



Interventional Procedures for the Cancer Patient

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Interventional Pain Management

The image features a white background with decorative curved lines in the corners. In the top right and bottom left, there are thick, multi-layered curved lines in shades of light blue and green. In the bottom right, there are faint, thin curved lines in the same color palette.

No Disclosures



Learning objectives

- Identify the role of interventional procedures in the management of cancer pain and non-cancer pain in the cancer patient
- Learn basic patient selection criteria and procedure indications
- Know the most common and important complications of the procedures

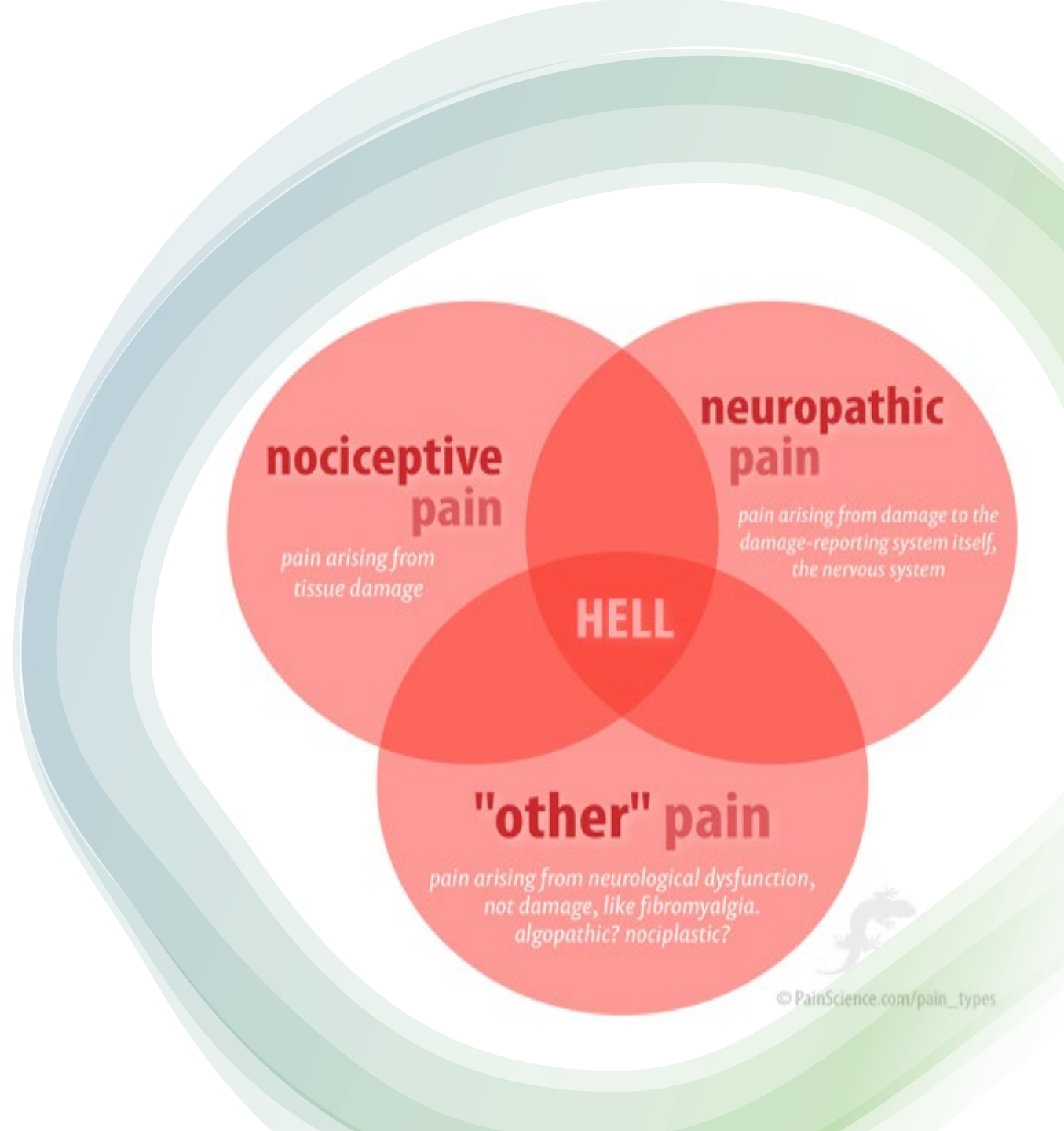


Pain Defined

“An unpleasant sensory and emotional experience associated with actual or potential tissue damage...”

Pain Types

- Nociceptive pain is pain arising from actual tissue damage
- Neuropathic pain is pain arising from the damage to the nervous system itself
- "Other" Pain includes nociplastic pain is a term used to describe persistent pain that arises from altered nociception, despite no clear evidence of actual or threatened tissue damage causing the activation of peripheral nociceptors, or evidence for disease or lesion of the somatosensory system causing the pain



Pain Etiologies in the Cancer Patient

- Tumor
 - Primary
 - Metastatic
- Surgery
- Chemotherapy and Radiation
- Pre-existing Chronic Pain
 - Neck and Back
 - Joint Pain





Cancer Pain Treatment Strategy

Multidisciplinary Care

- Pain Medicine/ Interventional Procedures
- Clinical Psychology
- Physical Medicine & Rehabilitation
- Supportive/Palliative Care

Multimodal Care

- Medications: NSAIDs, gabapentinoids, TCAs topicals, opioids, etc
- Pain procedures
- Psychotherapy
- PT/OT



Cancer Pain: The Role of Interventional Procedures

- Intervene early if risk/benefit is favorable
- Understand limitations/contraindications
- Sometimes interventional procedures needed for chronic non-malignant pain
- Sometimes beneficial in end stage situations/palliative

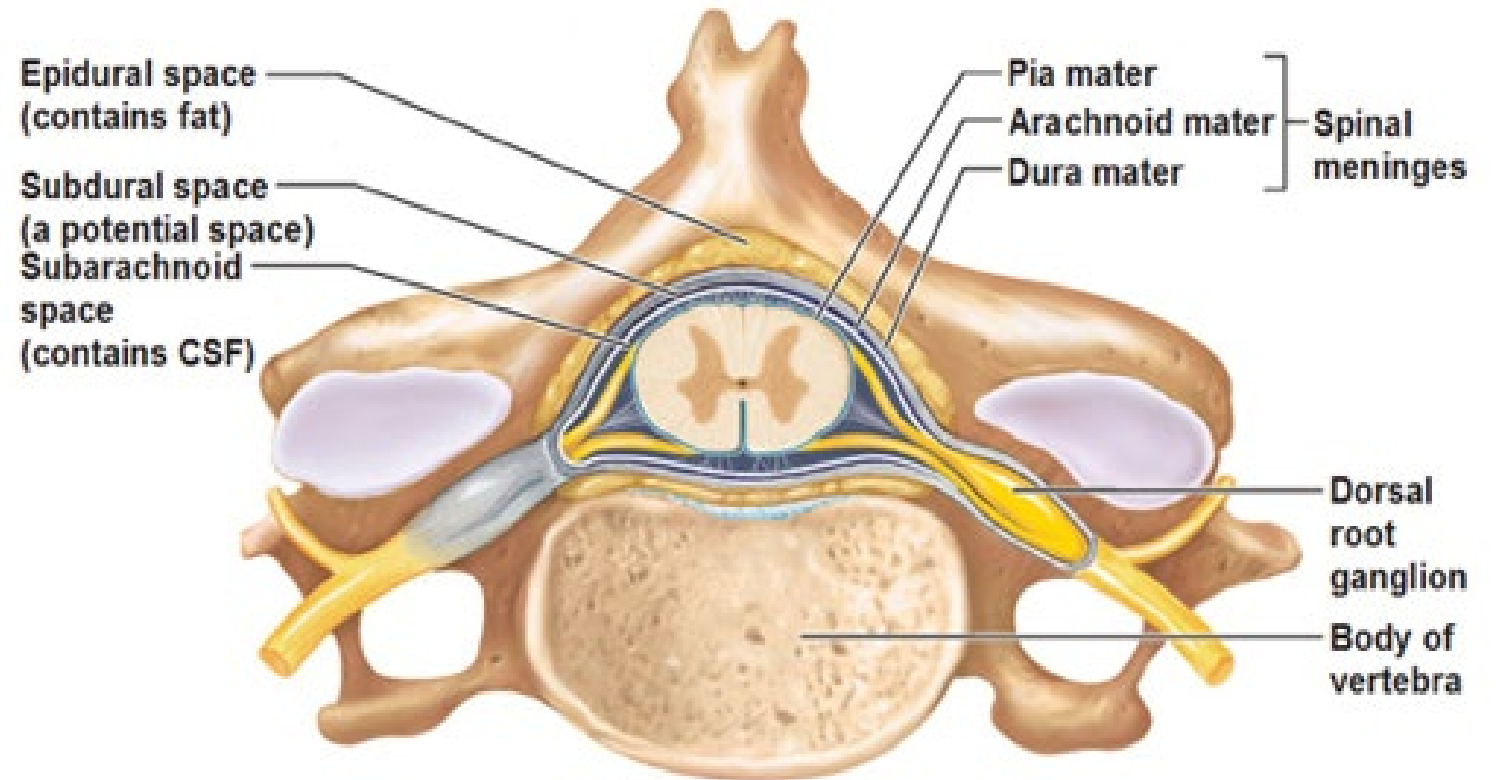
Common Pain Procedures



Epidural Steroid Injections



Anatomy



(a) Cross section of spinal cord and vertebra

Epidural Steroid Injection

Indications:

- Spinal radicular pain (to arms, legs, chest)
- Discogenic pain

Non-particulate steroid placed at or near the level of the exiting or traversing nerve root.

Multiple routes to epidural space

- Interlaminar
- Transforaminal
- Caudal

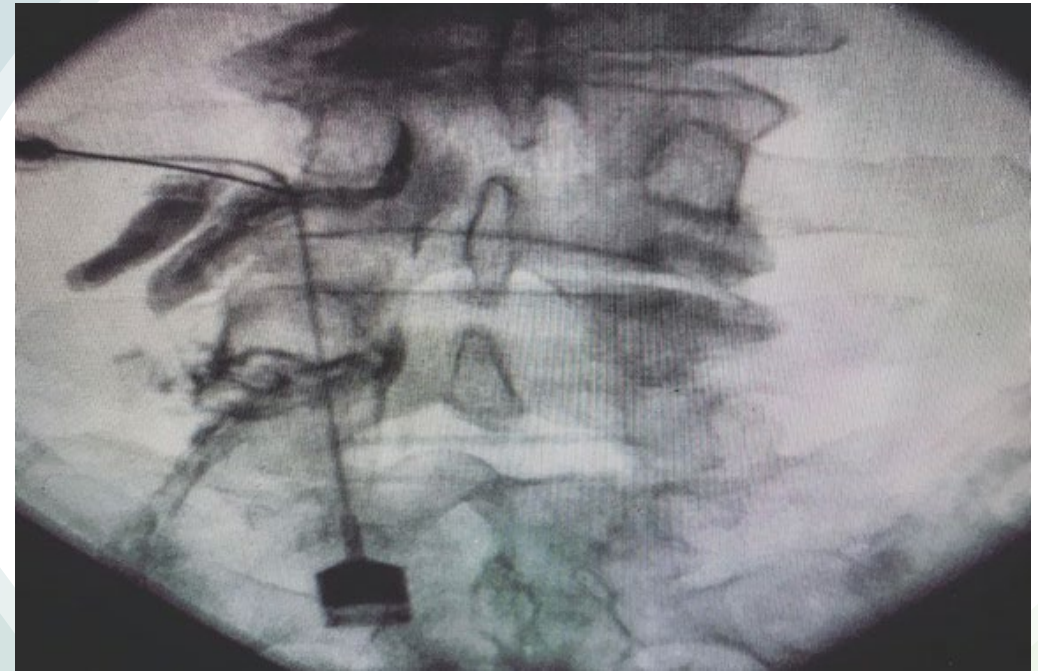
Epidural Steroid Injection

- Performed in Procedure room under Fluoroscopy with contrast dye
- Ideally, patient must be able to lay prone for 15-20 minutes
- Platelets 100k+
- Off Anticoagulation
- Afebrile
- Normal WBC
- No active infection
- If recently treated for infection, procedure can be performed 14 days after last dose of full antibiotic course

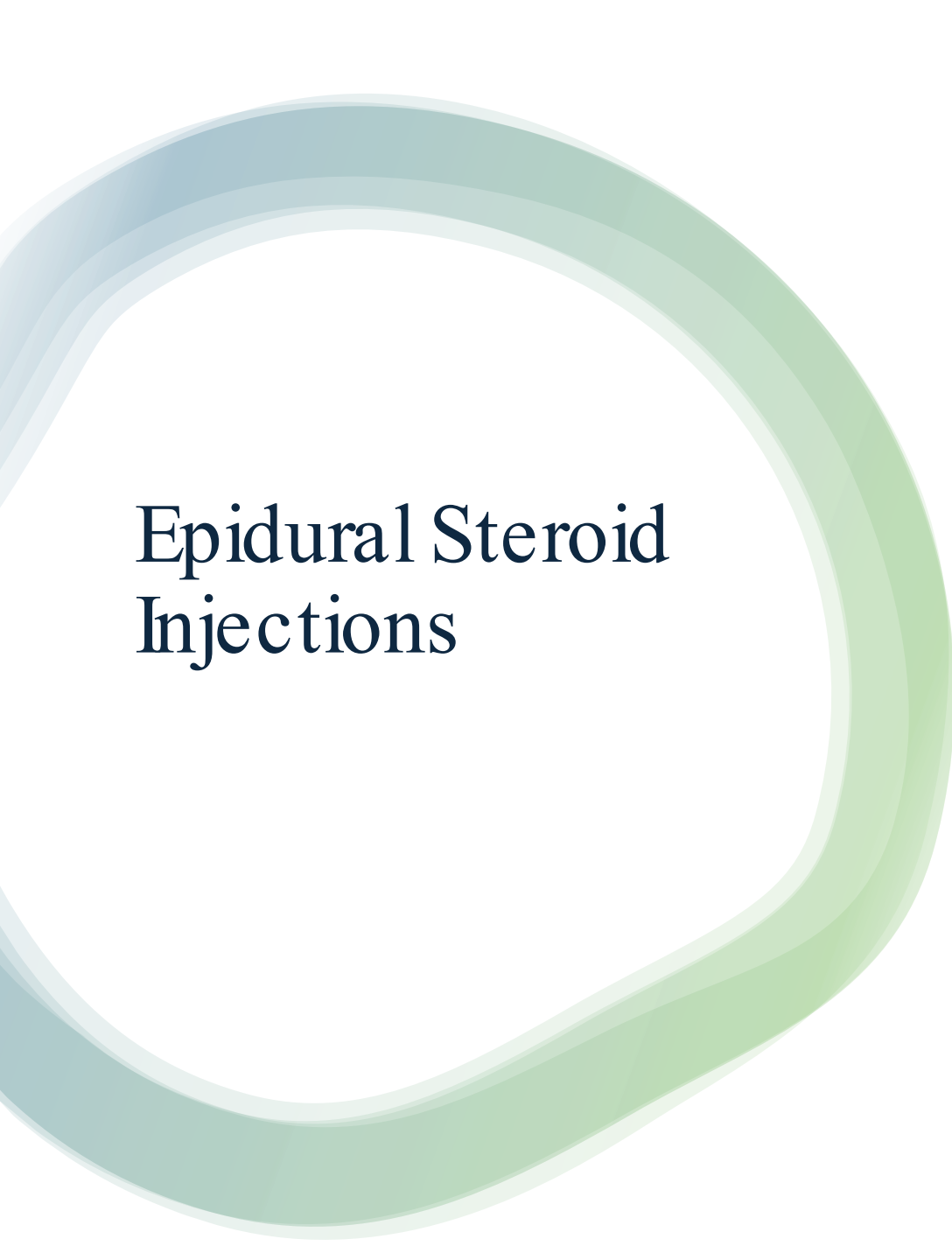


Interlaminar Epidural

Transforaminal Epidural



Caudal Epidural



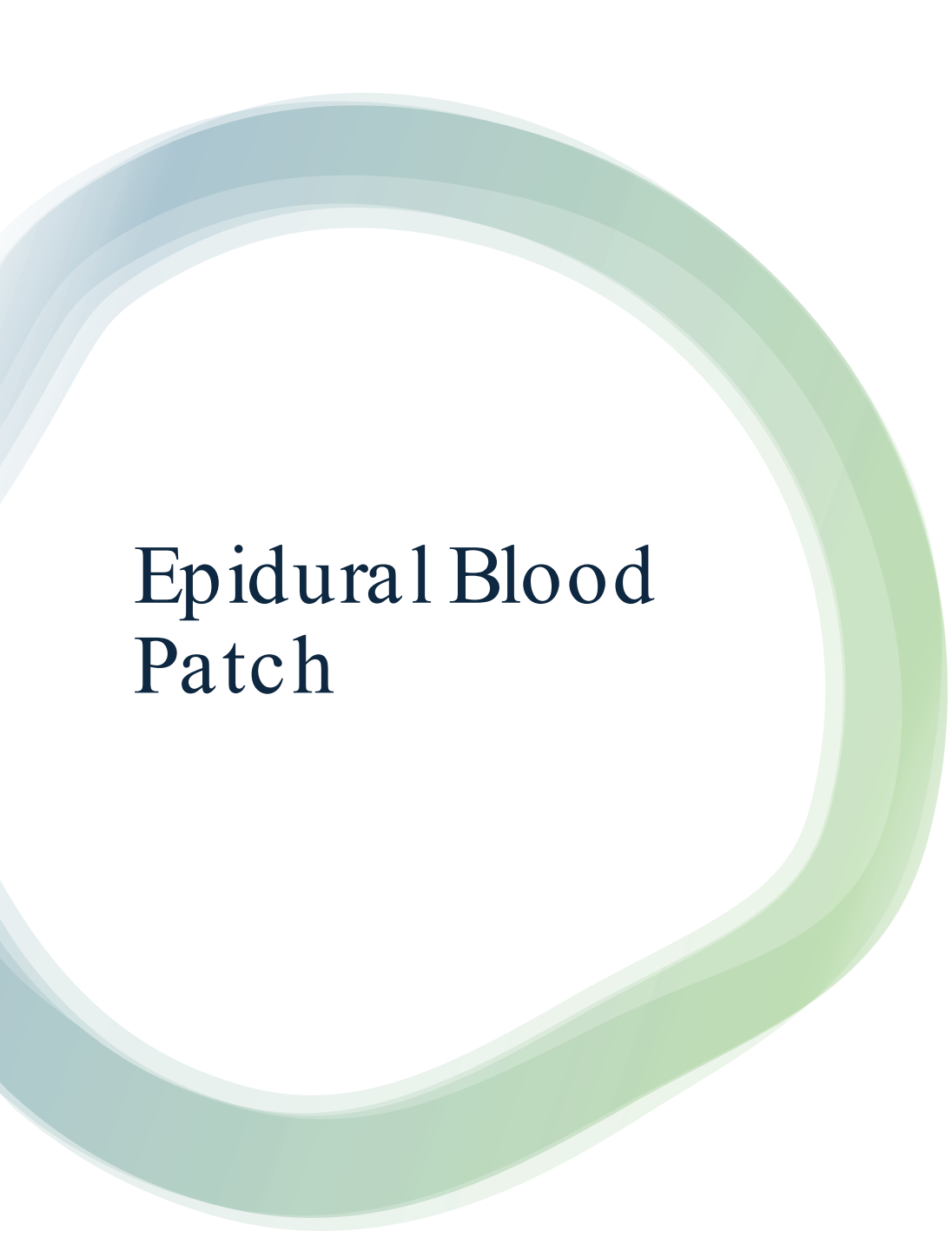
Epidural Steroid Injections

Possible complications

- Localized site discomfort
- Inadvertent dural puncture
- Epidural Hematoma
- Spinal Nerve Injury/Cord Injury
- Infection

Contraindications

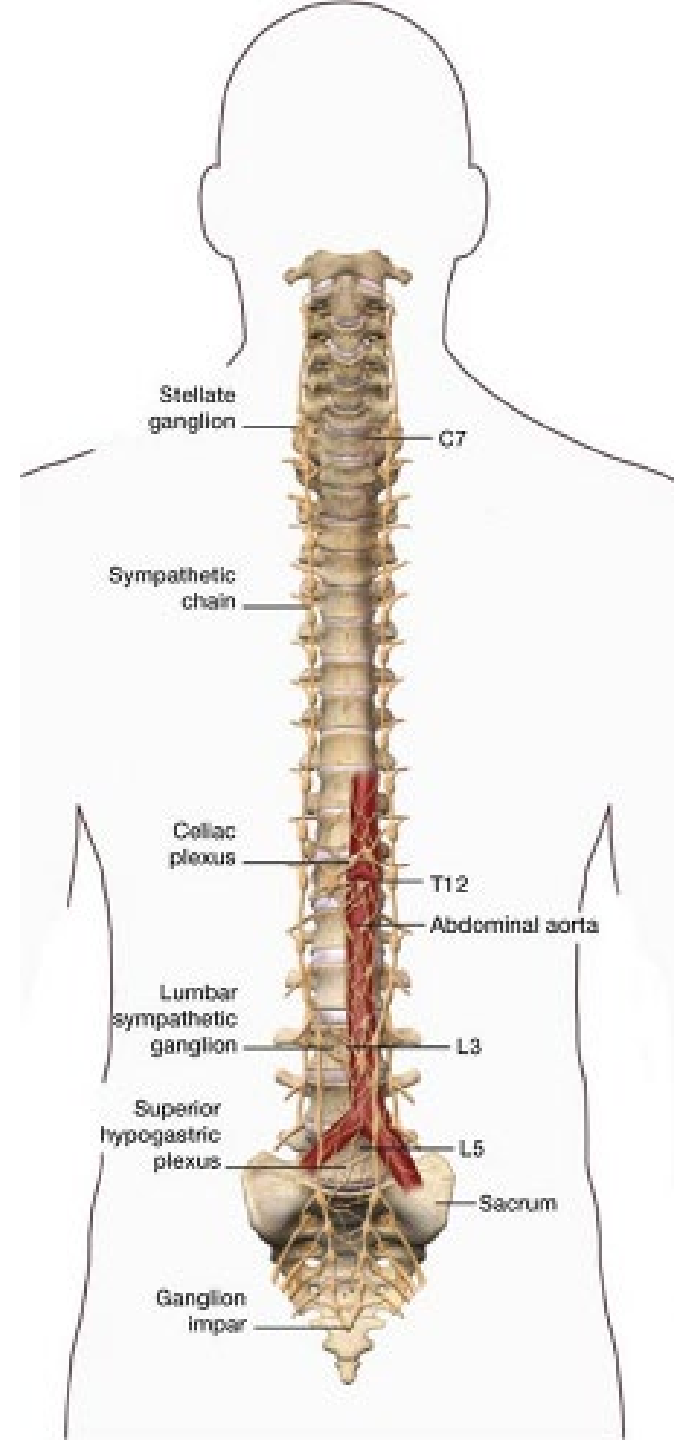
- Local or systemic infection
- Coagulopathy
- Advanced stenosis or spinal instability
- Cord compression



Epidural Blood Patch

- Definitive treatment for post dural puncture headache
 - PDPH may be seen after intra-thecal chemotherapy
- 10-20 ml of autologous blood injected into the epidural space
- Same contraindications as regular ESI

Sympathetic Blocks





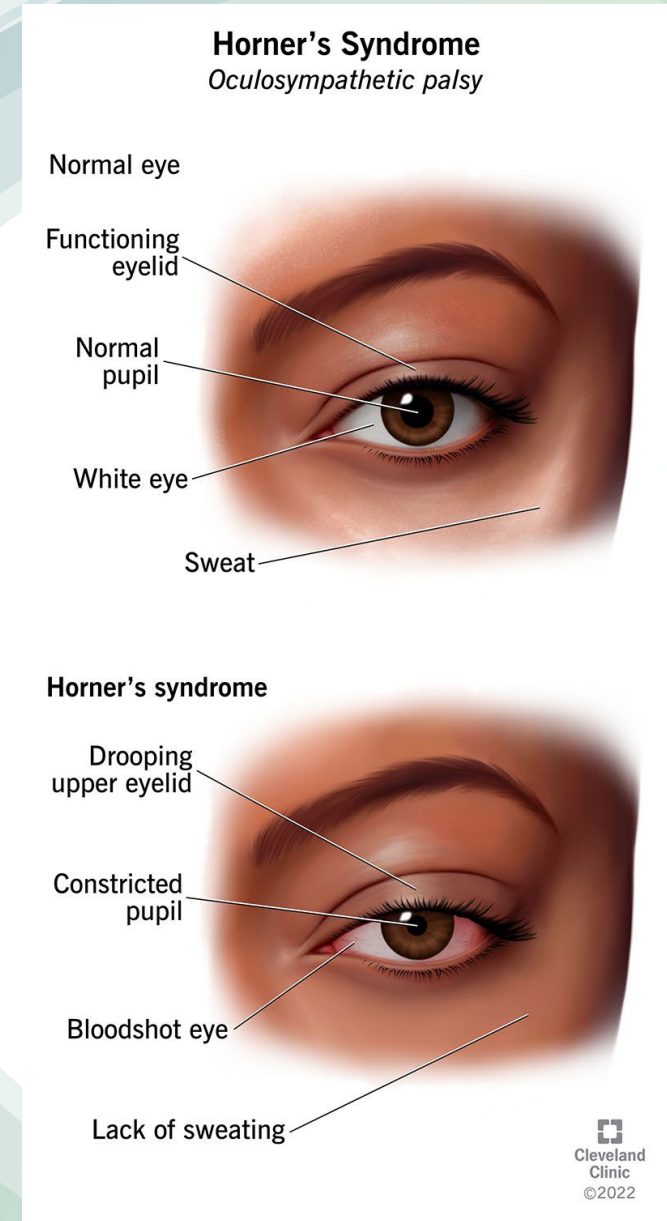
Stellate Ganglion Block

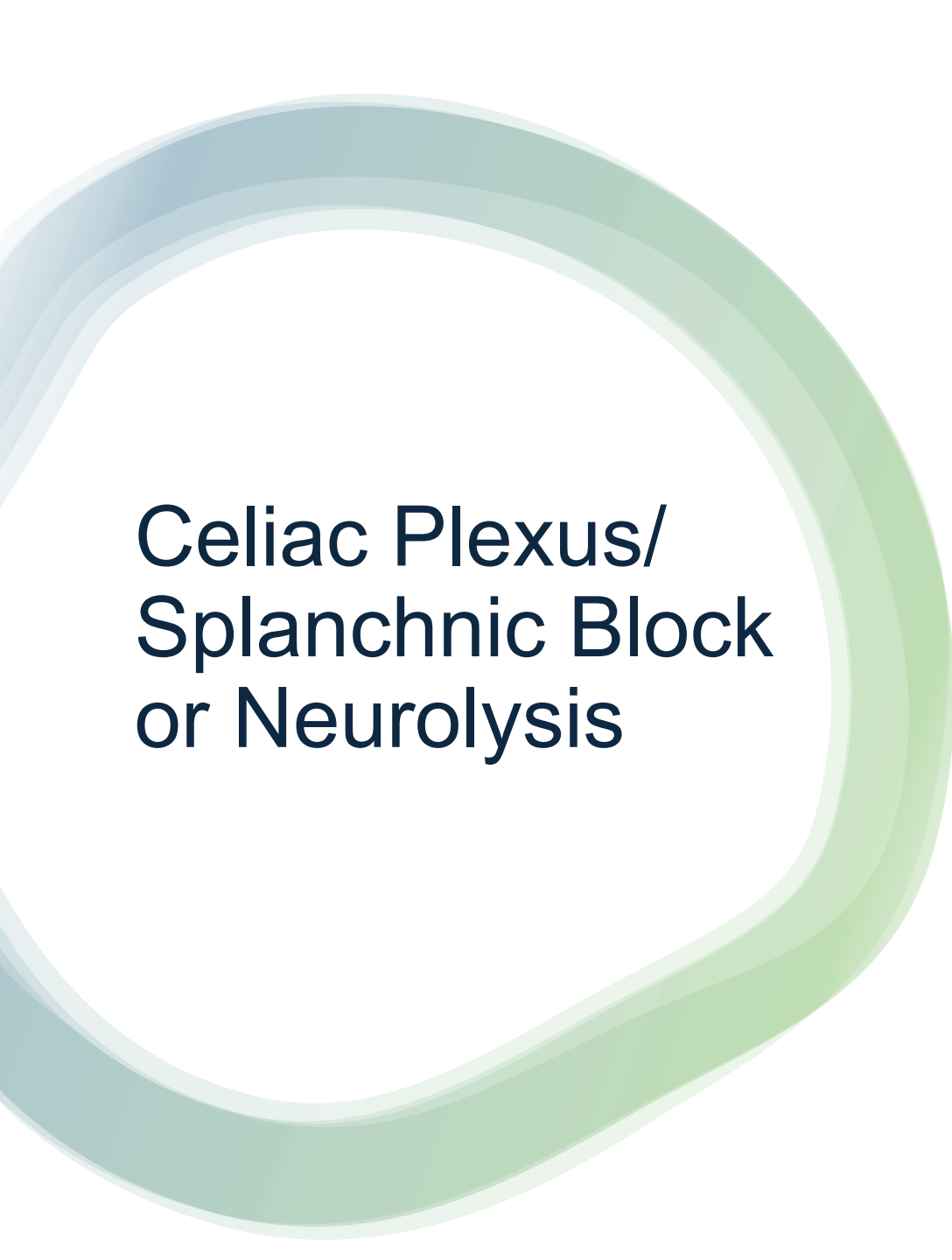
- Indication:
 - Diagnosis and treatment of CRPS
 - Impaired upper extremity perfusion
 - Phantom limb pain (upper extremity)
 - Post Radiation Neuritis
 - Intractable Head/Neck Pain
- The block is performed with needle placement at C6 beneath the prevertebral fascia and over the longus colli muscle to avoid damage to nearby vascular structures.

Stellate Ganglion Block

Complications

- Transient Horner syndrome
- Recurrent laryngeal nerve block
- Phrenic nerve block
- Pneumothorax
- Epidural or Intrathecal injection
- Inadvertent puncture of carotid artery/vertebral artery or vein

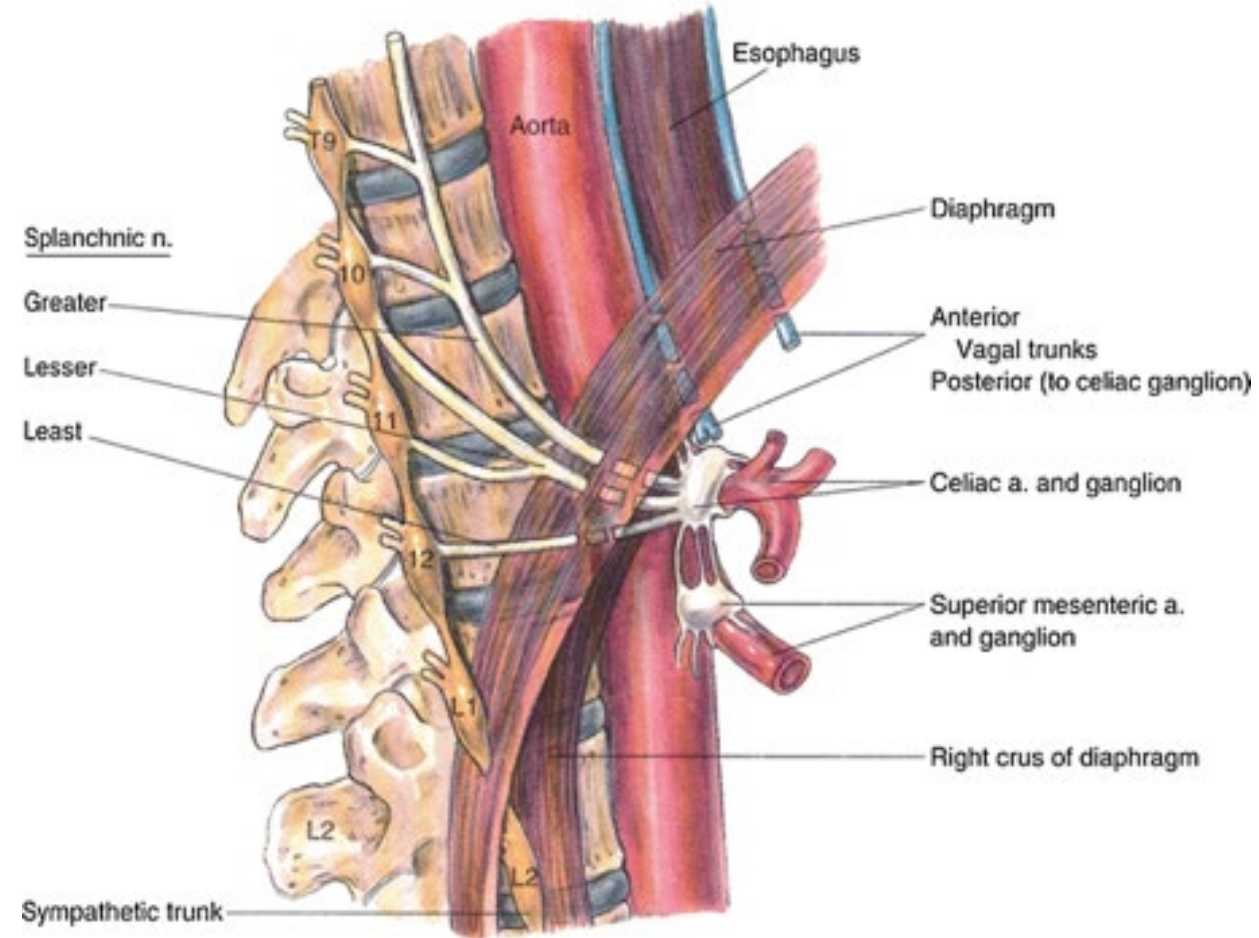


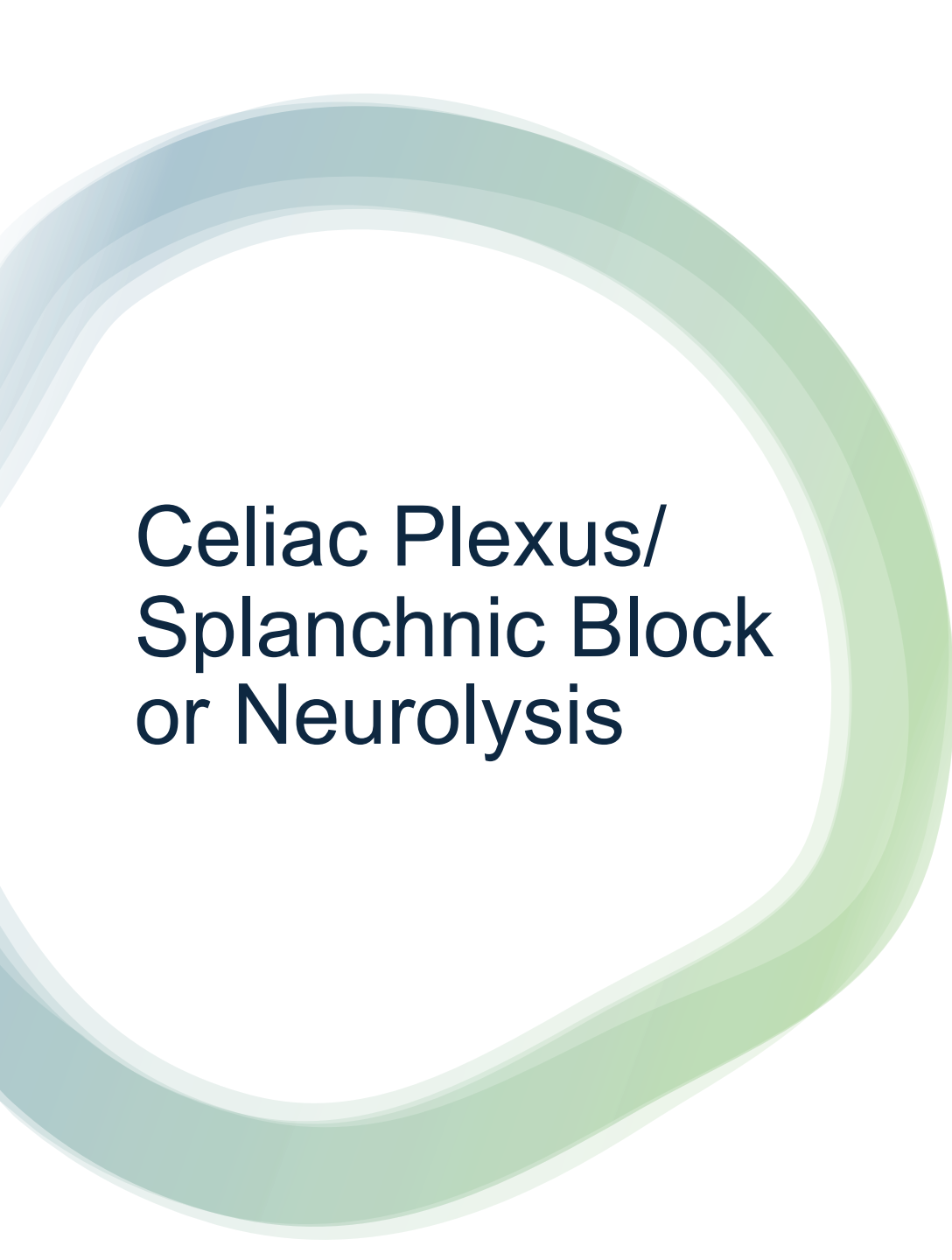


Celiac Plexus/ Splanchnic Block or Neurolysis

- Celiac Plexus is located retroperitoneally in the upper abdomen at the level of the T12 and L1 vertebrae, anterior to the crura of the diaphragm. It surrounds the abdominal aorta and the celiac and superior mesenteric arteries.
- “Celiac Axis Pain” is generally in upper abdomen and frequently refers to the back
- Visceral afferents from the lower esophagus, stomach, pancreas, liver, gall bladder and parts of the intestine up to the splenic flexure
- Block / neurolysis disrupts afferent nerves
- Patients with cancer in the upper abdomen who have a visceral pain component tend to respond well to this block (pancreatic cancer, etc)

Celiac Plexus Anatomy

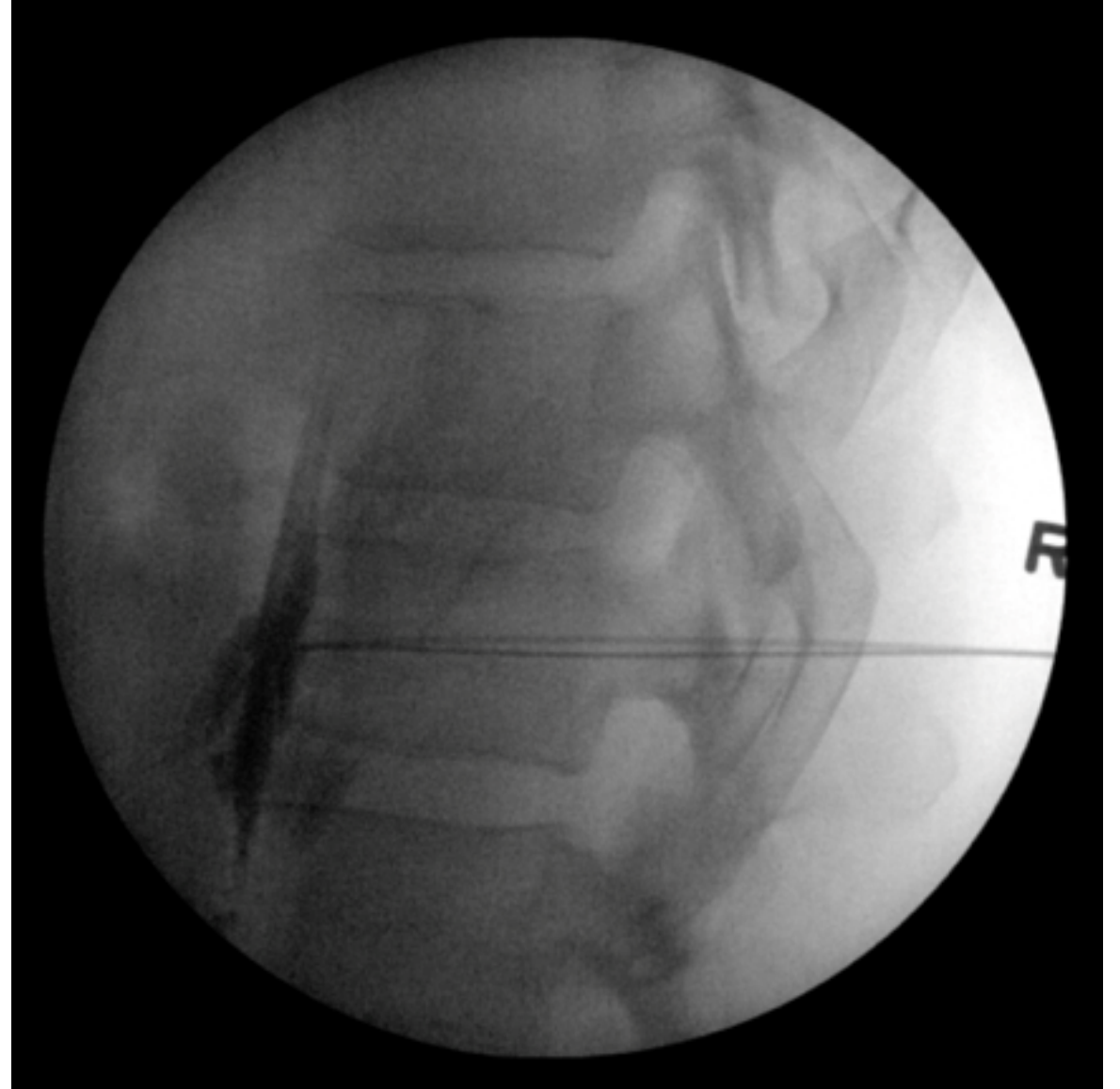




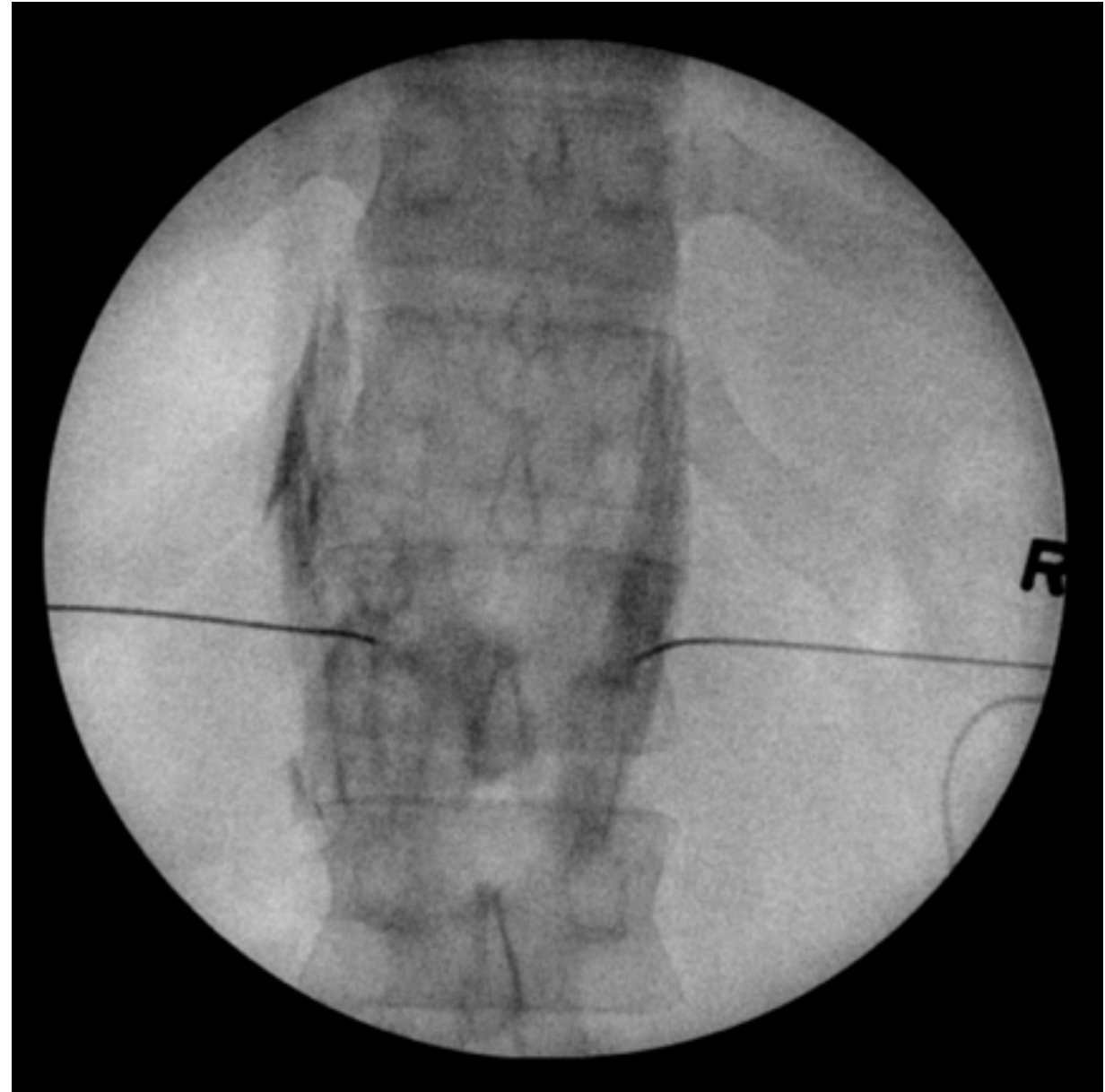
Celiac Plexus/ Splanchnic Block or Neurolysis

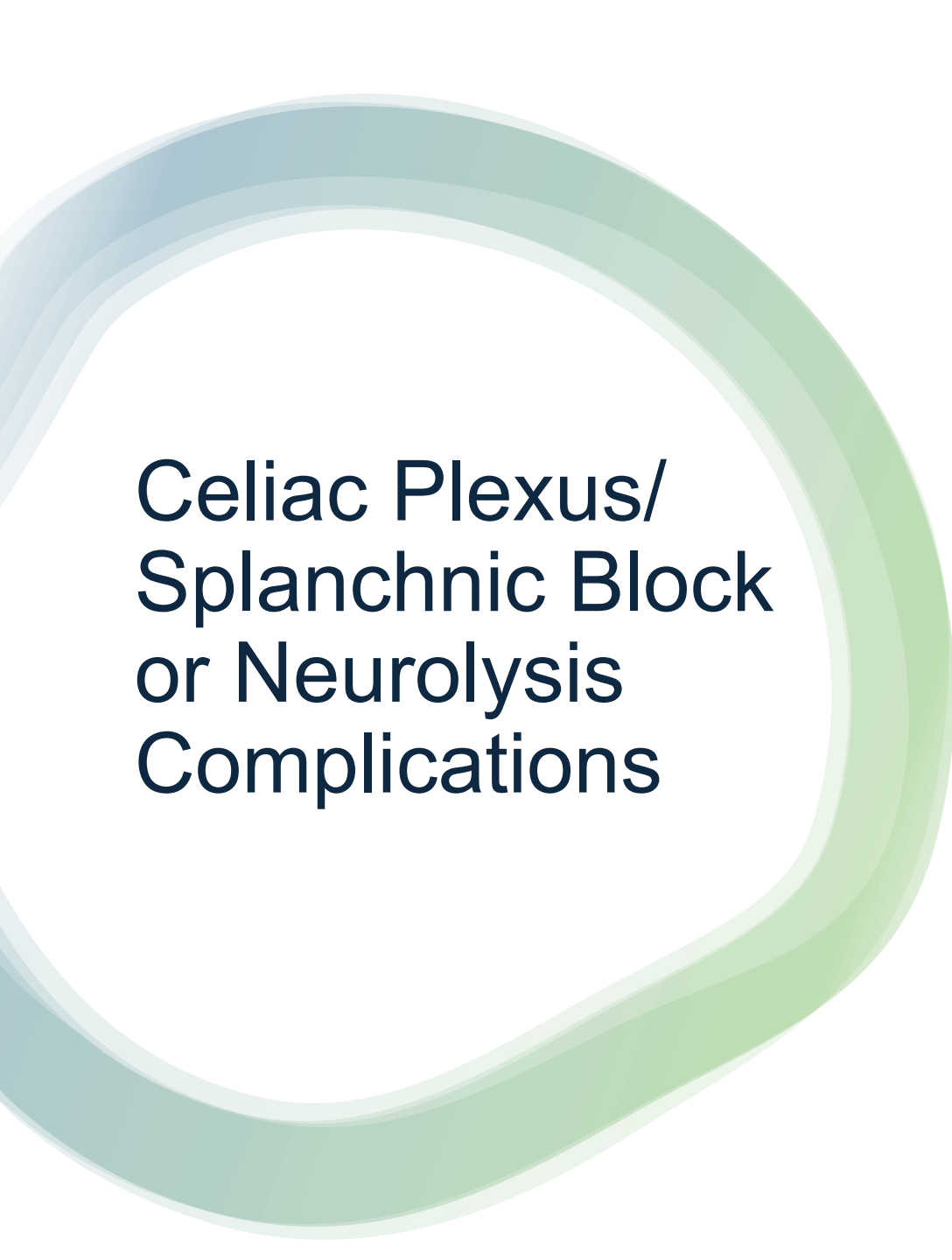
- Performed in Procedure room under Fluoroscopy (with contrast)
- Must be able to lay prone > 30 min.
- Platelets 100K+
- Off Anticoagulation
- Afebrile
- Normal WBC
- No active infection
- If recently treated for infection, procedure can be performed 14 days after last dose of full antibiotic course

Celiac Plexus/ Splanchnic Block



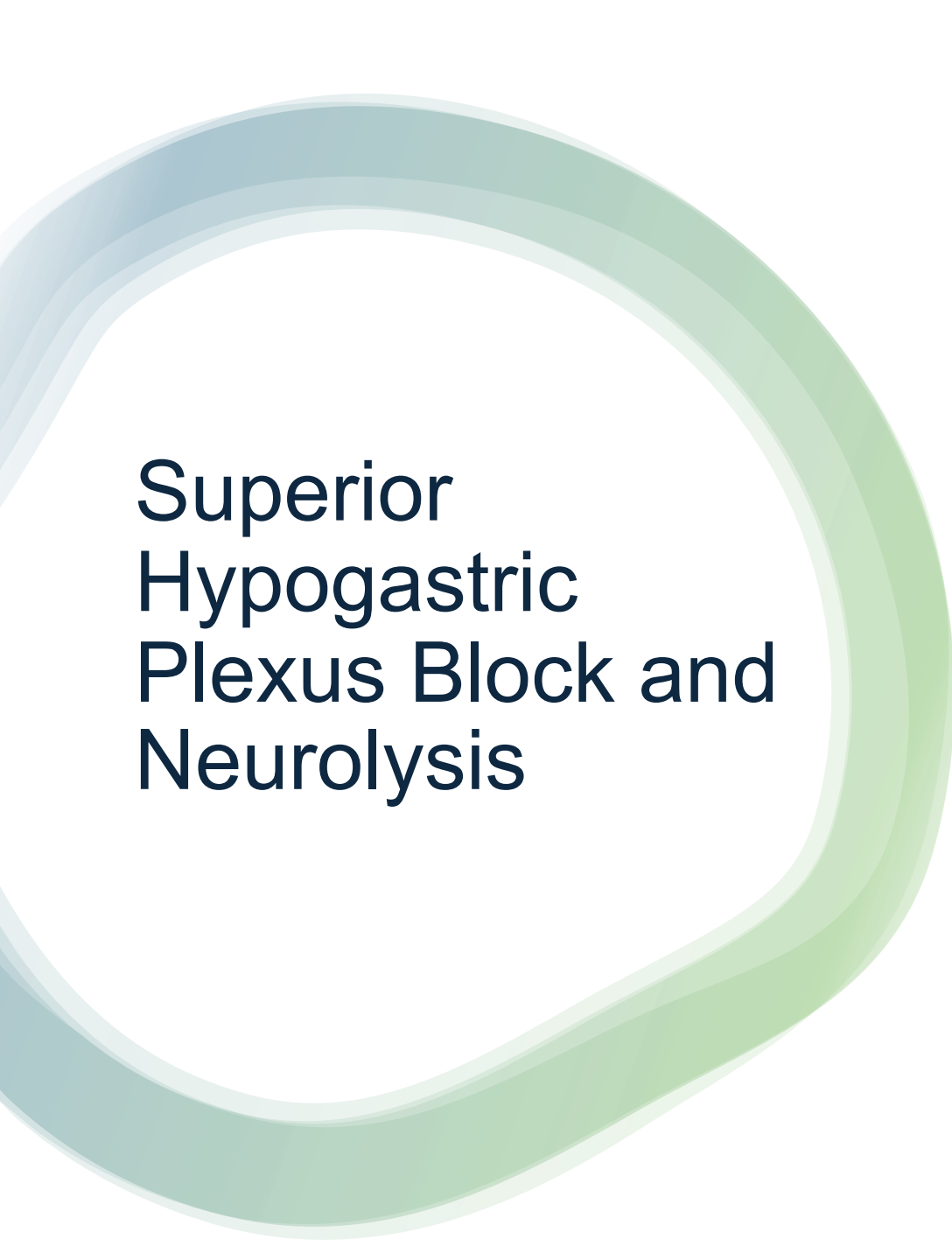
Celiac Plexus/Splanchnic Block





Celiac Plexus/ Splanchnic Block or Neurolysis Complications

- Pneumothorax
- Sensory and motor loss in lower extremities
- Spinal Cord ischemia, paraparesis and paraplegia
- Neuritis
- Inadvertent epidural or intrathecal puncture
- Chylothorax (inadvertent puncture of thoracic ducts)
- Inadvertent Vascular injection
- Hemi-diaphragmatic paralysis
- Hypotension (unopposed parasympathetic innervation, regional vasodilation and pooling within the splanchnic bed)
- Hematoma
- GI Hypermobility (usually resolves within 48 hrs)
- Kidney puncture/Hematuria
- Intravascular inj. or absorption of phenol (transient tinnitus, flushing)



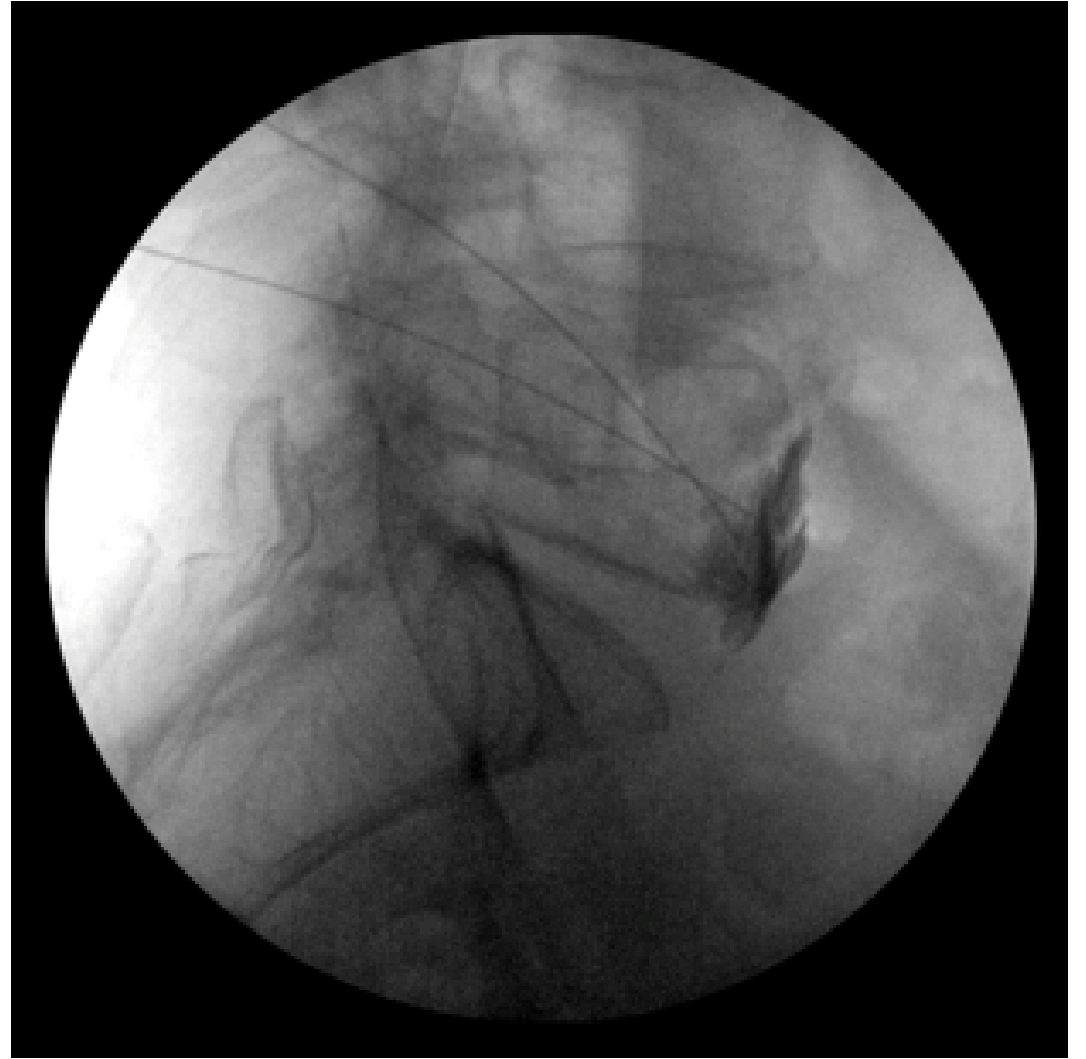
Superior Hypogastric Plexus Block and Neurolysis

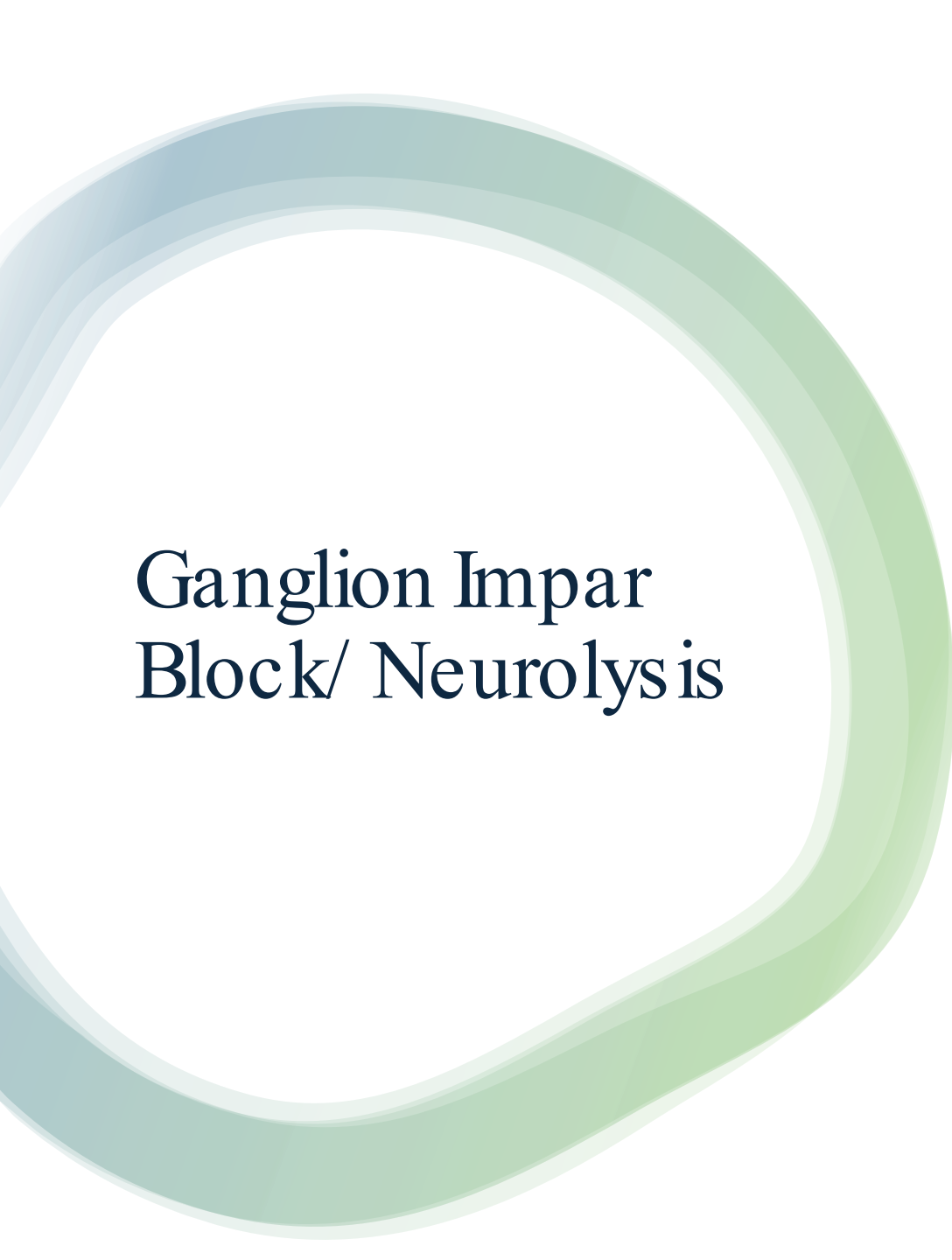
- Superior Hypogastric Plexus is located in the retroperitoneum bilaterally and extends from the lower third of the 5th lumbar vertebral body (L5) to the upper third of the 1st sacral vertebral body (S1).
- Indication:
 - Diagnostic and therapeutic block for pelvic cancer pain (cervical, vaginal, uterine, ovarian, testicular, prostatic, and rectal)
 - Benign chronic pelvic pain
- Complications:
 - Retroperitoneal hematoma
 - Hypotension
 - Damage to nearby structures
 - Acute ischemia of the foot due to dislodgement of an atherosclerotic plaque from the iliac vessels

Superior Hypogastric Plexus Block



Superior Hypogastric Plexus Block

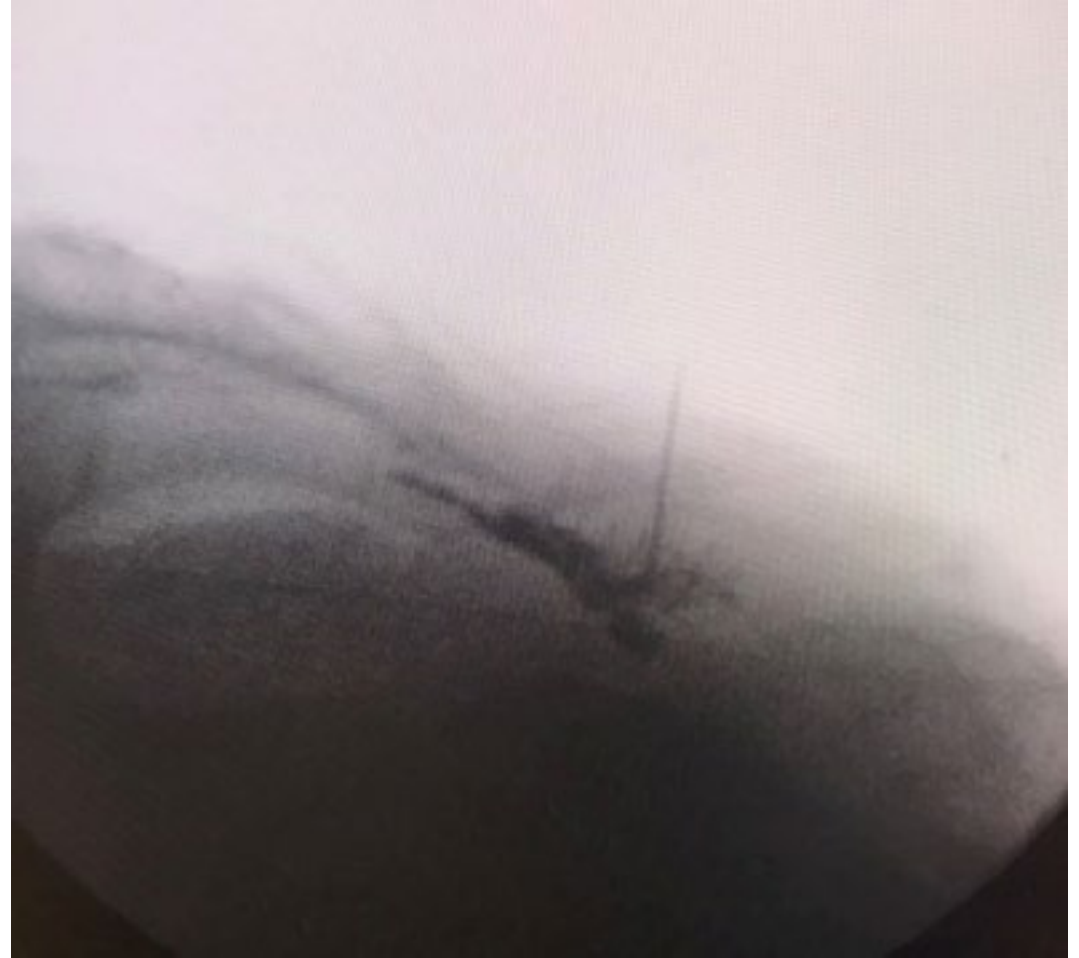


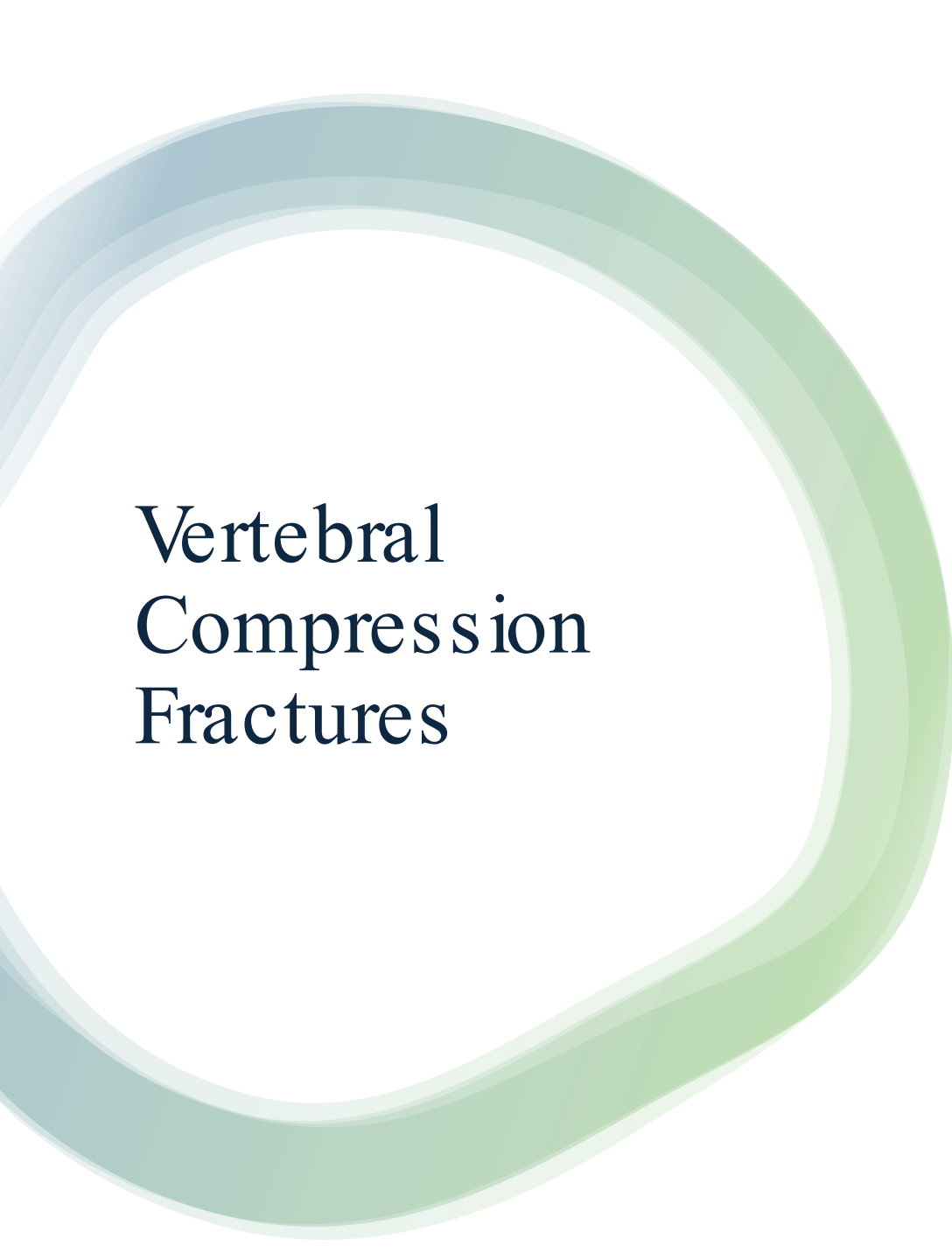


Ganglion Impar Block/ Neurolysis

- Termination of paravertebral sympathetic chains.
- Solitary retroperitoneal structure located anterior to the sacrococcygeal ligament
- Indications
 - Visceral pain in the perineal area (cervix, colon, bladder, rectum, endometrium)
 - Cancer pain originating from distal rectum, anus, perineum, and vagina
 - Coccygodynia

Ganglion Impar Block/Neurolysis





Vertebral Compression Fractures

- Incidence of 1 million / year in U.S
- Majority are caused by osteoporosis, but other causes include multiple myeloma, metastatic tumors, and hemangiomas
- More common in women
- Approximately 1/3 are symptomatic
- Cancer related VCF
 - Common in myeloma (regardless of stage), and metastatic breast, prostate, lung, renal cancers



Vertebral Compression Fracture Pain

- Patients with symptomatic vertebral compression fractures typically present with acute or subacute back pain and is sudden in onset and described as severe aching pain at midline location and exacerbated with movement, coughing, sneezing, and bowel exertion.
- Conservative management includes back bracing, rest, NSAIDs, opioids
- If no improvement with conservative therapy, consider vertebral augmentation if appropriate
- MRI (or CT if MRI contraindicated) needed to assess age of the fracture and determine presence of canal compromise or tumor presence.
- Edema on advanced imaging is highly predictive of success with vertebral augmentation

Vertebral Augmentation

- Percutaneous image guided injection of PMMA(cement) into the vertebral body
- Stabilization of fractured bone
- Performed with Fluoroscopy or CT
- Kyphoplasty vs Vertebroplasty



Kyphoplasty vs. Vertebroplasty

Kyphoplasty

- Balloon used to create cavity in vertebral body
- More expensive
- More time required
- May restore vertebral height if < 3 months
- Lower chance of cement extrusion
- May be safer with retropulsion

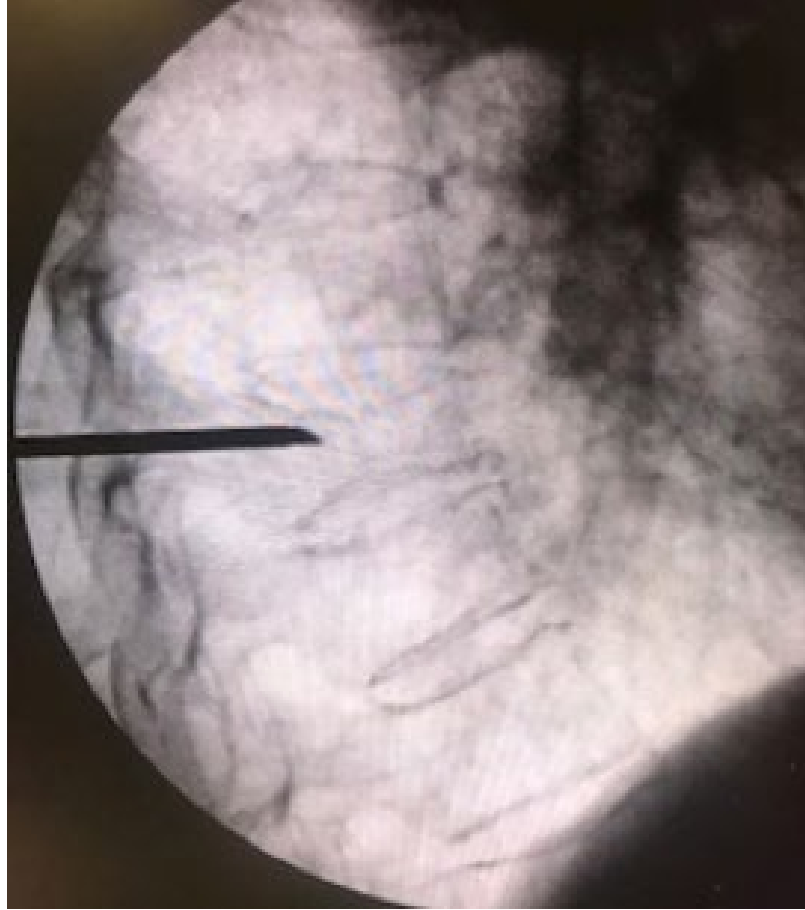
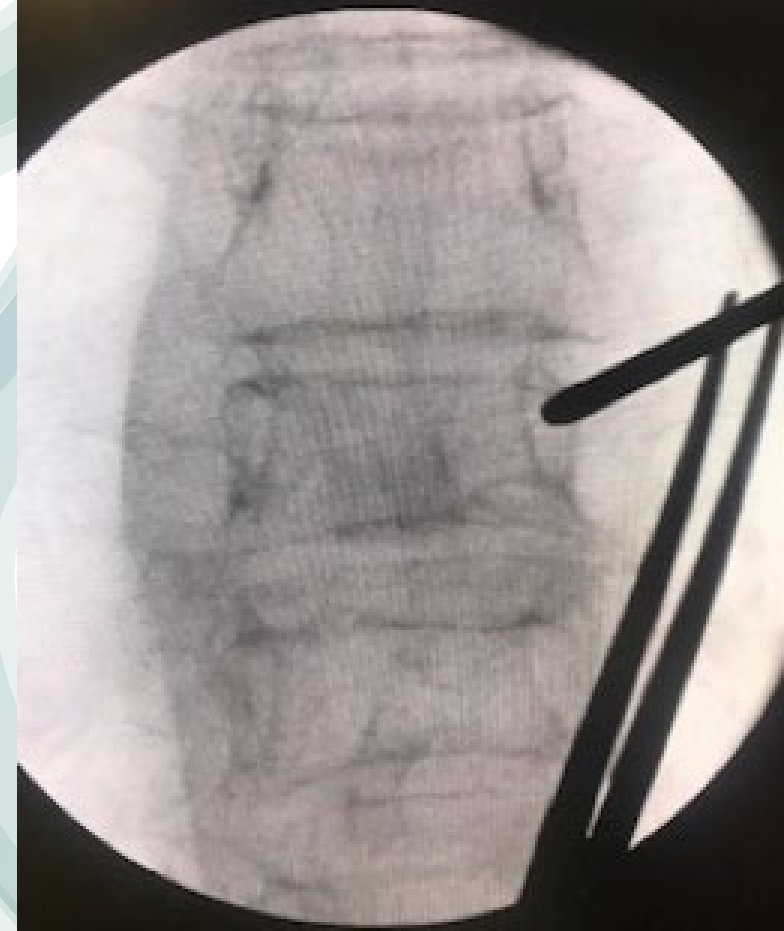
Vertebroplasty

- Cement directly injected into vertebral body
- Less expensive
- Less time required
- No restoration of height, indicated for > 3 months
- Higher chance of cement extrusion



Vertebral Augmentation



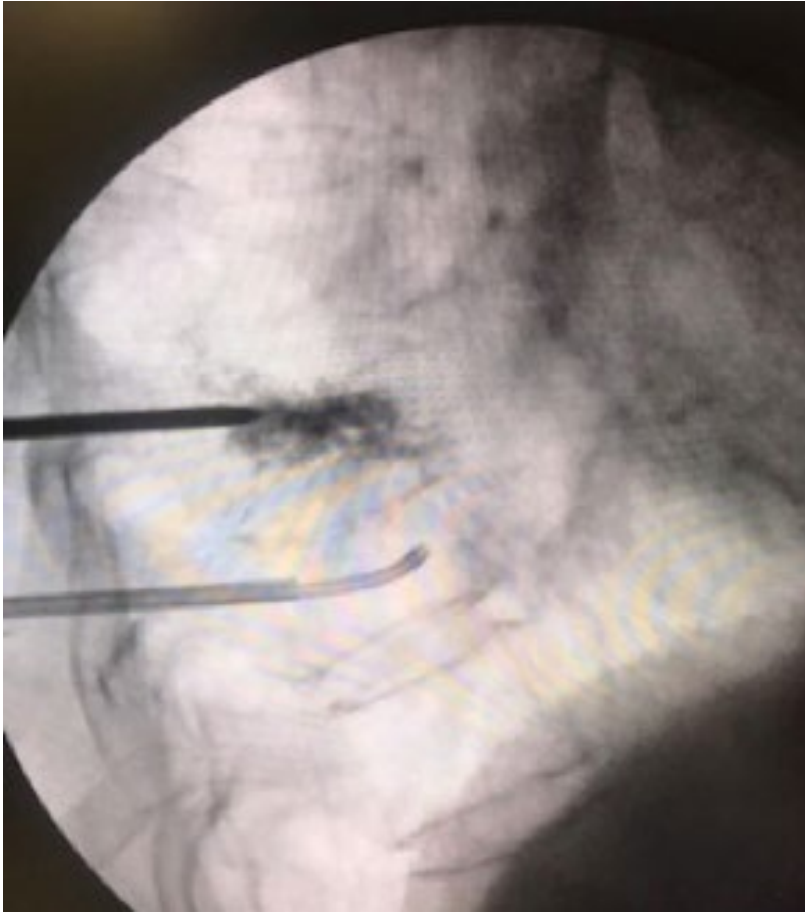


Vertebral Augmentation

Vertebral Augmentation

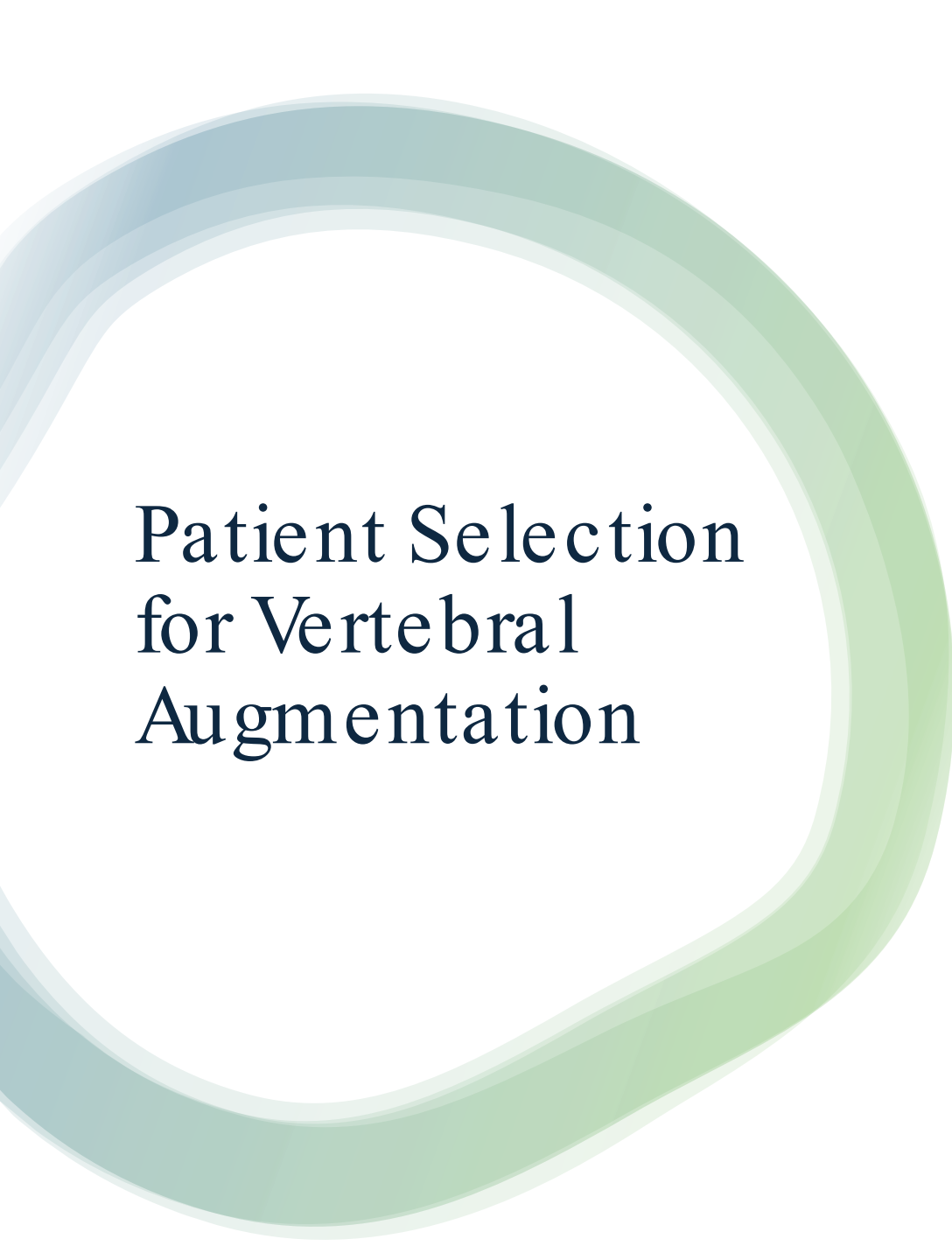


Vertebral Augmentation



Vertebral Augmentation

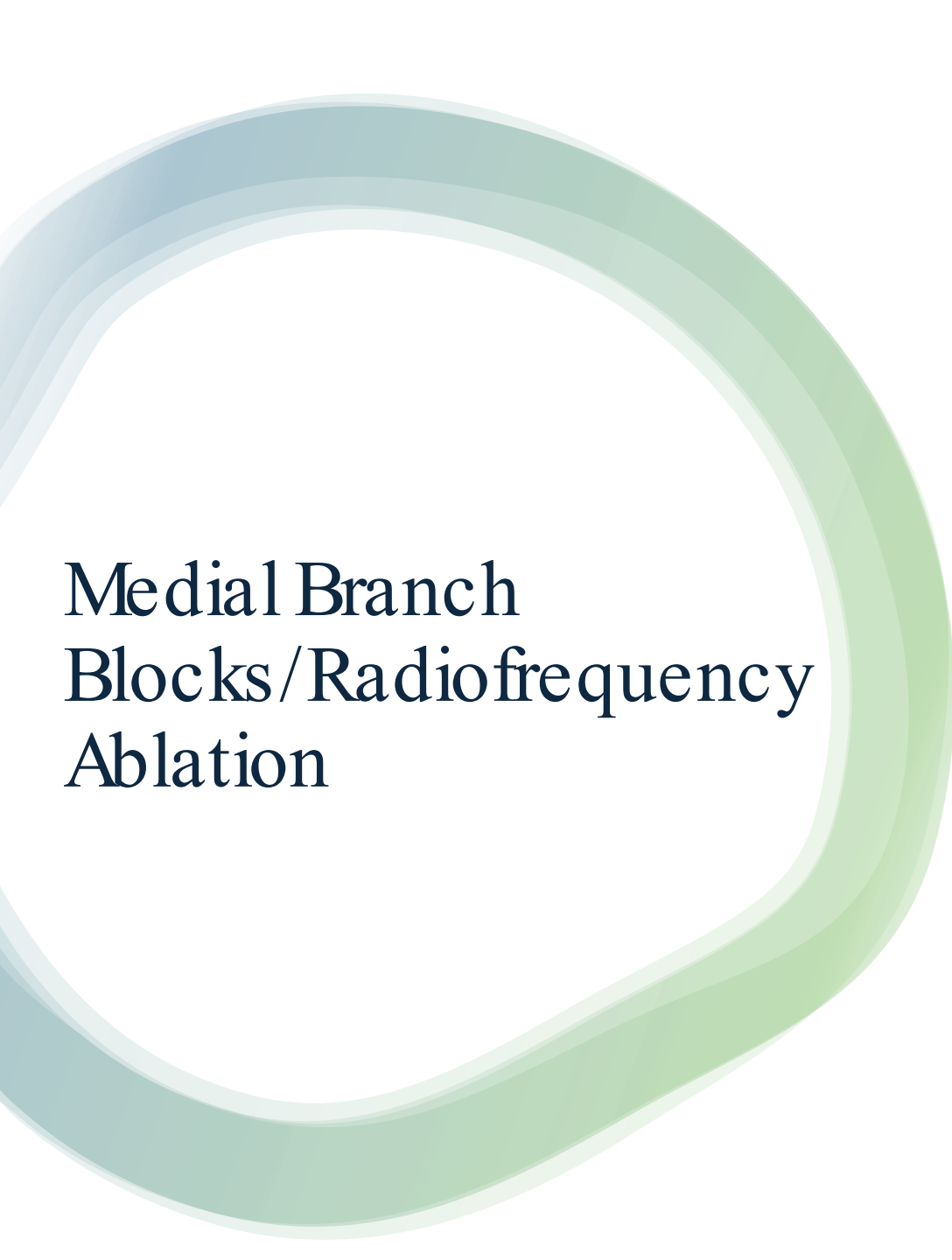




Patient Selection for Vertebral Augmentation

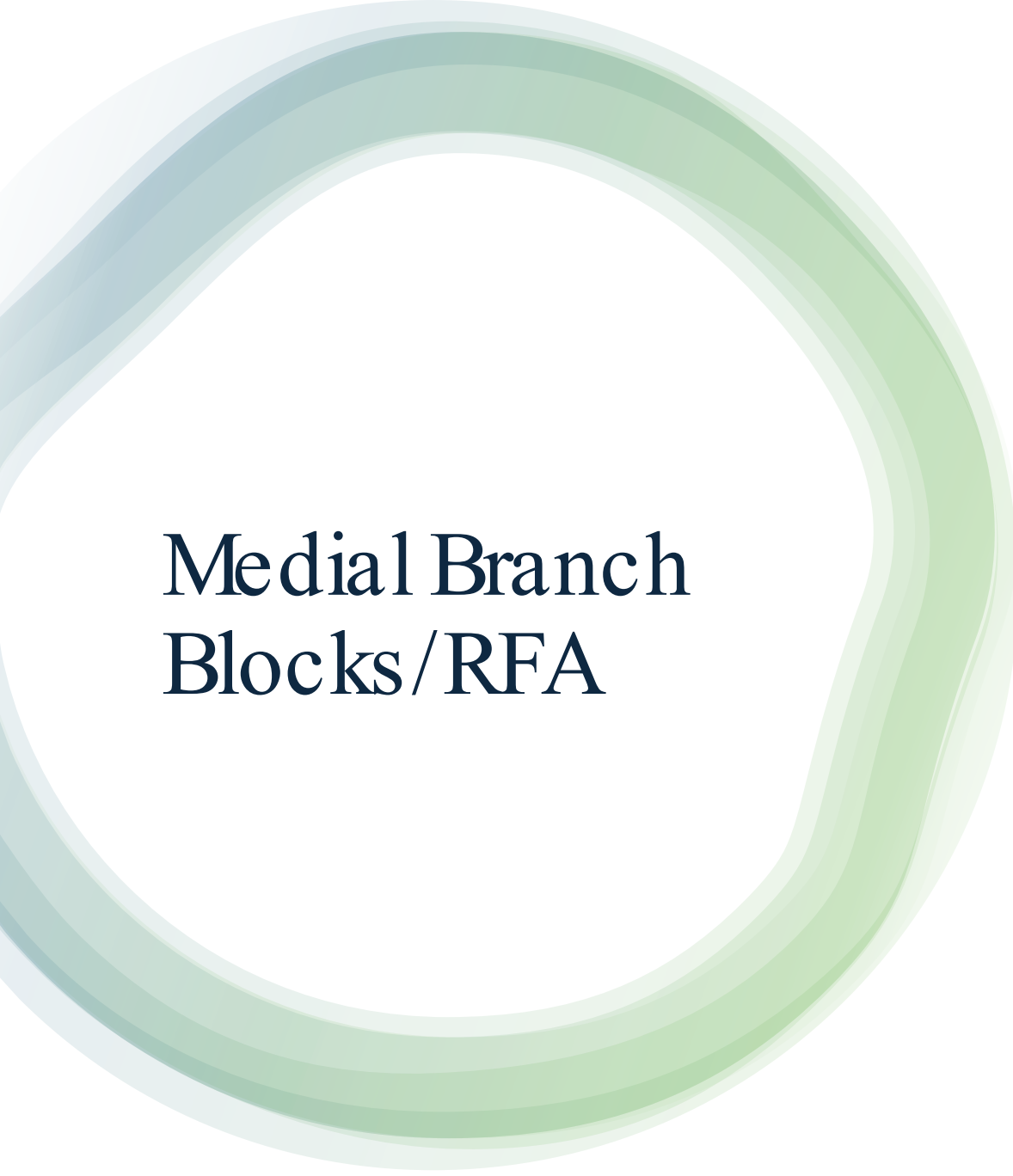
Best Therapeutic Response

- Acute to sub-acute fracture
- Edema on imaging
- Concordant pain on exam
- Fracture <6 months old or recent worsening of fracture



Medial Branch Blocks/Radiofrequency Ablation

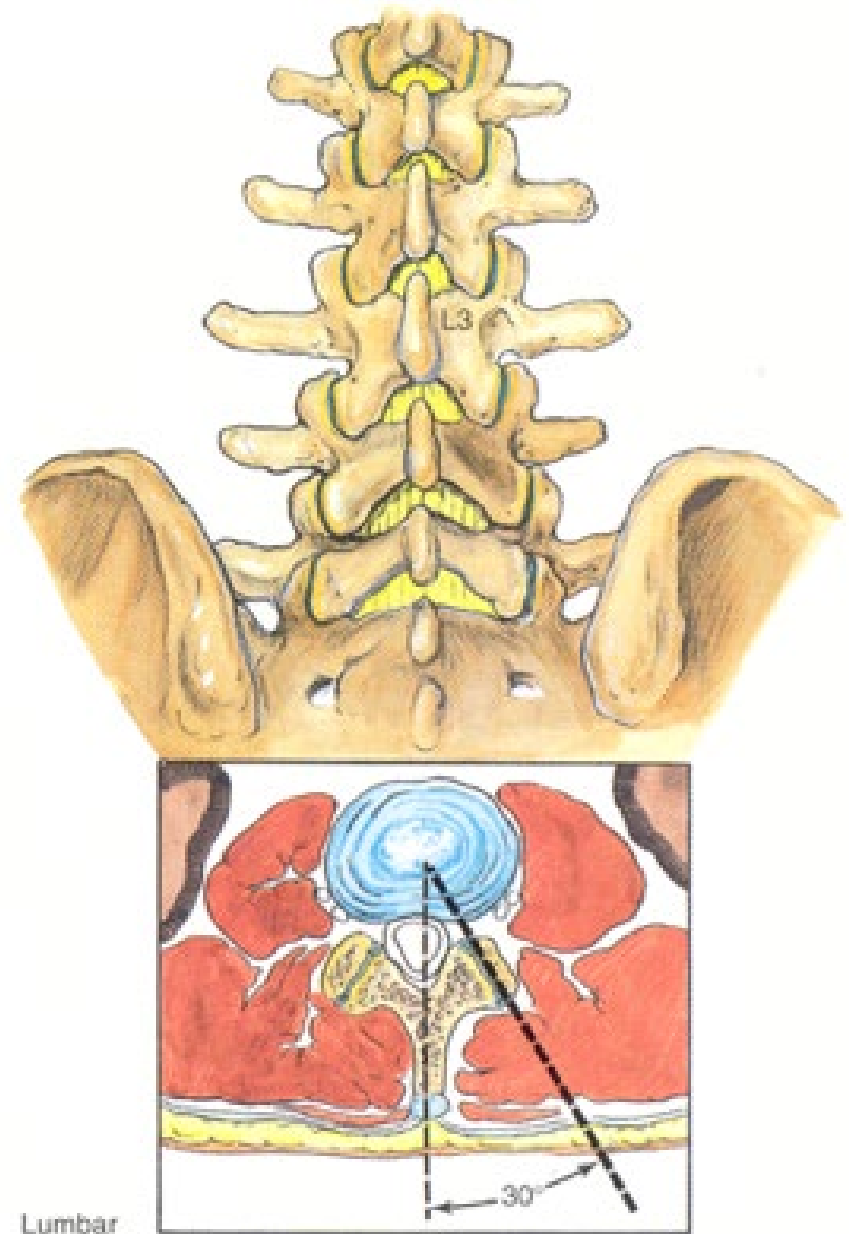
- Facet Joint mediated pain
- Synovial joint formed by the inferior and superior articular processes
- Allow flexion, extension, and rotation of the vertebral column.
- Facet joint has dual innervation. Medial branch of the posterior ramus innervate joint at its own level and one level below.

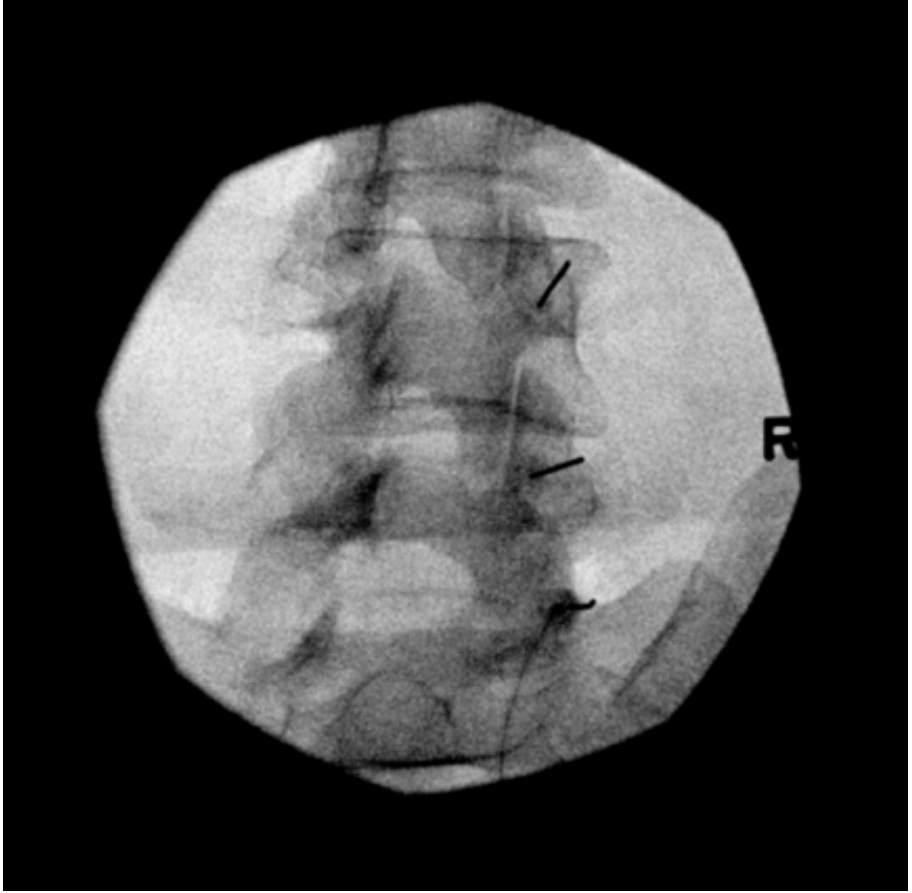


Medial Branch Blocks/RFA

- Indication:
 - Axial back and neck pain
 - Persistent pain after vertebral augmentation
- Patient selection
 - Physical Exam (pain with palpation of the facet joints and with facet loading, extension and rotation)
 - Radiological study

Lumbar Facet Joints





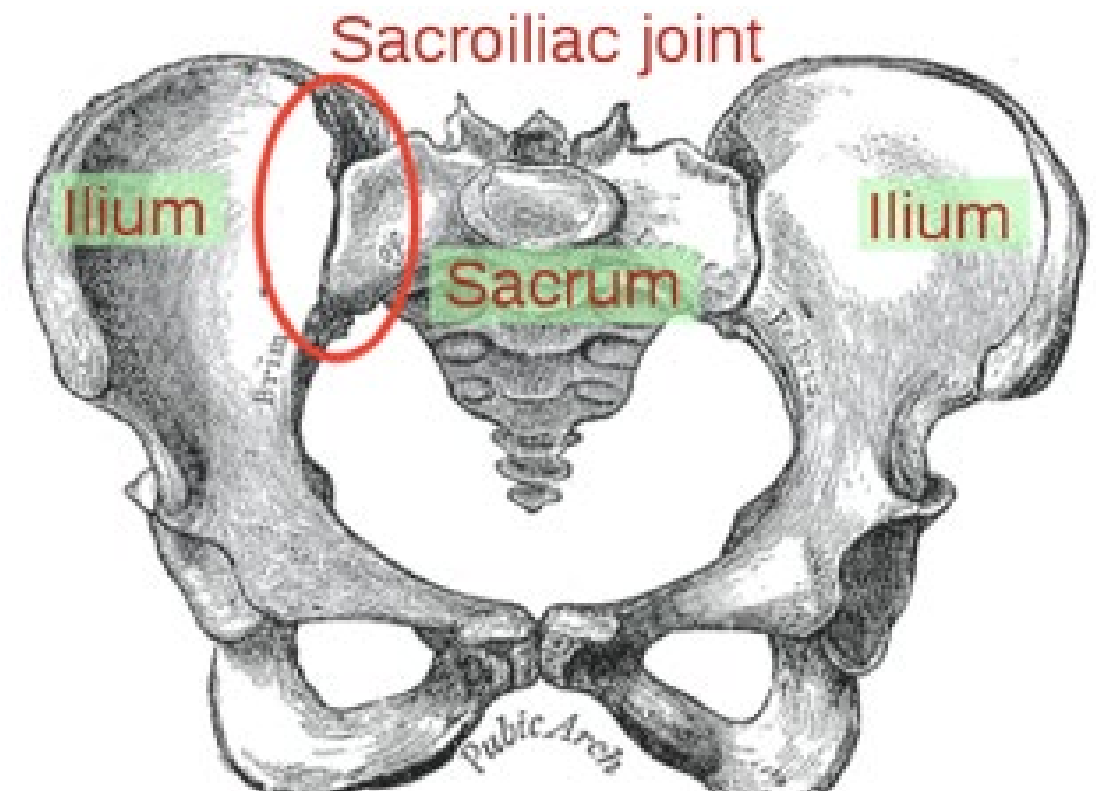
Medial Branch Block/RFA



Sacroiliac Joint

- Asynovial joint joining sacrum and ilium
- Primary function is stability and weight bearing; very small degrees of rotation and translation
- Causes of pain: arthritis, spondyloarthopathy (inflammatory arthritis), ligamentum laxity or injury, trauma, myofascial pain, enthesopathy, malignancy, infection

Sacroiliac Joint Anatomy



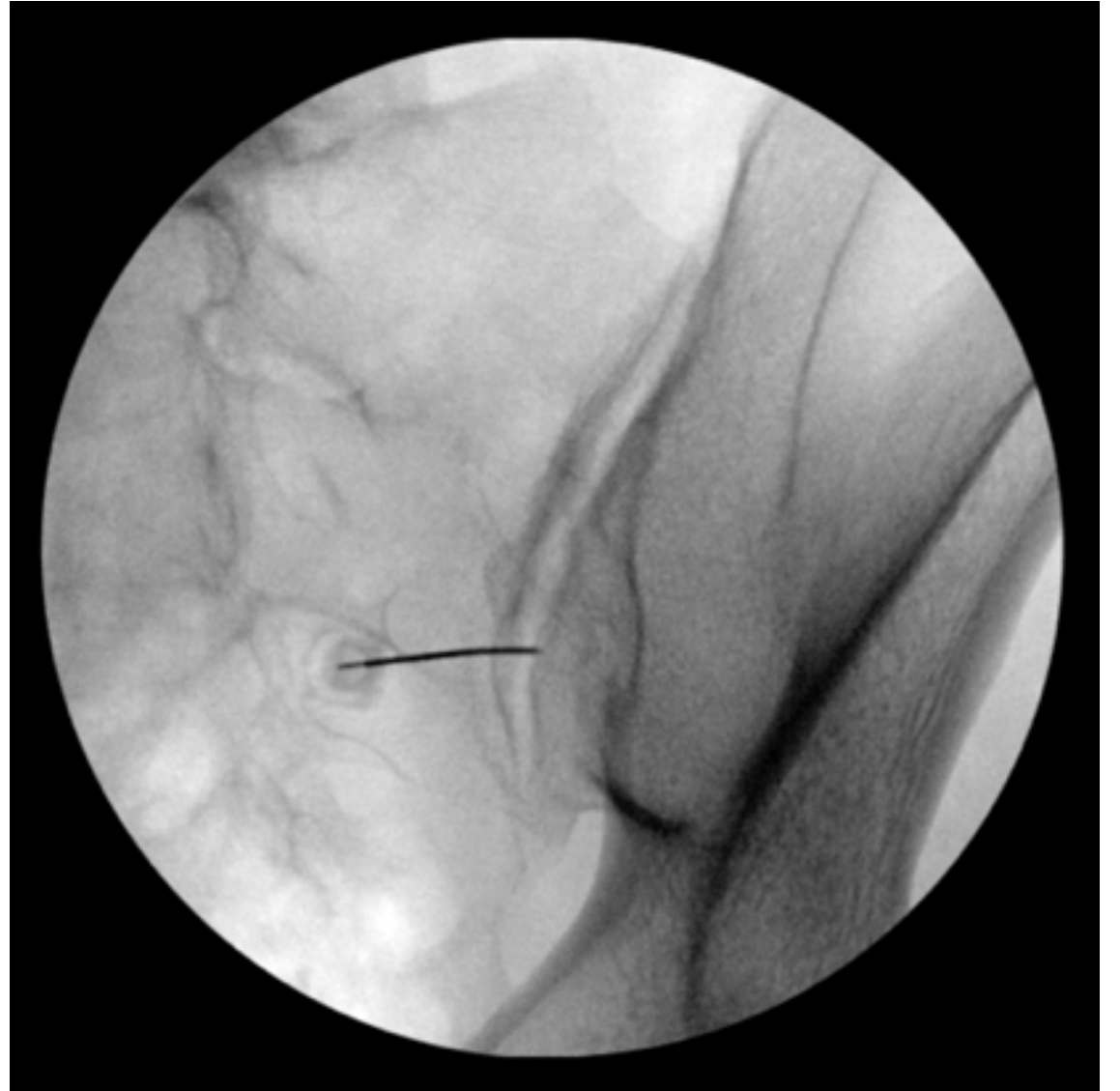


Sacroiliac Joint Injection/ Radiofrequency Ablation

Indication:

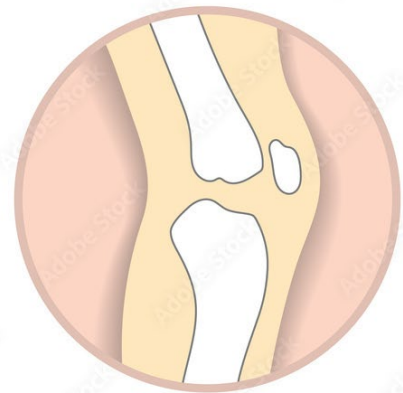
- Unilateral or Bilateral LBP that may radiate to buttock, groin, or leg.
- Physical exam: Patrick's test (FABER), PSIS, SI-compression, SIDistraction, Yeoman Test, Gaenslen's Test, etc
- Radiofrequency ablation of the sacral lateral branches may provide longer term relief (covered less and less by insurances)

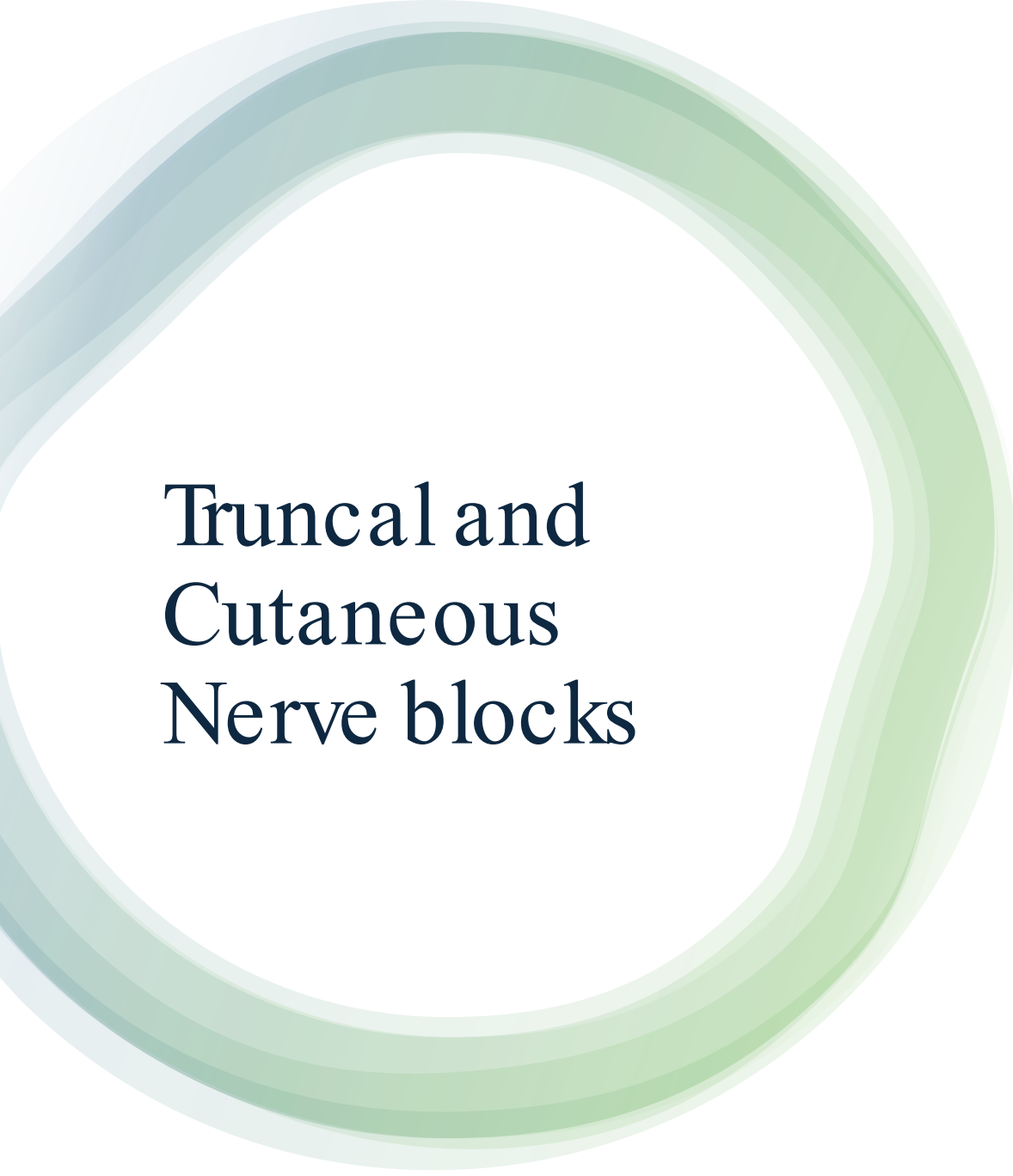
SI Joint Injection



Additional Peripheral Joint Injections & Ablations

- Shoulder
- Hip
- Knee





Truncal and Cutaneous Nerve blocks

- Intercostal nerve blocks/ paravertebral nerve blocks
 - Truncal Pain, incisional pain
 - Post-mastectomy pain, thoracotomy pain
- Ilioinguinal/Iliohypogastric
 - Inguinal surgery, suprapubic incisional pain
- Transversus Abdominal Plane Block (TAP)
 - Post-surgical abdominal wall pain

Surgical Interventions for Cancer Pain

- Intrathecal Drug Delivery
- Neuromodulation (SCS)

Cancer Pain Algorithm

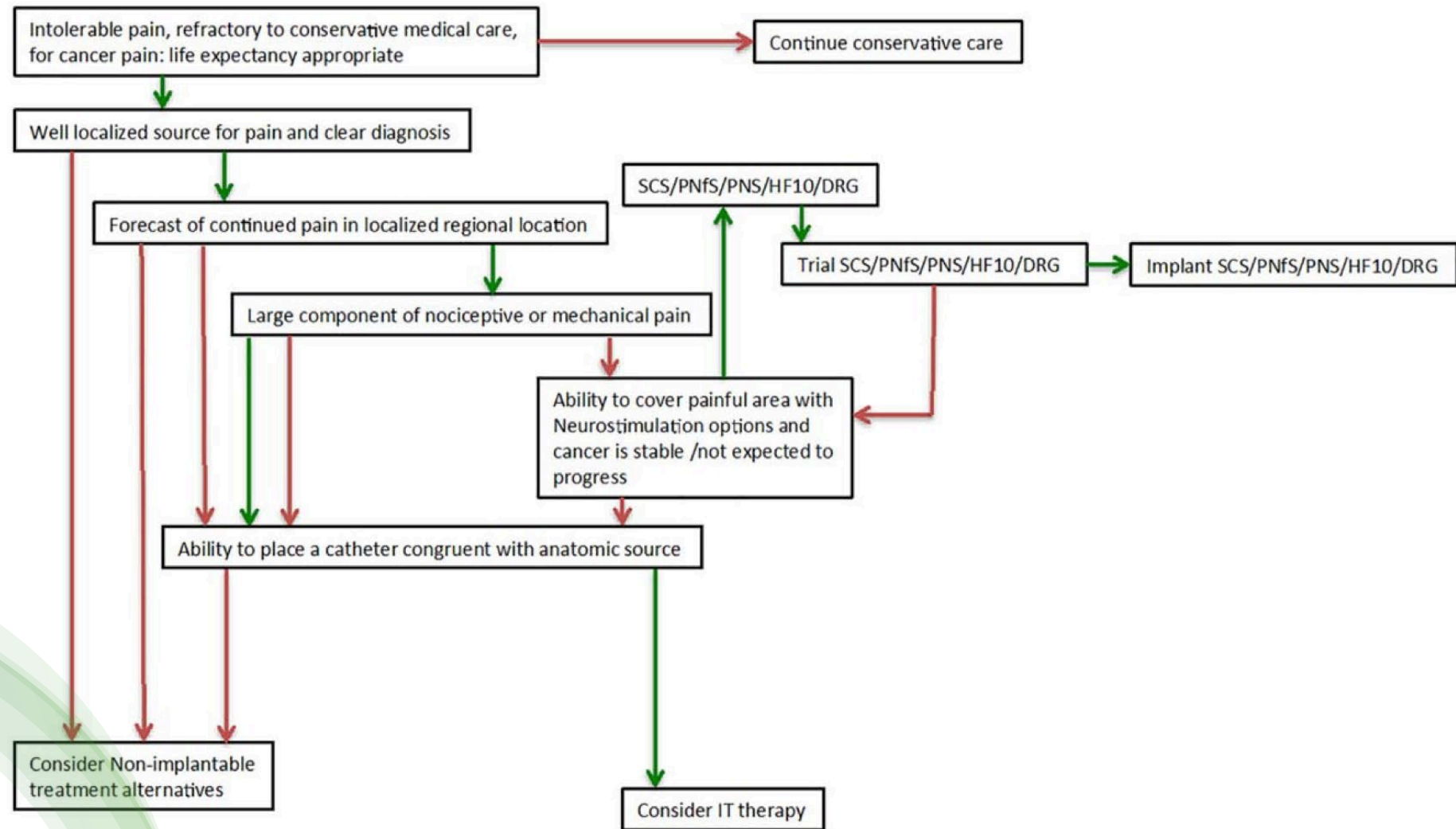
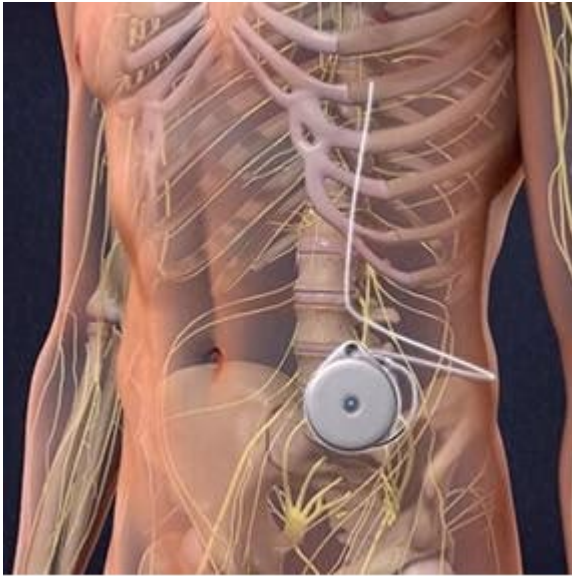
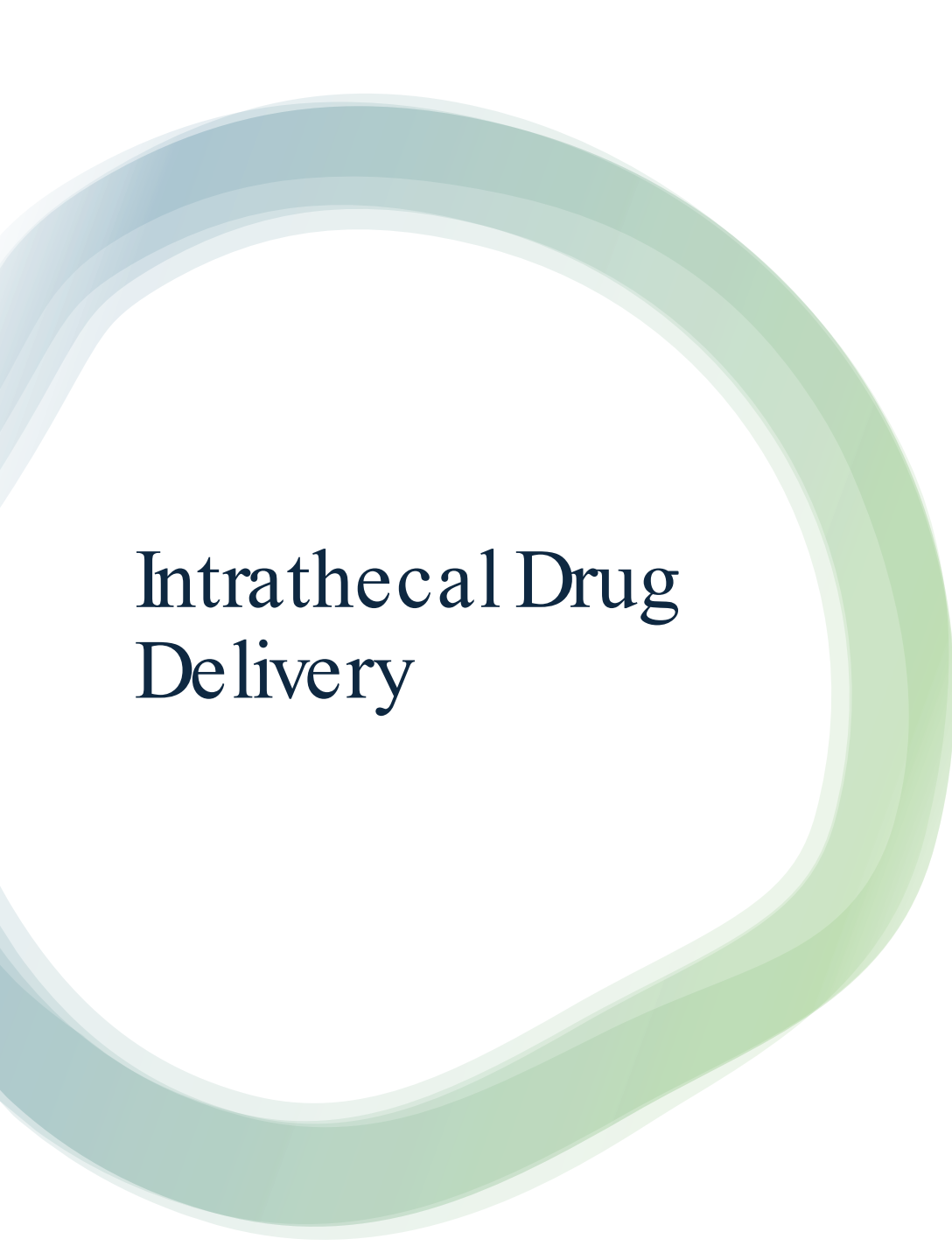


Figure 3. Pain care algorithm for cancer-related pain. DRG, dorsal root ganglion; HF10, high frequency stimulation; PNfS, peripheral nerve field stimulation; PNS, peripheral nerve stimulation; SCS, spinal cord stimulation. Green arrows indicate affirmation or positive response; red arrows signify negative response.

Intrathecal Drug Delivery



- Electronic system with continuous delivery of neuraxial medication
- Catheter inserted into the intrathecal space then tunneled to abdomen where the pump and medication reservoir is implanted
- Disadvantages of chronic oral opioid use
 - Increased side effects
 - Hyperalgesia
 - Tolerance
 - Pseudoaddiction
- Benefits of IDDS
 - Limits side effects
 - Higher concentration at analgesic site



Intrathecal Drug Delivery

Good Candidates

- Intolerable side effects on oral medications
- Inadequate (but present) analgesia on optimal medications
- Necessary to deliver CSF specific drugs (ziconitide)
- Patients with advanced stage cancer at presentation and life expectancy > 3 months
- Well localized pain with ability to place catheter tip congruent with anatomic source

Poor Candidates

- "Nothing else works"
- Unmet psychiatric needs
- Active or untreated addiction
- Cannot follow-up

Intrathecal Pump Complications

Table 2 Technical complications associated with intrathecal drug delivery		
Complication	Symptoms	Management
Superficial skin infection	Erythema along incision	Oral or IV antibiotics, rarely system must be removed
Pump pocket infection	Erythema or drainage from incision, pocket erythema or tenderness, possible systemic symptoms (fever, chills, malaise)	Must remove pump; catheter often removed; antibiotics per cultures
Pump pocket seroma/hematoma	Swelling and palpable fluid around pump pocket	Abdominal binder, warm compresses; may require ultrasound-guided drainage of fluid
Meningitis	Headache, nuchal rigidity, altered mental status, fever, chills	Must remove pump and catheter; antibiotics per cultures
Postdural puncture headache	Fronto-occipital postural headache	Conservative management with rest and fluids; rarely epidural blood patch required if symptoms persist >2 wk
Pump malfunction (overinfusion)	Lower-than-expected reservoir volume at time of pump refill; intrathecal medication side effects, such as sedation, respiratory depression, lower extremity weakness, bradycardia, and so forth	Pump replacement
Pump malfunction (underinfusion)	Greater-than-expected reservoir volume at time of pump refill; diminishing analgesia; may provoke baclofen or clonidine withdrawal symptoms	Monitoring considered if underinfusion is mild and patient asymptomatic; may require pump replacement
Pump motor stall	Sudden loss of analgesia; may provoke life-threatening withdrawal syndrome with baclofen	Supportive care, pump replacement
Catheter malfunction	Decreased analgesia, inability to withdraw CSF from catheter access port, greater-than-expected reservoir volume at time of pump refill; may provoke baclofen or clonidine withdrawal symptoms; confirm with imaging	Intrathecal catheter revision (kinking of catheter) or replacement (catheter tip obstruction)
Catheter tip granuloma	Diminishing analgesia, new neurologic symptoms; associated with high doses and high concentrations of infusate	If no neurologic symptoms are present use less concentrated solution and monitor symptoms. The development of neurologic symptoms necessitates intrathecal catheter revision or replacement and myelopathy may require surgical decompression.



Spinal Cord Stimulation

- Spinal Cord Stimulation
 - The application of controlled pulsed electrical energy near neural structures to modulate pain
- Dorsal Column Stimulation – traditional SCS
- Dorsal Root Stimulation – DRG stimulator

Spinal Cord Stimulation in Cancer Related Pain

- While cancer related pain symptoms have traditionally been managed with medications, injections, and neuraxial therapies, there is low-level evidence that SCS and DRG stimulation should be considered as an additional therapeutic option.
- Might consider SCS in patients who have pain associated with instrumentation of the spine due to tumor invasion, metastasis, patients with chemotherapy induced peripheral neuropathy, and patients with CRPS related to their cancer or cancer treatment
- Is the patient appropriate for a spinal cord stimulator? Often patients will be immunosuppressed, have issues with wound healing, or are dealing with coagulopathies

Spinal Cord Stimulation in Cancer Related Pain

- Traditional Indications for SCS include management of chronic, intractable pain of the trunk and/or limbs including unilateral or bilateral pain associated with conditions such as:
 - Failed Back Syndrome
 - Post laminectomy pain
 - Radicular pain syndrome resulting in pain secondary to FBS or herniated disk
 - Degenerative Disk Disease (DDD)/herniated disk pain refractory to conservative and surgical interventions
 - Complex Regional Pain Syndrome (CRPS)
 - Painful Diabetic Peripheral Neuropathy

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