW cont'd

Bland embolization performed.

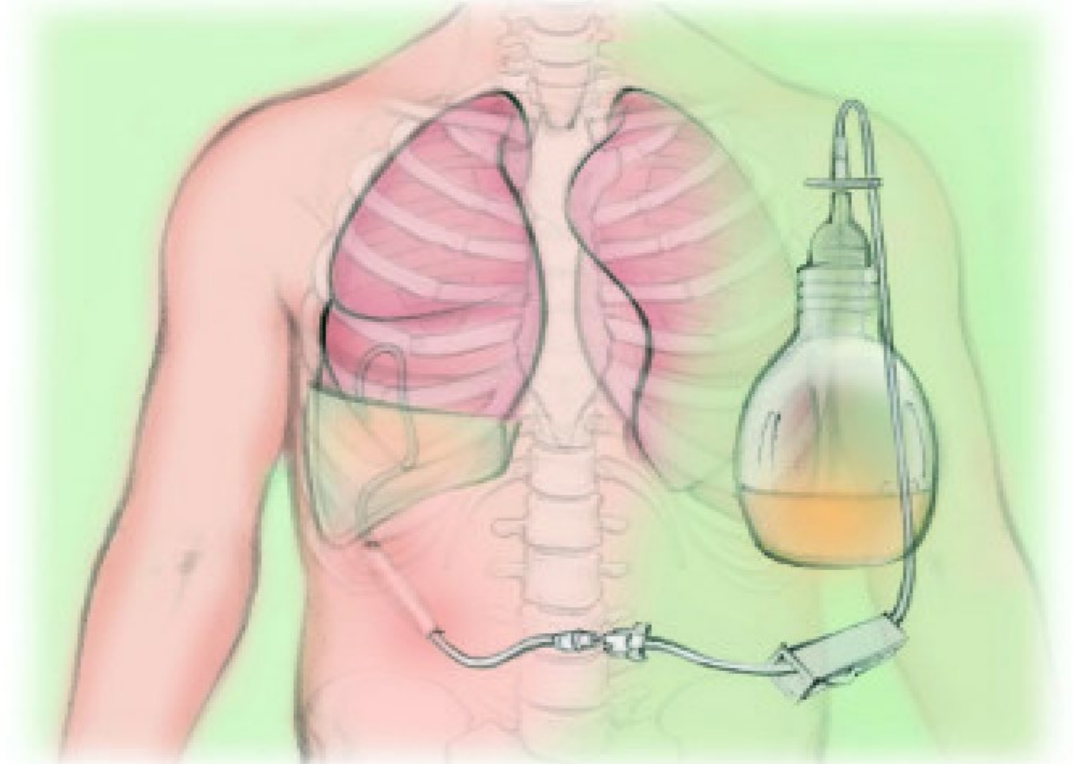
Returned to IR Clinic for 1-month follow up, reporting significant improvement in subjective pain:

- numeric pain score down to 4/10
- Improved functional status, able to perform ADLs independently, slowly increasing activity
- Decreased opioid use, no longer requiring prn doses



Tunneled peritoneal/pleural drainage catheter

- Placed under the skin into the peritoneum or pleural cavity for recurrent (malignant) fluid
- Allows patients to manage symptoms at home and reduce the need for frequent hospital visits for drainage
- Allows for increased independence, reduced hospitalization
- Risks include infection, blockage, leakage around the catheter



Discussion

- If patient has localized pain refractory to other treatment, s/he is likely a candidate for IR
- Early engagement of tumor boards:
 - Multi-disciplinary collaboration that focuses on symptom management
 - Shared input from all aspects of patients' care team to focus on QOL
 - Summary of 23 randomized control trials with over 7000 enrolled patients: Symptom management intervention improve symptom burden, QOL, and overall survival based on patient-reported objectives (Li, 2023).



Questions?



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