City of Hope

**Multidisciplinary Approaches to Cancer Symposium**

# Cancer Pain Management: Interventional Therapies

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City of Hope Medical Center

# Disclosures

- I do not have any relevant financial relationships.

*This presentation and/or comments will provide a balanced, non-promotional, and evidence-based approach to all diagnostic, therapeutic and/or research related content.*

# Cultural Linguistic Competency (CLC) & Implicit Bias (IB)

**STATE LAW:**

The California legislature has passed Assembly Bill (AB) 1195, which states that as of July 1, 2006, all Category 1 CME activities that relate to patient care must include a cultural diversity/linguistics component. It has also passed AB 241, which states that as of January 1, 2022, all continuing education courses for a physician and surgeon **must** contain curriculum that includes specified instruction in the understanding of implicit bias in medical treatment.

*The cultural and linguistic competency (CLC) and implicit bias (IB) definitions reiterate how patients' diverse backgrounds may impact their access to care.*

***EXEMPTION:***

Business and Professions Code 2190.1 exempts activities which are dedicated solely to research or other issues that do not contain a direct patient care component.

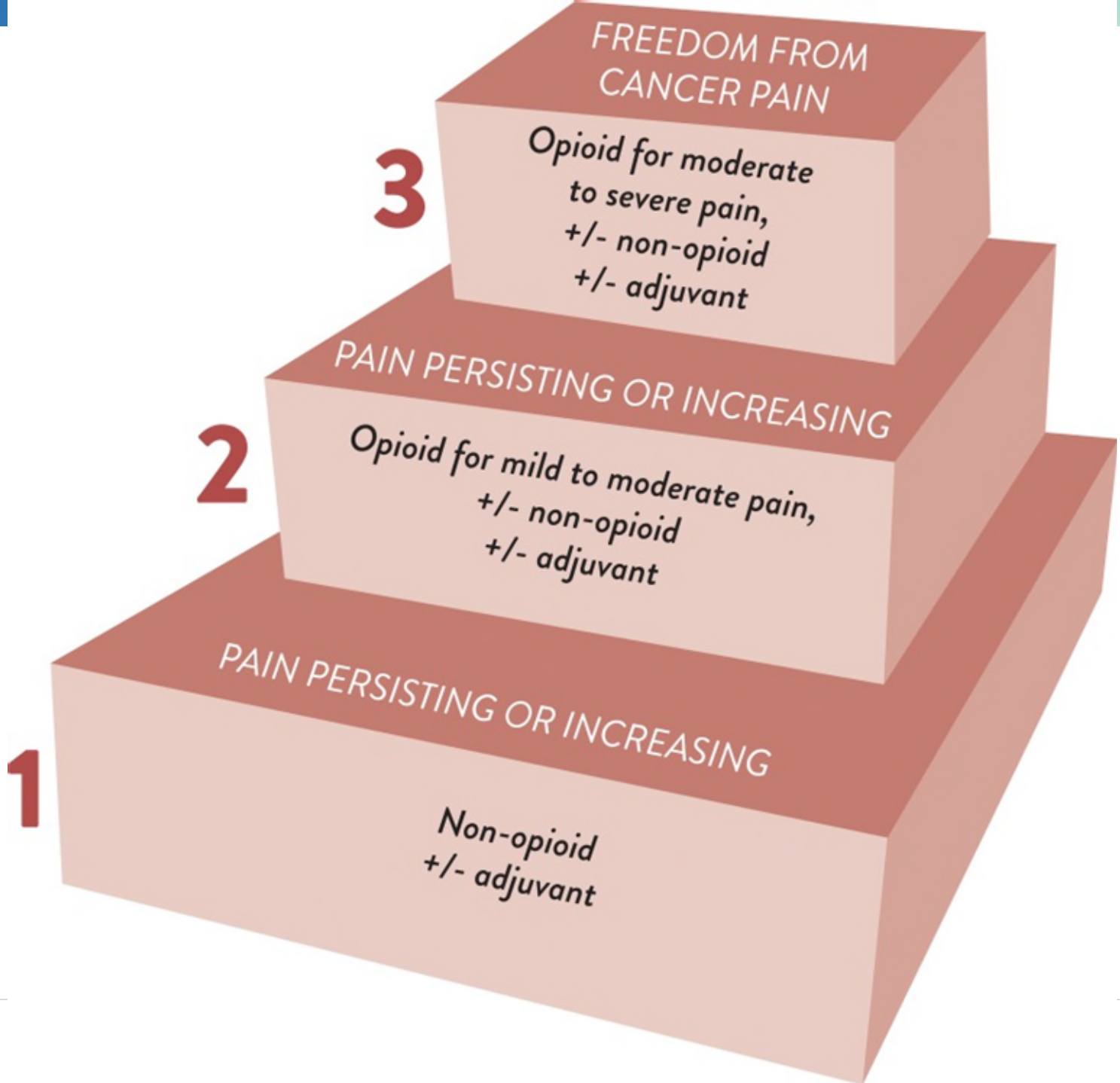
***The following CLC & IB components will be addressed in this presentation:***

- *Consider racial and age disparities.*

# Is it time to revisit current algorithm of cancer pain management??

The WHO analgesic ladder has served as the guideline since 1986

Revised algorithm added " Invasive and Minimally Invasive treatments" as step 4


FREEDOM FROM CANCER PAIN
3
Opioid for moderate to severe pain, +/- non-opioid +/- adjuvant
PAIN PERSISTING OR INCREASING
2
Opioid for mild to moderate pain, +/- non-opioid +/- adjuvant
PAIN PERSISTING OR INCREASING
1
Non-opioid +/- adjuvant

# Goals of Cancer Related Pain Management

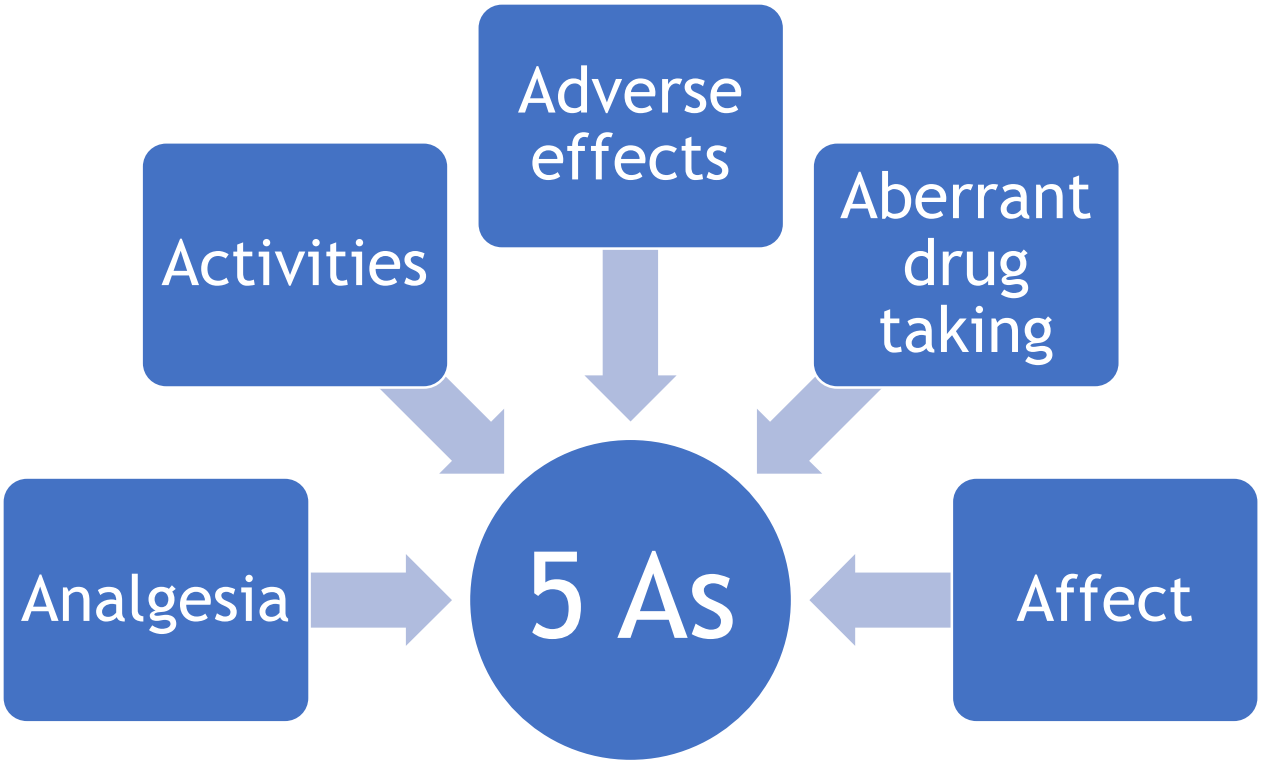
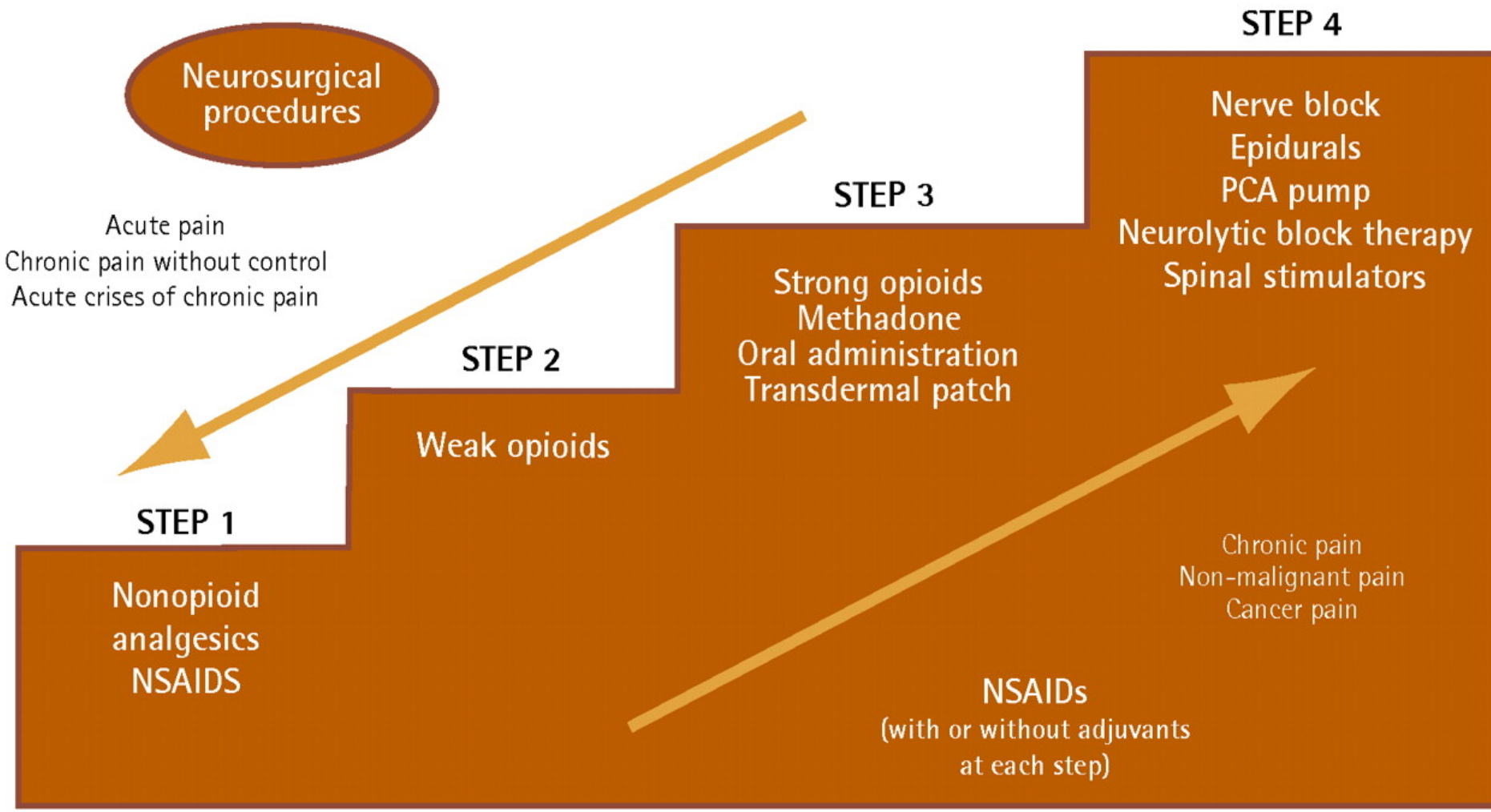
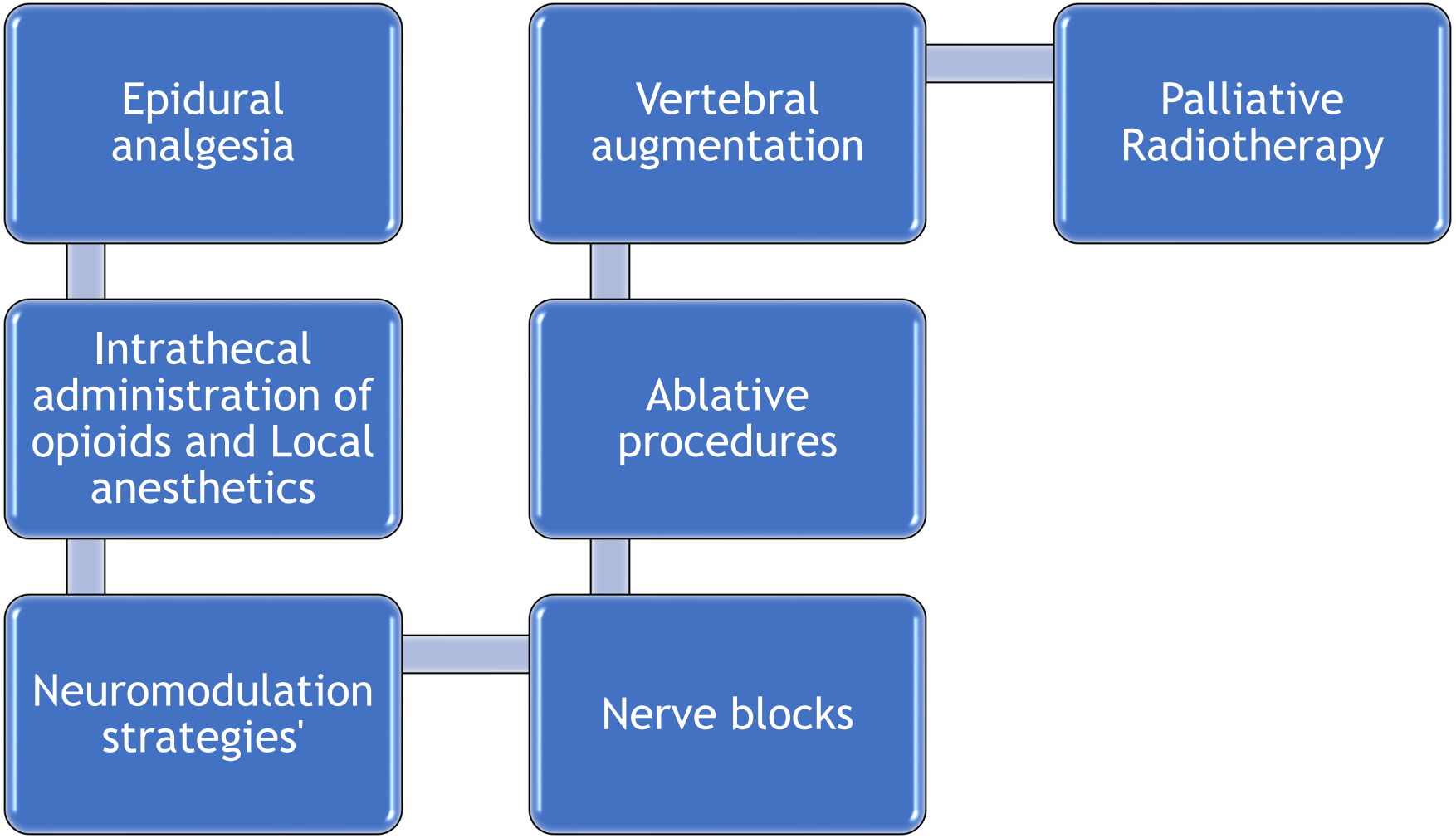


**Figure 2.** New adaptation of the analgesic ladder



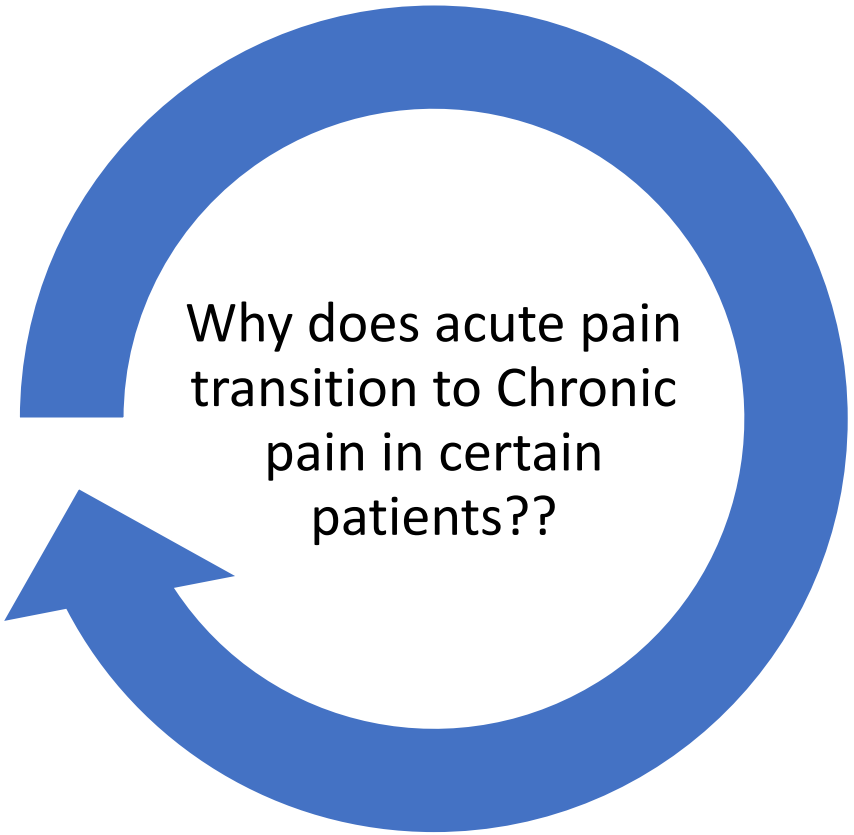

NSAID—nonsteroidal anti-inflammatory drug, PCA—patient-controlled analgesia.

# Interventions

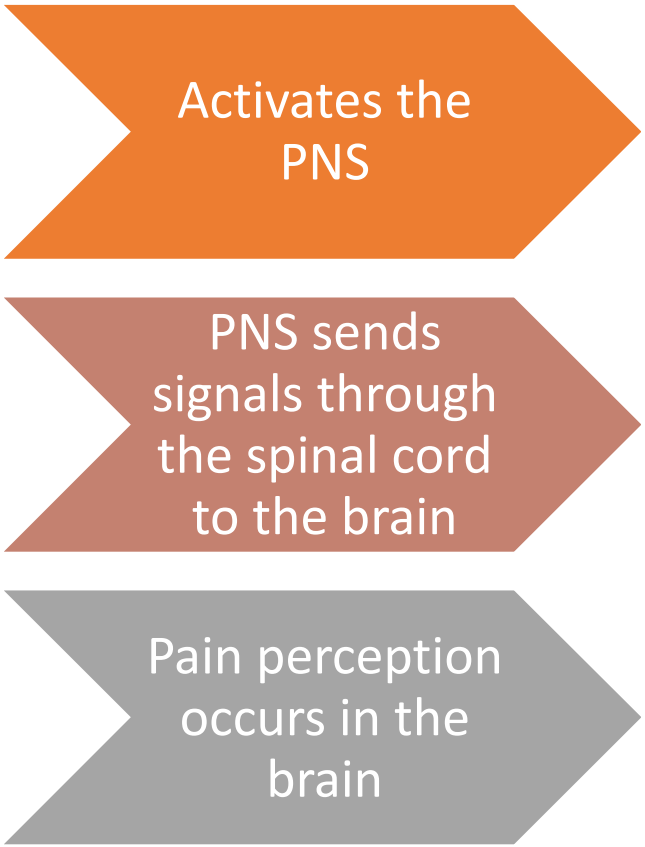


# Cancer Pain

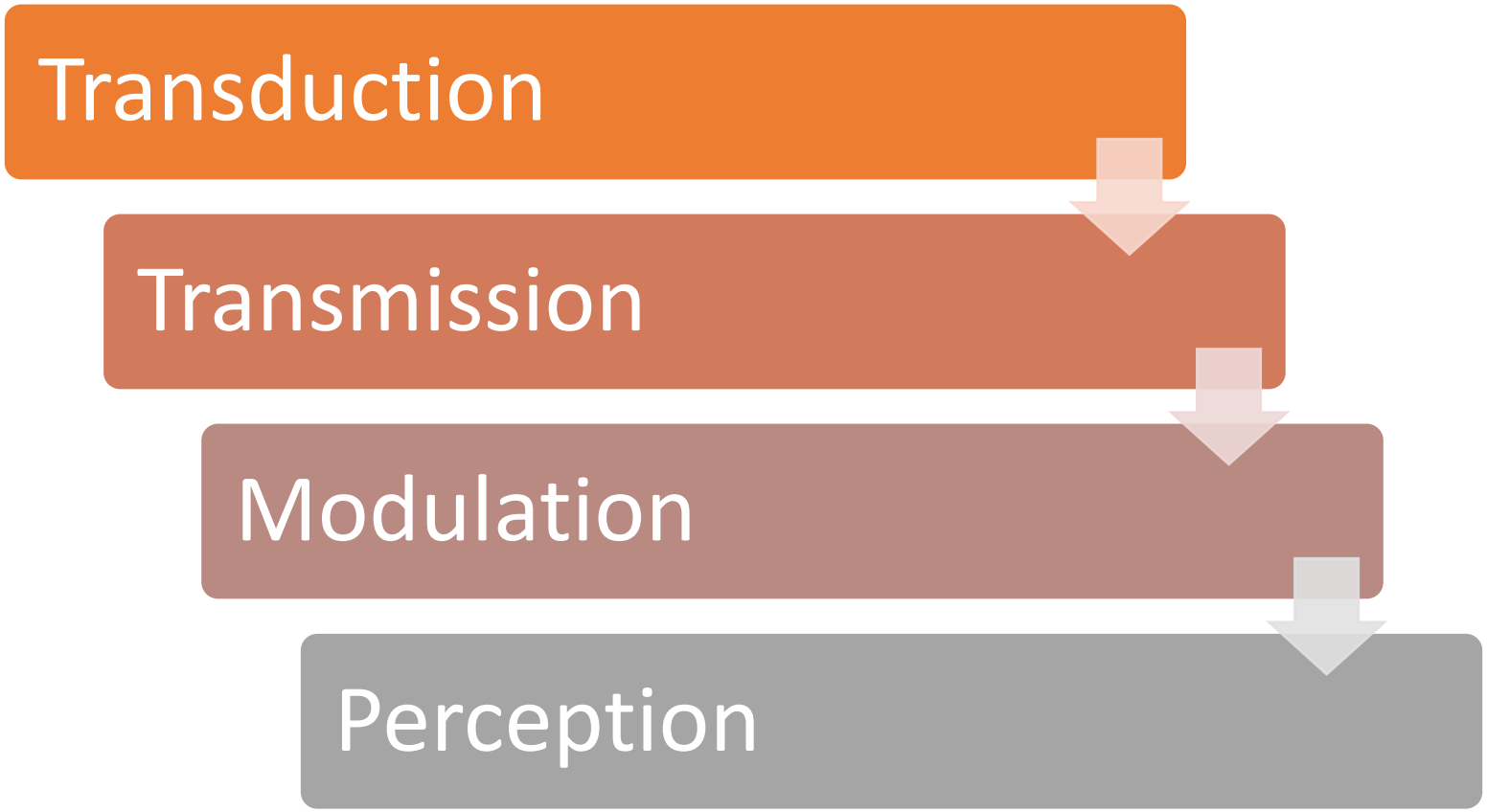
| | |
|---|---|
| Tumor effects | • local mass<br>• metastatic disease<br>• bone pain<br>• central sensitization |
| Treatment related | • Surgery<br>• Chemo<br>• RT<br>• Other – immunotherapy, hormone therapy |
| Associated conditions | • Osteoporosis<br>• Immunosuppression (HSV)<br>• Hypercalcemia<br>• immobility |
| Pain unrelated to cancer | |


Why does acute pain transition to Chronic pain in certain patients??

# Tissue Injury



# Sequence of Events



# Transduction

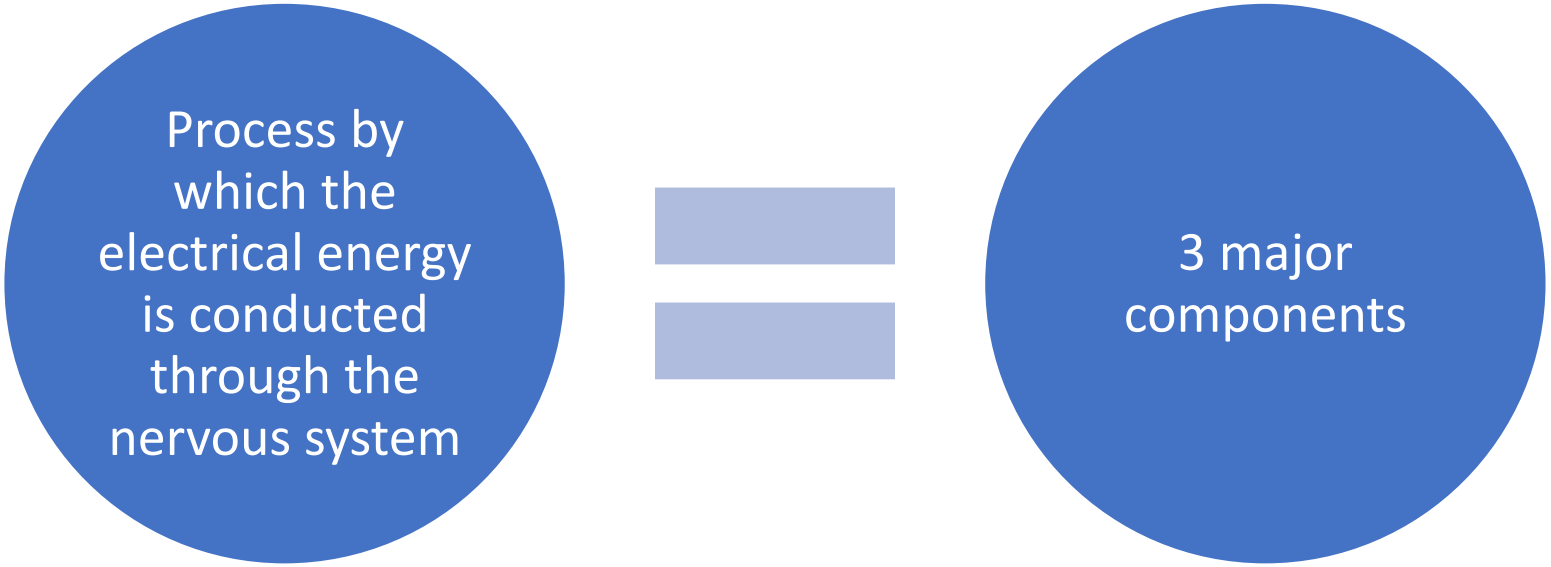
Occurs in the peripheral terminals

primary afferent neurons where different

forms of energy e.g. mechanical, cold, heat

converted to electrical energy

# Transmission



# Modulation

Dorsal column is one major site where modulation occurs involving various NT systems.

+

Process whereby neural activity may be altered along the pain transmission pathway.

→

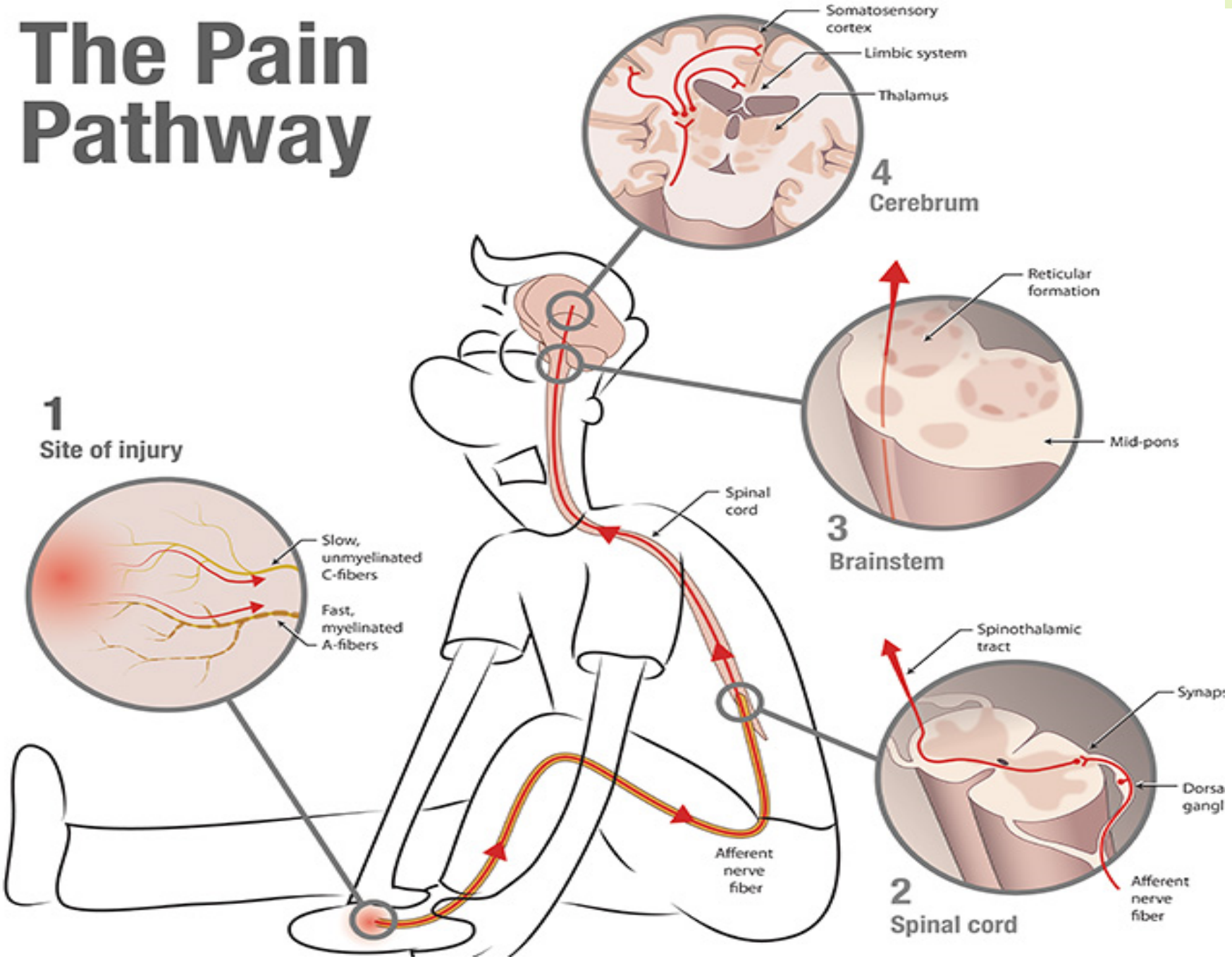
It is the balance of the spinal excitatory and inhibitory systems that determine what messages are delivered to the CNS

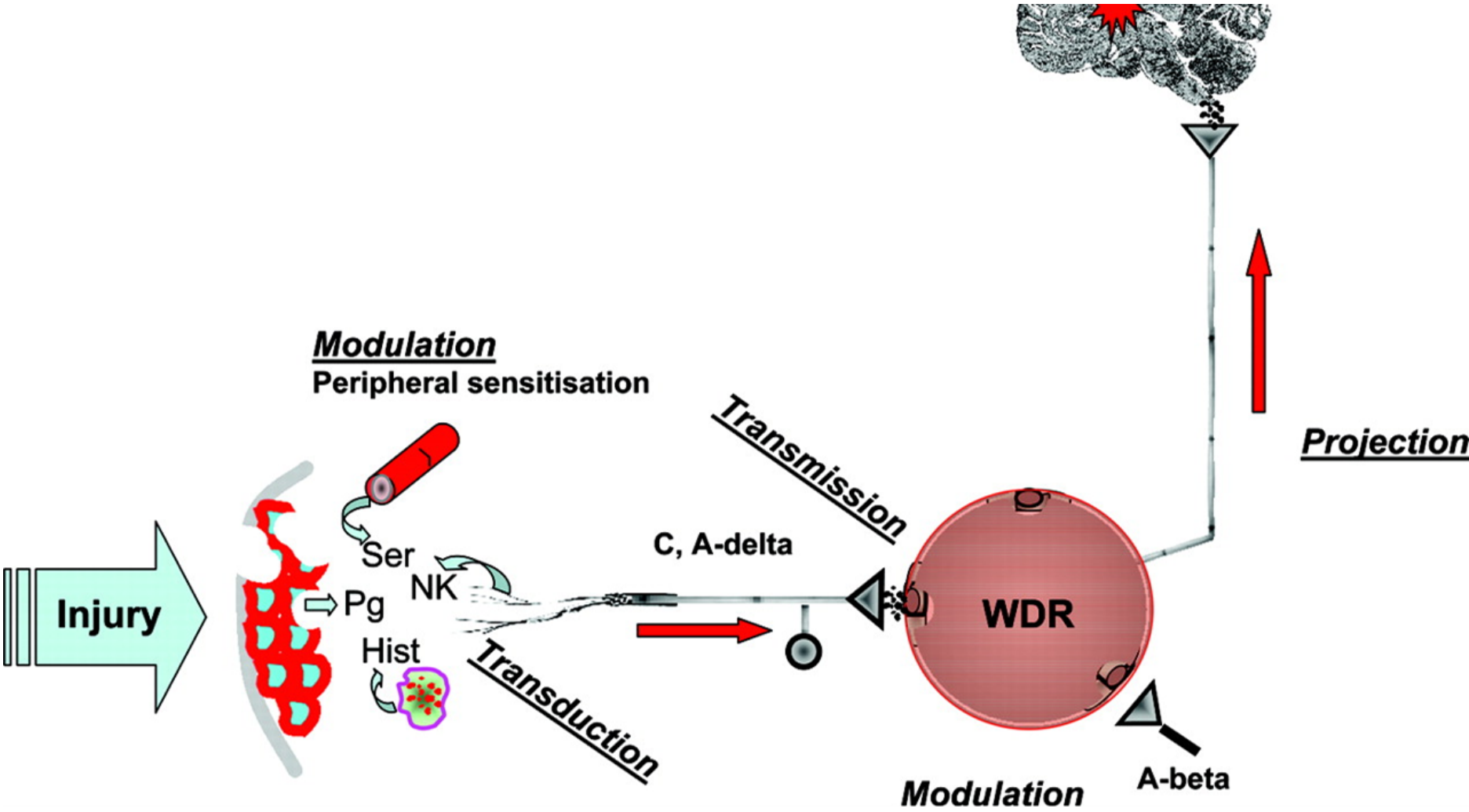
# The concept

Pain signals are not transmitted to the CNS through “hard wired” pathways

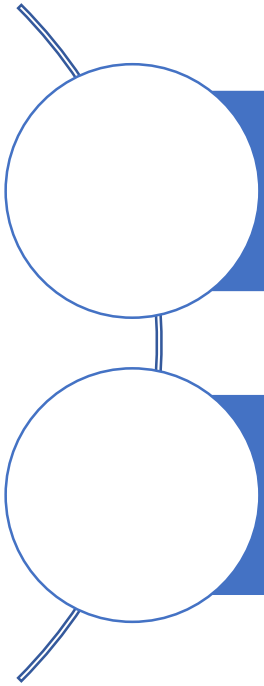
In contrast, nociceptive signals, once initiated, will launch a cascade of alternations in the somatosensory system

# The Pain Pathway




Modulation
Peripheral sensitisation
Transmission
Projection
Injury
Ser
NK
Pg
Hist
C, A-delta
WDR
Transduction
Modulation
A-beta

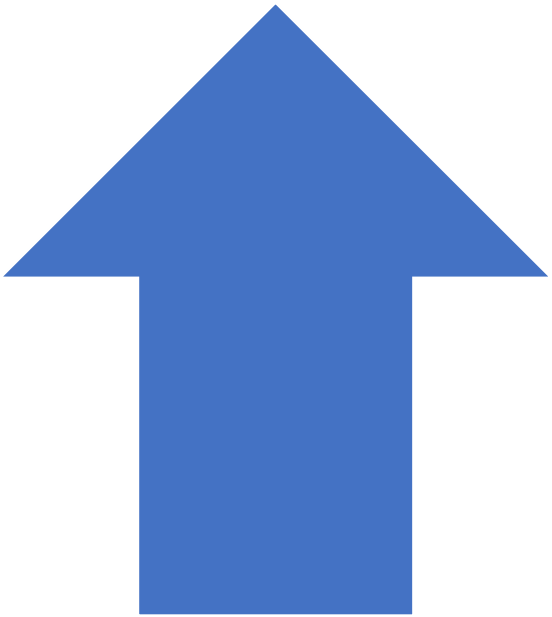
# Dorsal Horn Neurons



Nociceptive – specific (NS) neurons that respond only to pain signals in ***Aδ and C*** fibers

WDR neurons that respond to both non-nociceptive impulses in ***Aβeta*** ( touch) and nociceptive impulses in ***Aδ and C*** fibers

# HYPERALGESIA



Signals from the A δ and C fibers will be amplified- HYPERALGESIA

# ALLODYNIA

Activity in A β fibers will be interpreted not as touch but as pain signals by the WDR neurons - ALLODYNIA

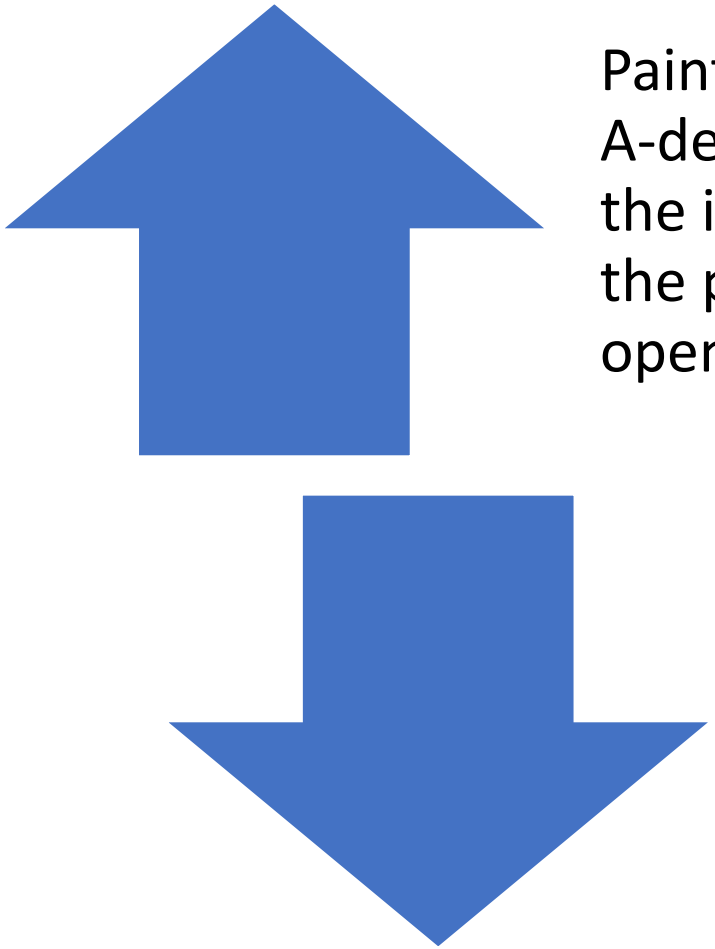
# Central Sensitization

This sensitization may outlast the stimuli that triggered the alterations in the first place and thus become a

“pain memory”.

# Neuromodulation

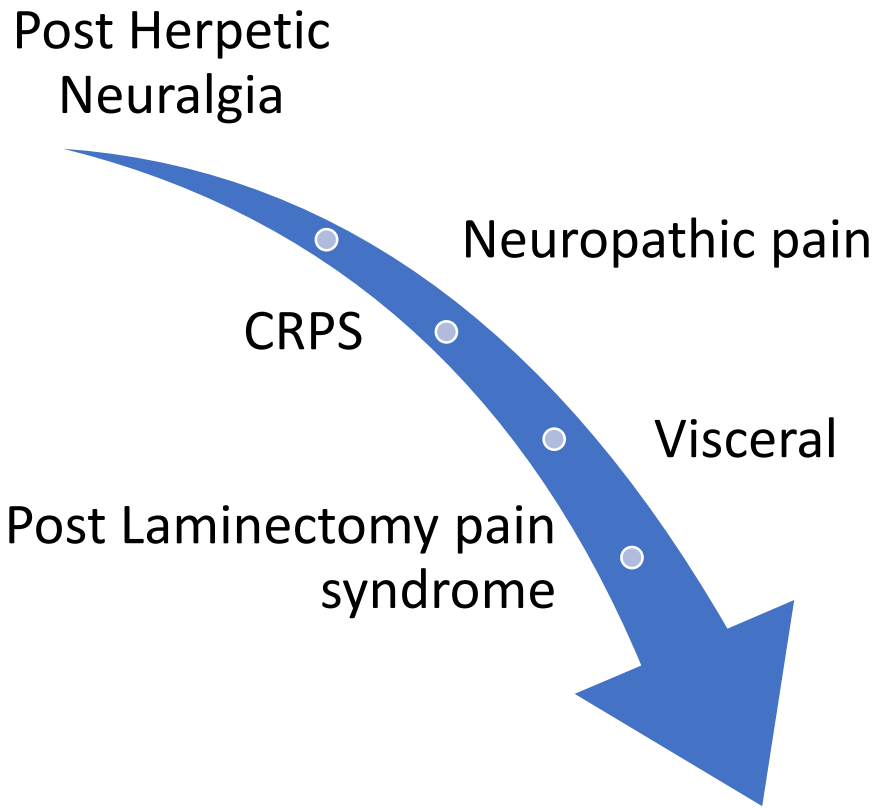
# Neuromodulation



Painful stimuli at periphery (via A-delta and C fibers) override the inhibitory pathways allowing the pain signal to be transmitted opening the “gate” to the CNS

Activation of the large A-Beta non noxious nerve fibers leads to inhibitory neurons to be reactivated allowing the “gate” to close

# Evidence for Spinal Cord Stimulation




At cross road for

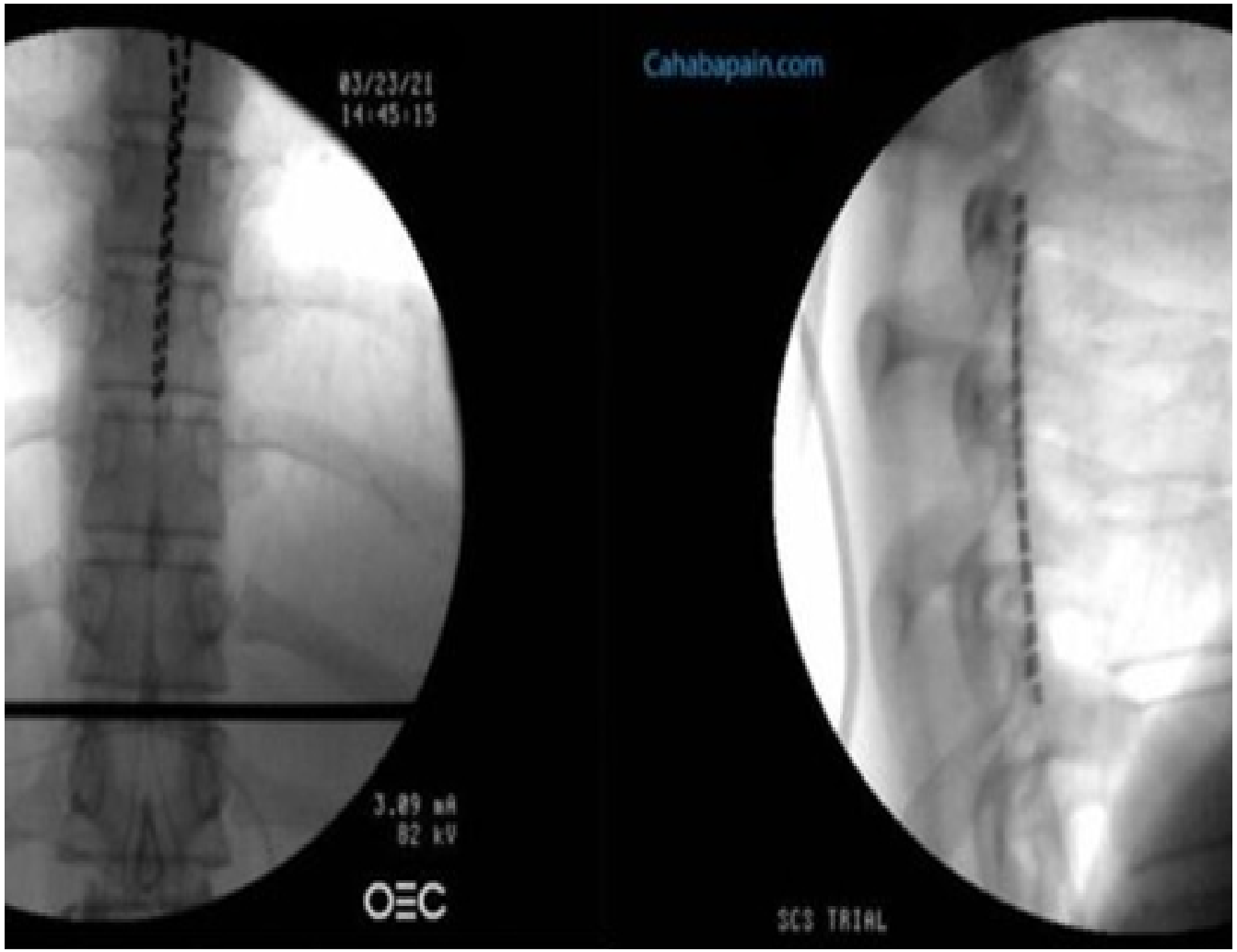
- Cancer pain and Chemotherapy induced Neuropathy

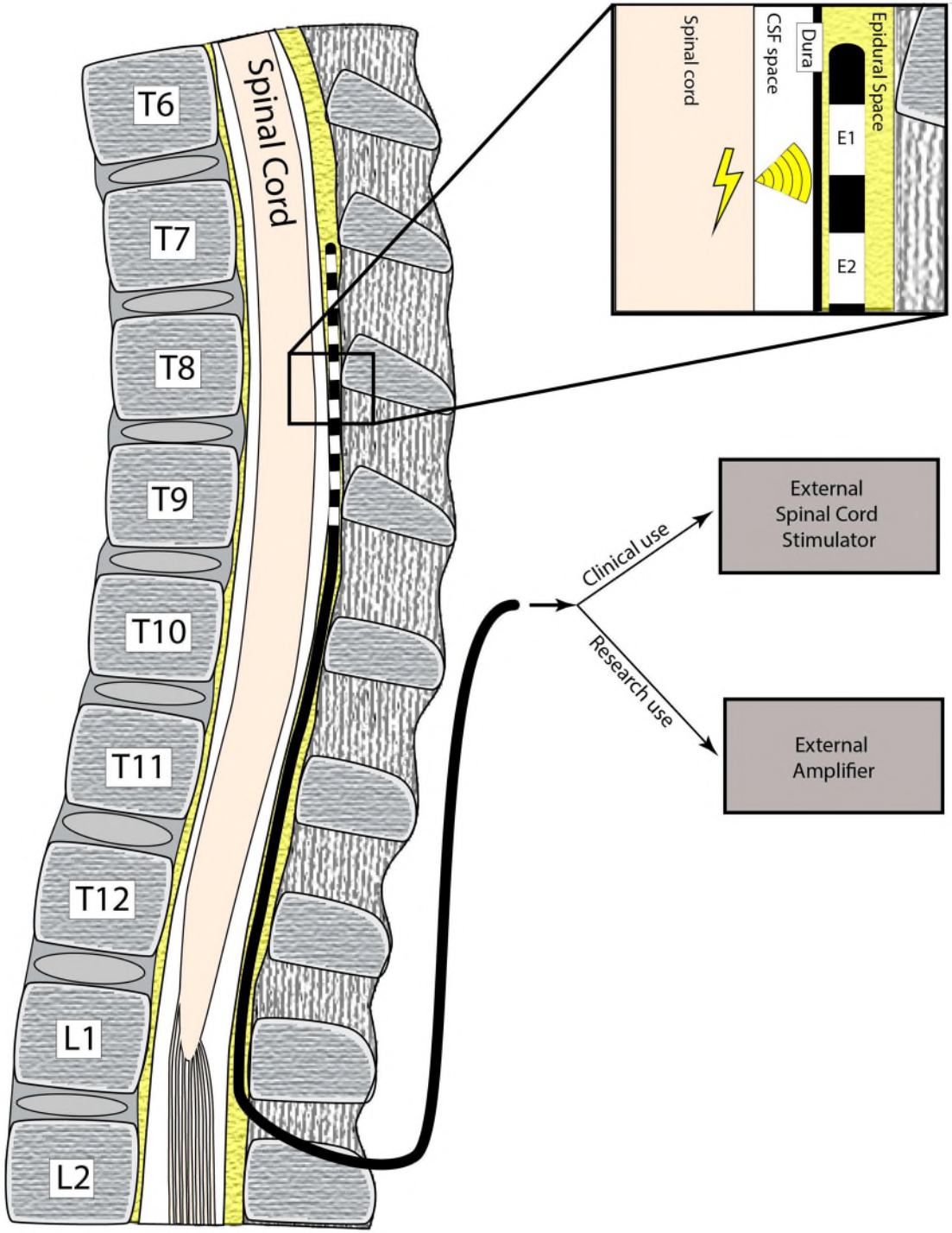
# 2 step process

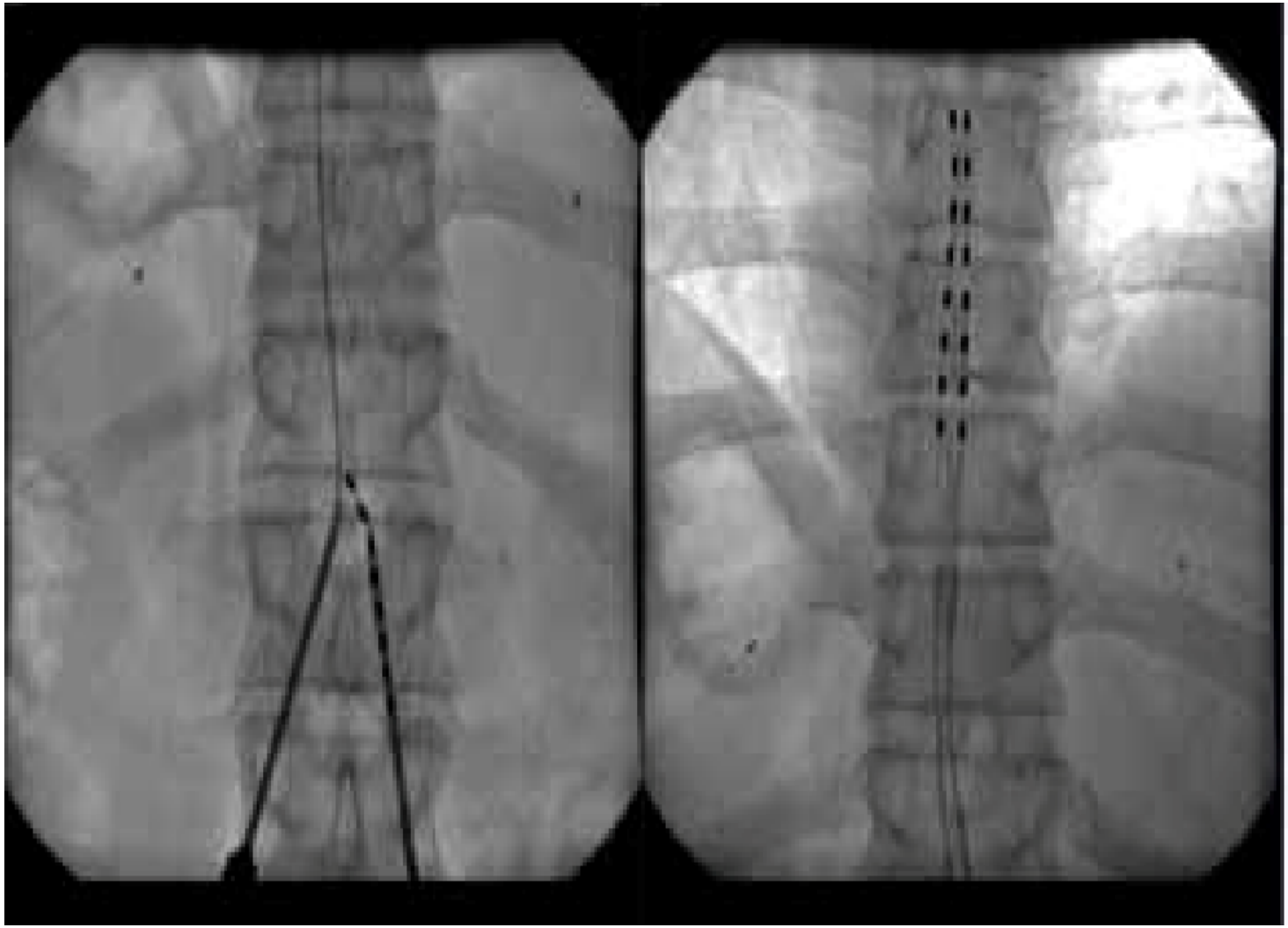
Trial- 3-7 days trial with temporary epidural leads

If >50% relief is achieved, patient is considered for a permanent implantation

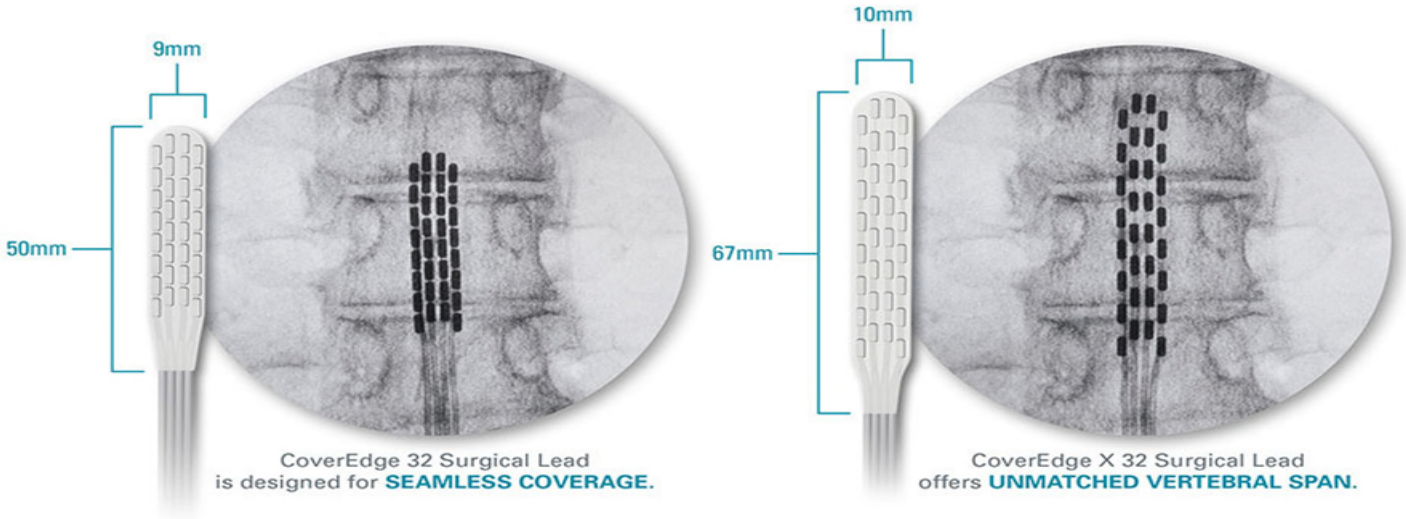
- Electrodes that deliver the electrical impulses- Paddle or Percutaneous
- Generator (IPG) that serves as the power source and pacemaker


03/23/21
14:45:15
Cahabapain.com
3.89 mA
82 kV
OEC
SCS TRIAL

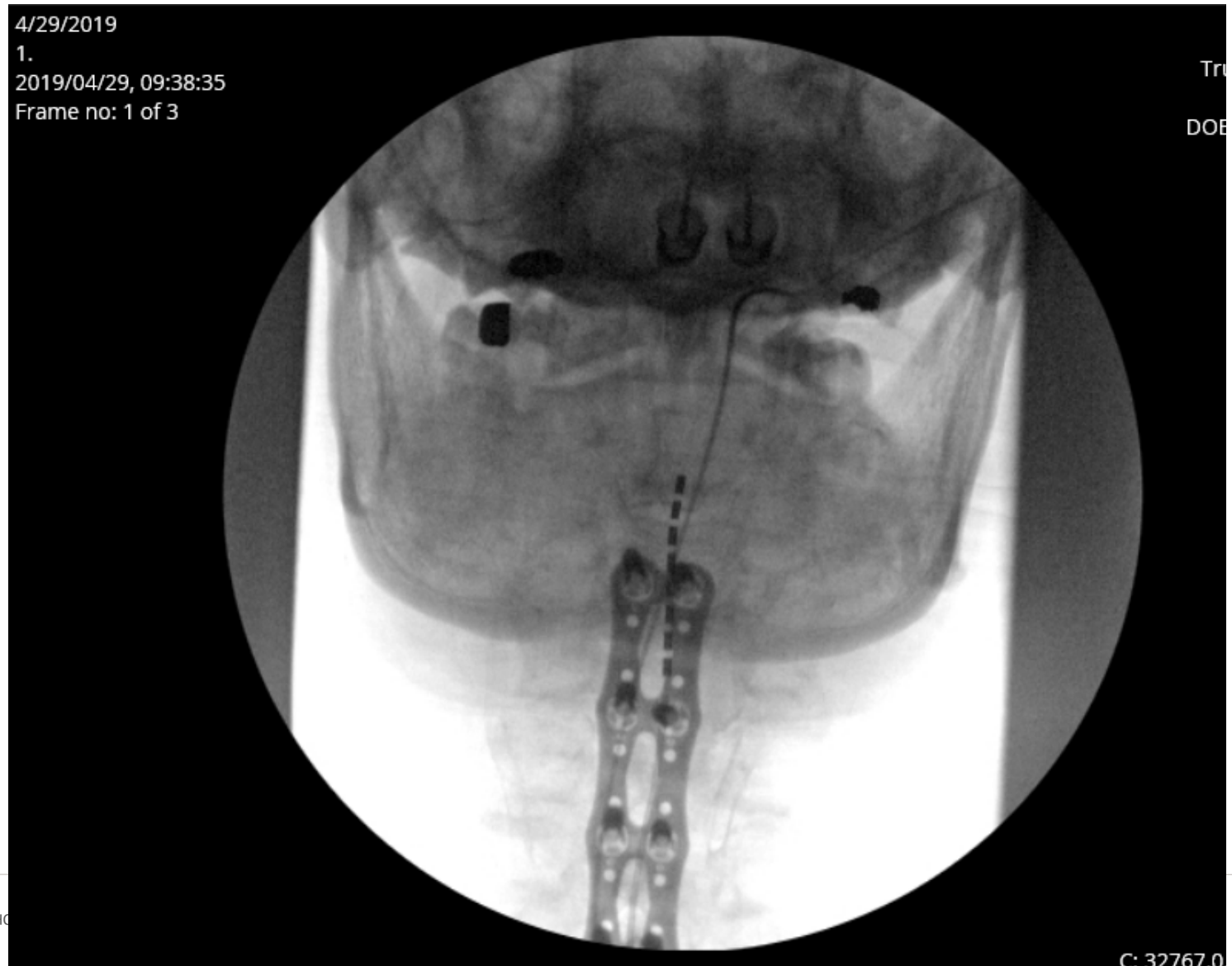

T6
T7
T8
T9
T10
T11
T12
L1
L2
Spinal Cord
Spinal cord
CSF space
Dura
Epidural Space
E1
E2
Clinical use
Research use
External Spinal Cord Stimulator
External Amplifier



# Paddle Lead


9mm
50mm
CoverEdge 32 Surgical Lead
is designed for SEAMLESS COVERAGE.
10mm
67mm
CoverEdge X 32 Surgical Lead
offers UNMATCHED VERTEBRAL SPAN.

# Brachial plexopathy from Lung CA



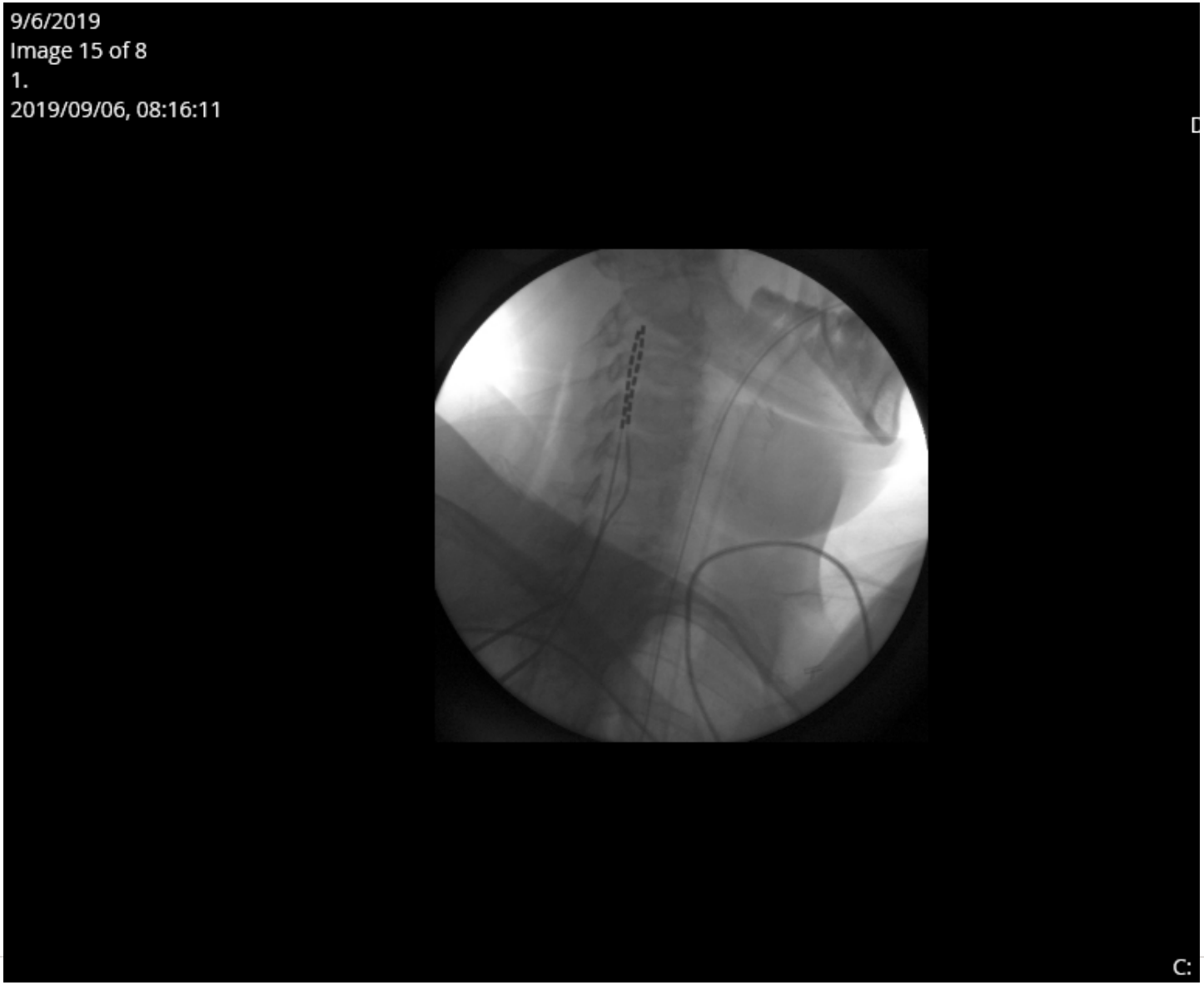

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Image 15 of 8
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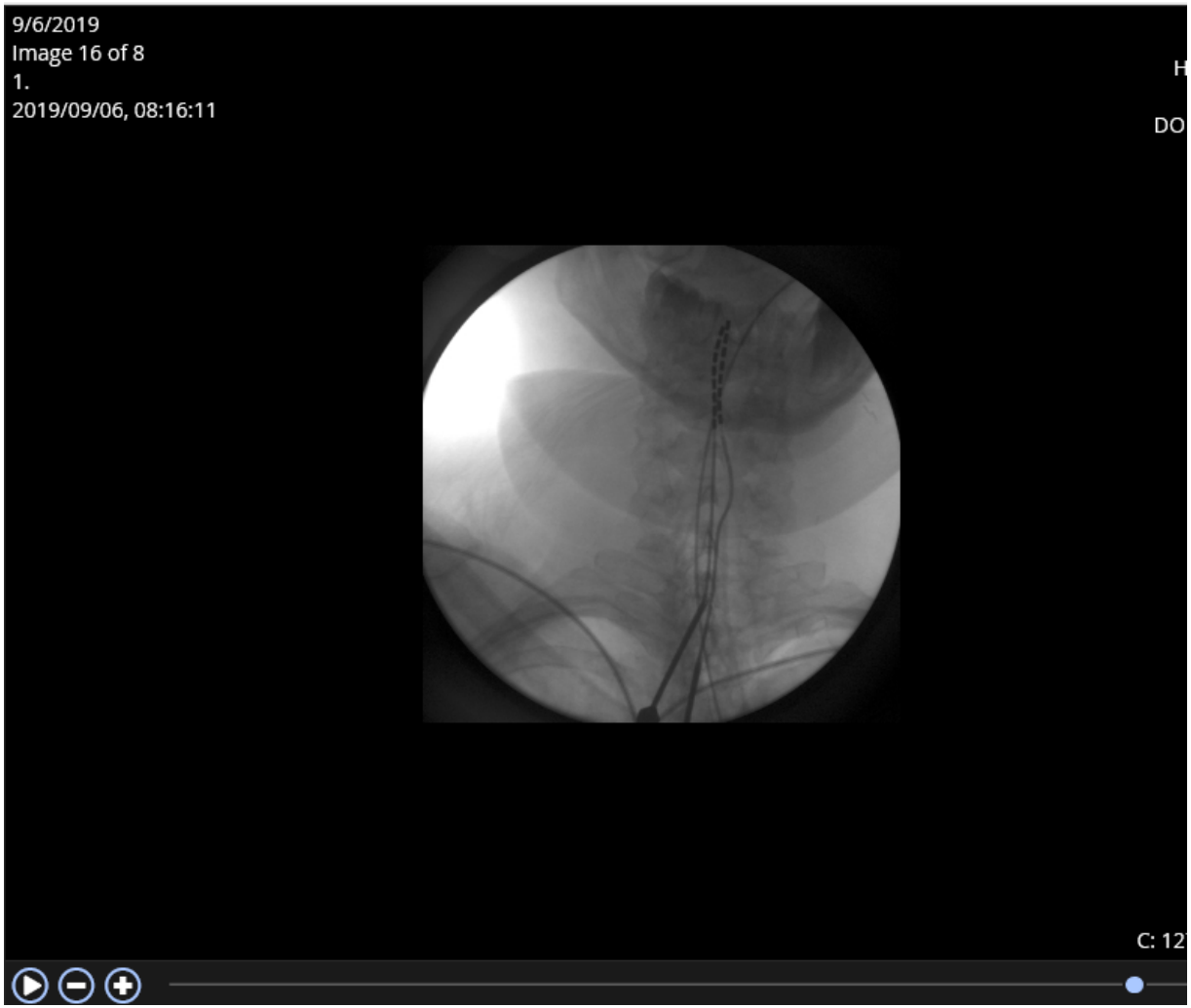
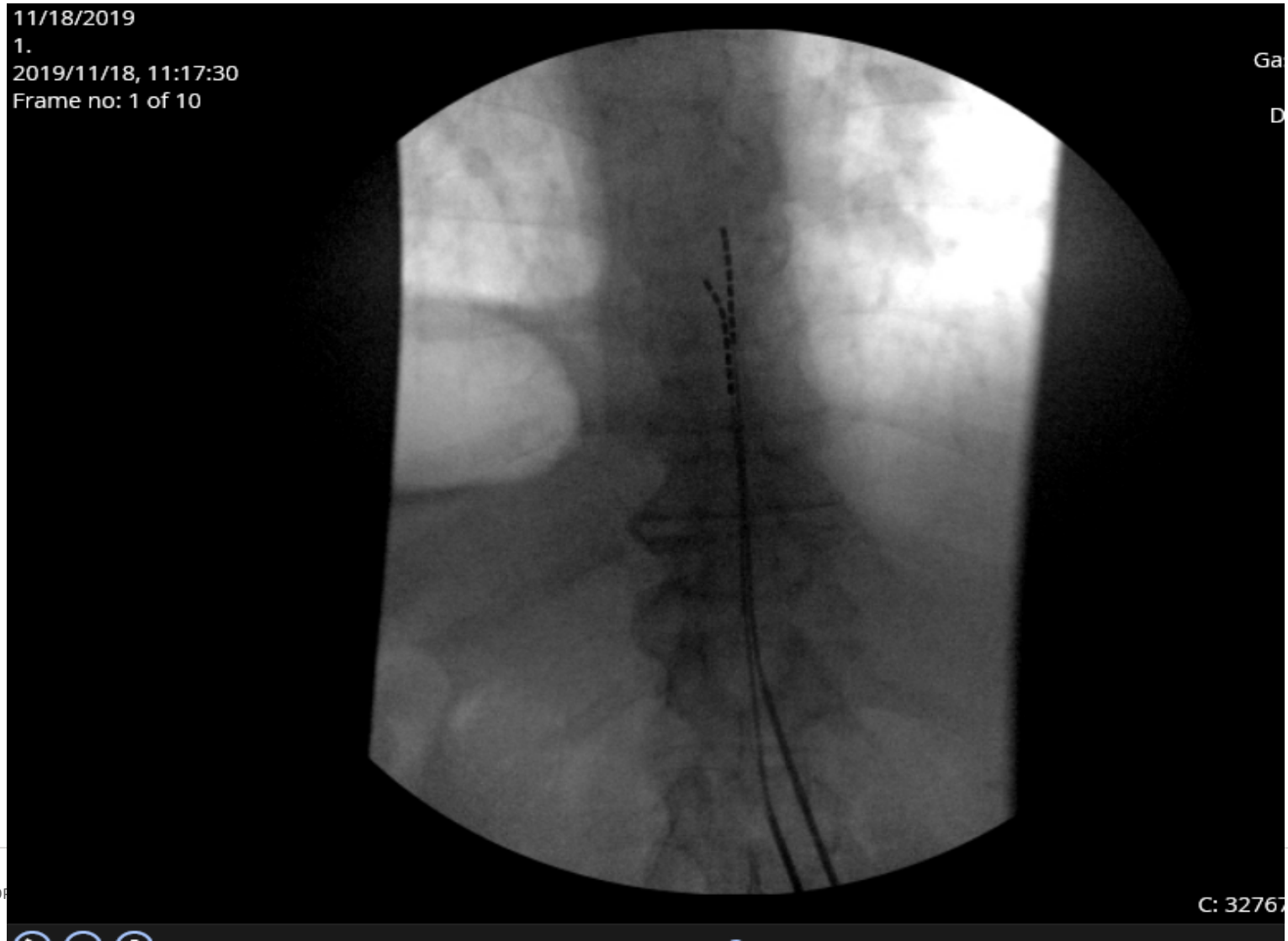
# Metastatic Melanoma



# Metastatic Colon CA with Sacral Mets



# Peripheral Nerve Stimulation

Electrical stimulation of a specific nerve trunk via implanted subcutaneous electrodes targeting a named nerve

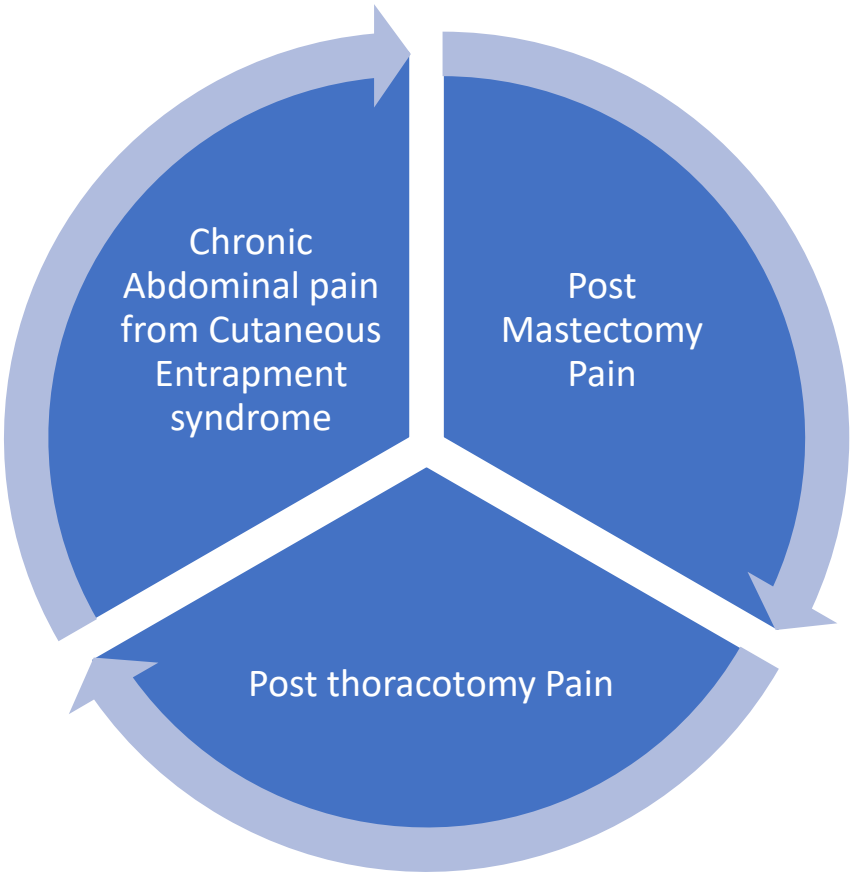
Gate control theory

Stimulation of large non noxious A delta fibers results in excitation of inhibitory dorsal horn pathways

Modulates inflammatory pathways, endogenous pain inhibitory pathways

- Occipital nerve
- Intercostal nerves
- Brachial plexus

# Persistent Post Surgical Pain



# Post Mastectomy Pain

Chronic neuropathic pain disorder that can occur following breast cancer related procedures

Particularly operations that remove tissue in the upper outer quadrant of the breast and/or axilla

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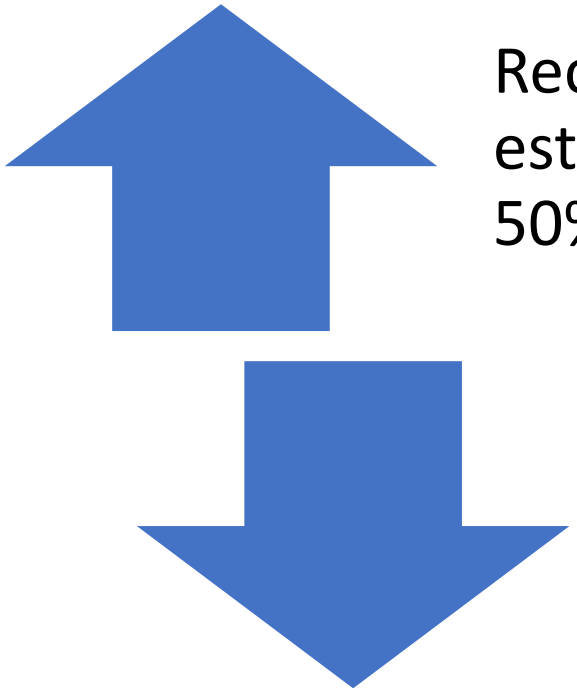

Recently, incidence is estimated to be around 20-50%

Wide variation in estimates largely reflects definitional inconsistencies across studies

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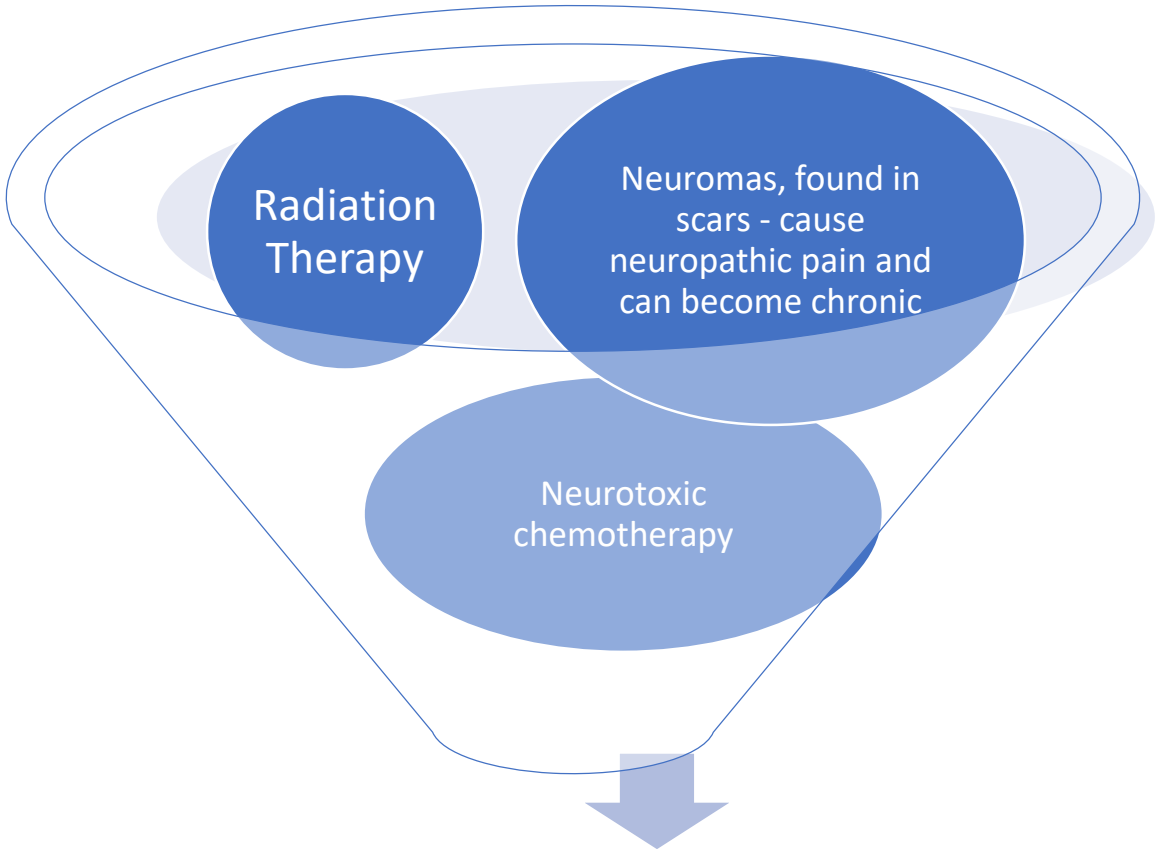
# Pathophysiology




Damaged nerves are easily excitatory, sending constant barrage of painful impulses with slightest mechanical distortion

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# Regional Anesthesia

- PECS 1 Block
- PECS 2 Block
- Serratus Anterior Plane Block
- Deep Serratus Anterior Plane Block
- Erector Spinae Plane Block

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# Chest innervation

The lateral pectoral nerve  and median pectoral nerve

The anterior division of thoracic intercostal nerves from T2-6

The long thoracic nerve (nerve to serratus anterior )  - brachial plexus

Thoracodorsal nerve (nerve to latissimus dorsi )-posterior cord of the brachial plexus

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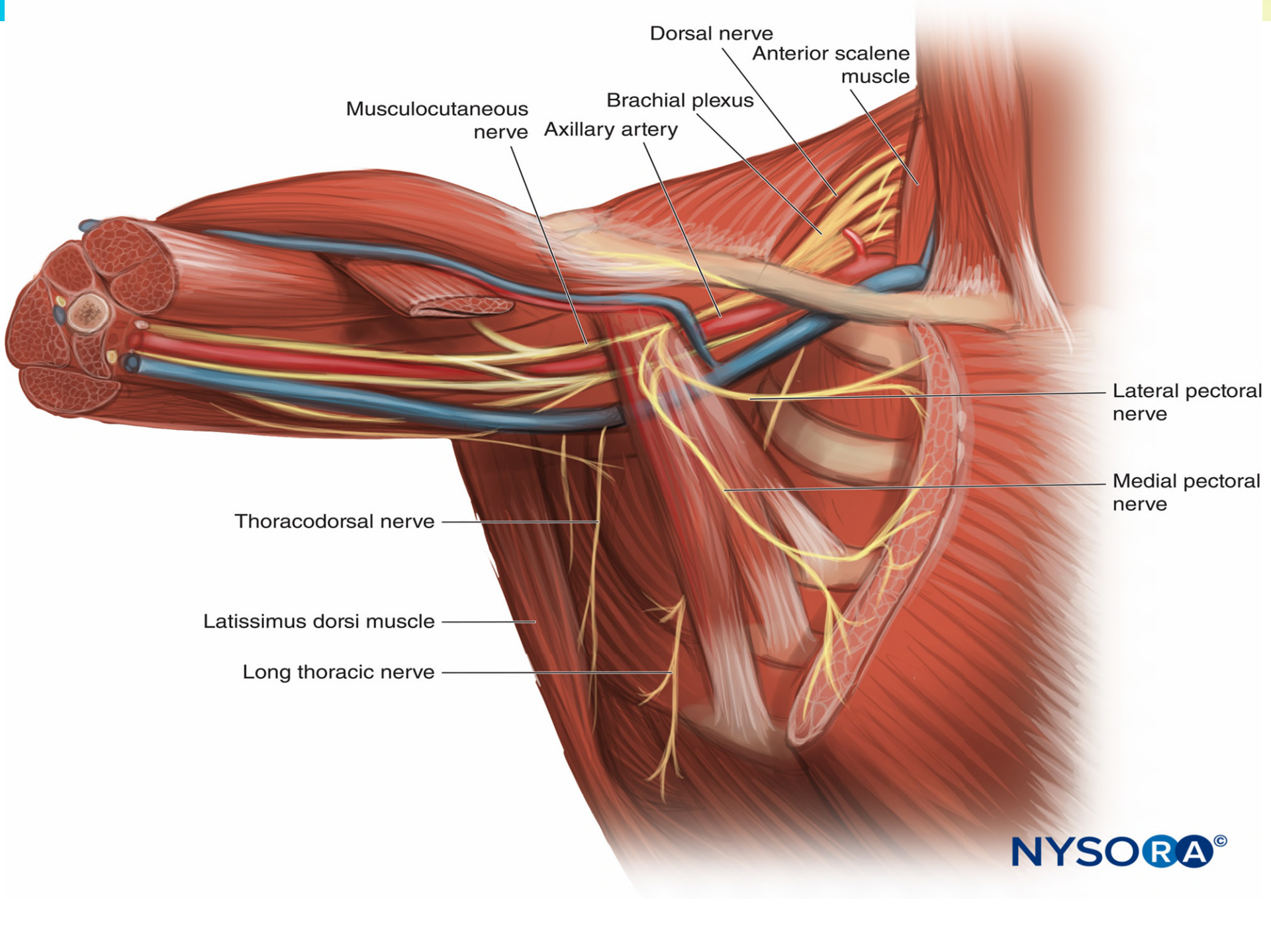
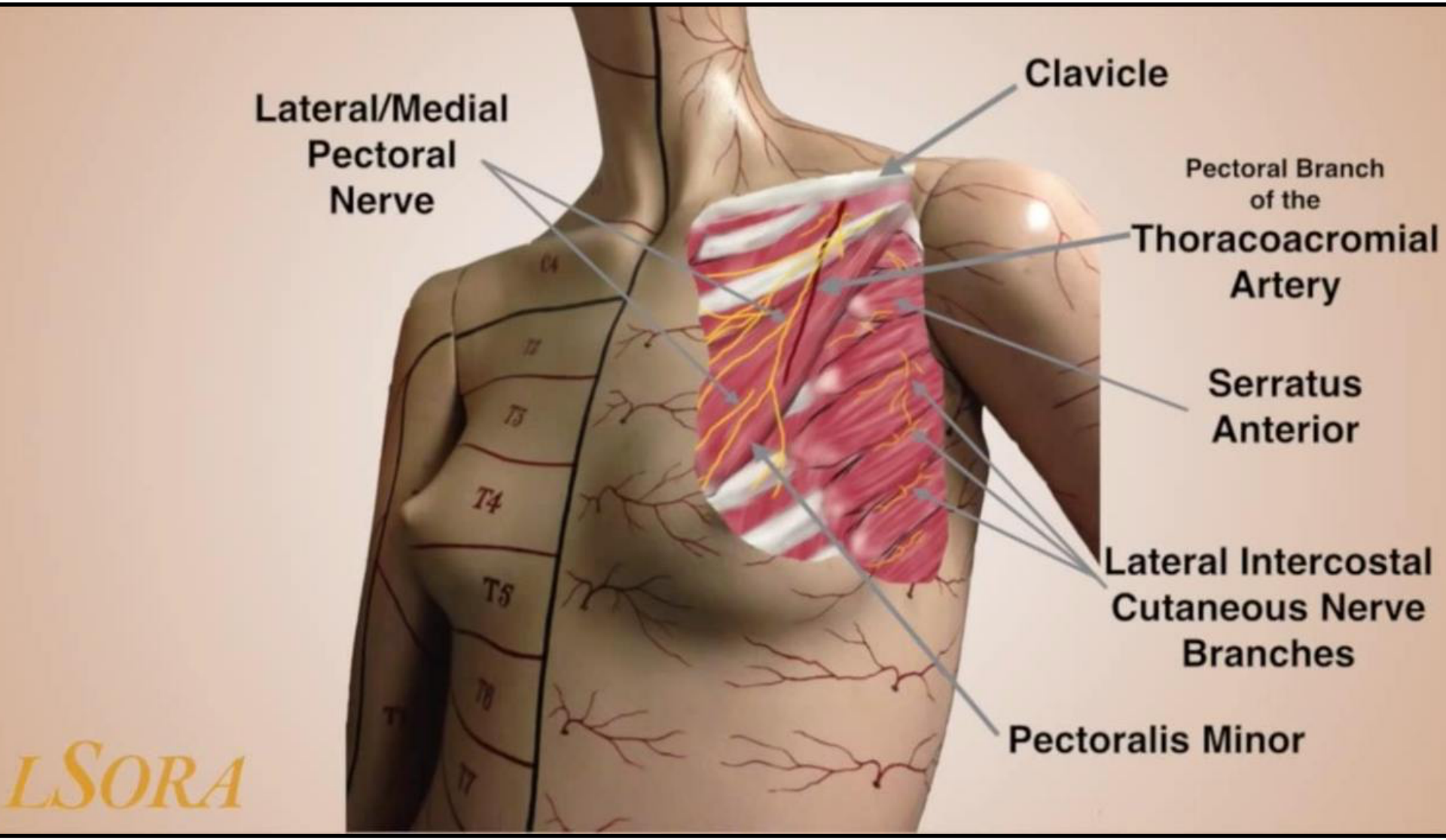

Dorsal nerve
Anterior scalene muscle
Brachial plexus
Musculocutaneous nerve
Axillary artery
Lateral pectoral nerve
Medial pectoral nerve
Thoracodorsal nerve
Latissimus dorsi muscle
Long thoracic nerve
NYSORA©


Clavicle
Lateral/Medial
Pectoral
Nerve
Pectoral Branch
of the
Thoracoacromial
Artery
Serratus
Anterior
Lateral Intercostal
Cutaneous Nerve
Branches
Pectoralis Minor
C4
T1
T3
T4
T5
T6
T7
LSORA

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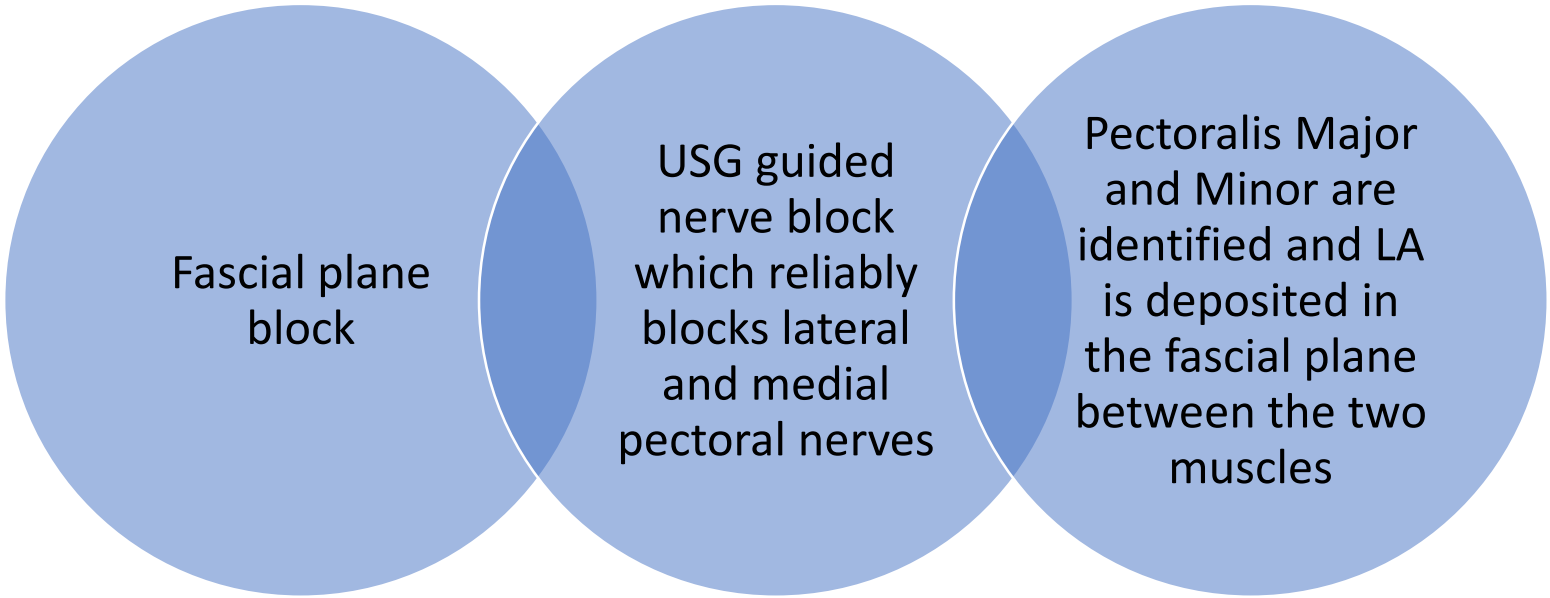
# PECS block

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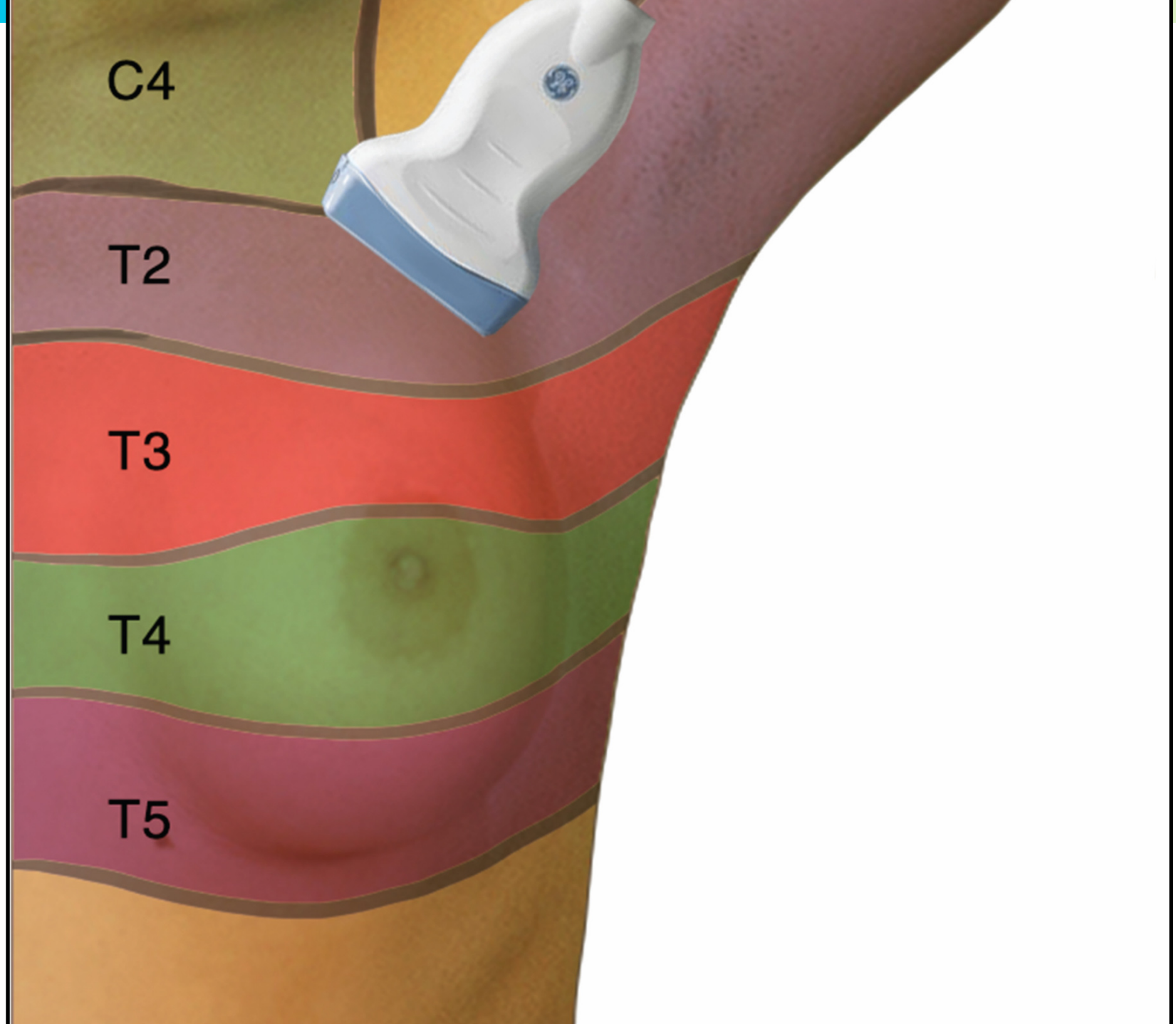
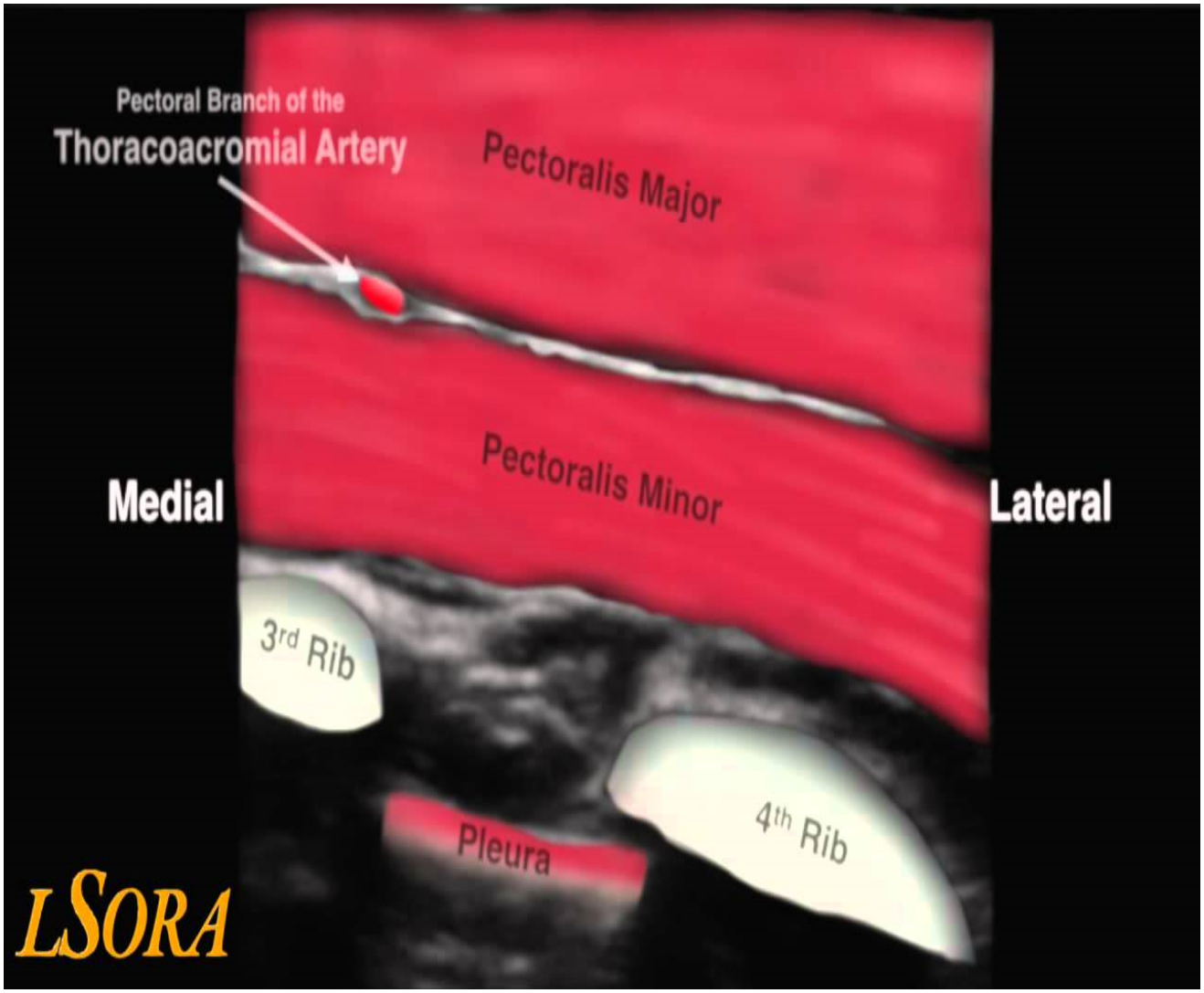
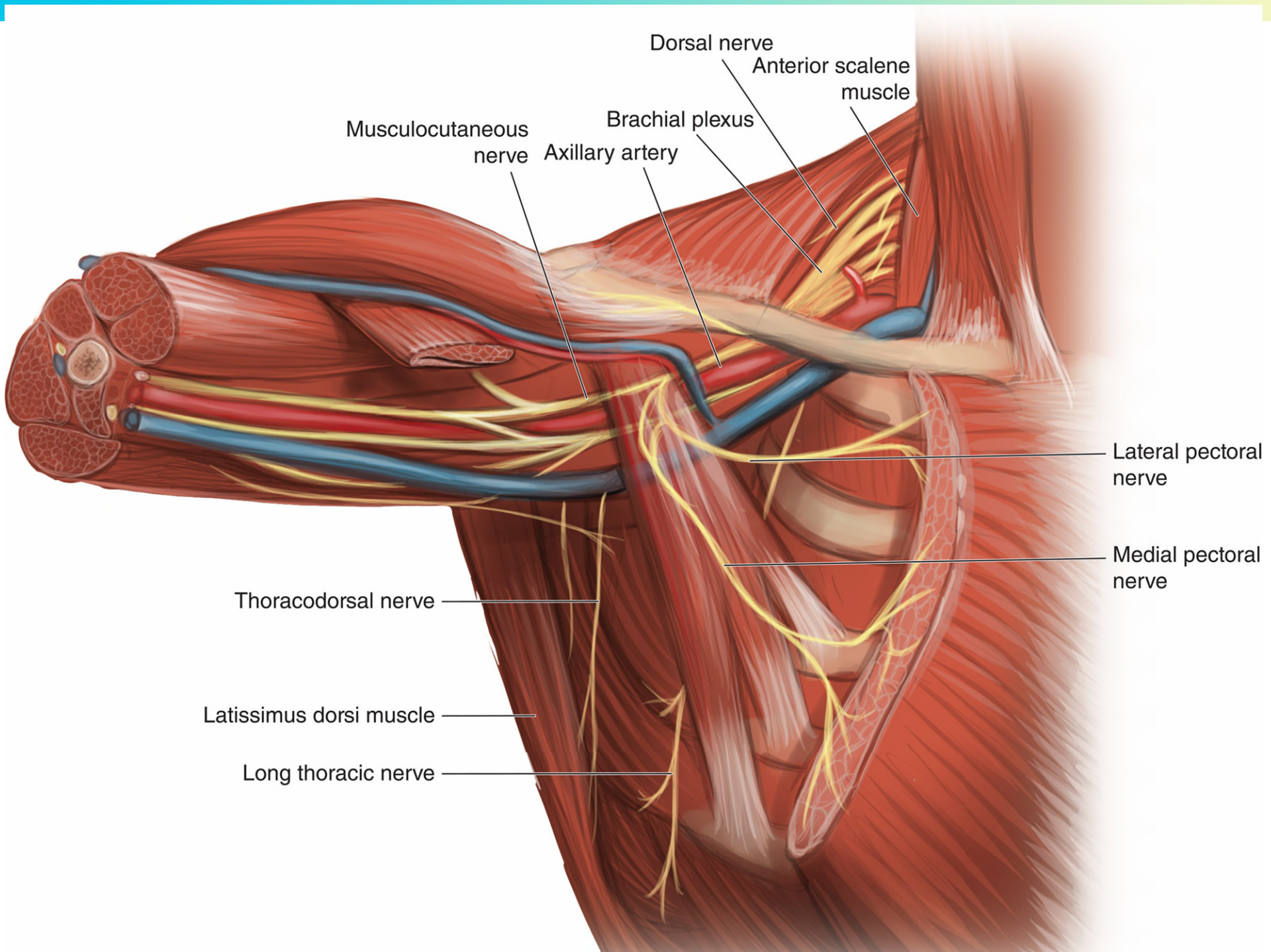

C4
T2
T3
T4
T5


Pectoral Branch of the
Thoracoacromial Artery
Pectoralis Major
Pectoralis Minor
Medial
Lateral
3rd Rib
4th Rib
Pleura
LSORA


Dorsal nerve
Anterior scalene muscle
Brachial plexus
Musculocutaneous nerve
Axillary artery
Lateral pectoral nerve
Medial pectoral nerve
Thoracodorsal nerve
Latissimus dorsi muscle
Long thoracic nerve

So a unilateral PEC 1 and PEC 2 block will provide analgesia for anterior-lateral aspect of the chest.

With PECS 2, the LA would spread to the axilla where the long thoracic nerve and lateral branches of the intercostal nerves are found as they exit at the level of mid axillary line

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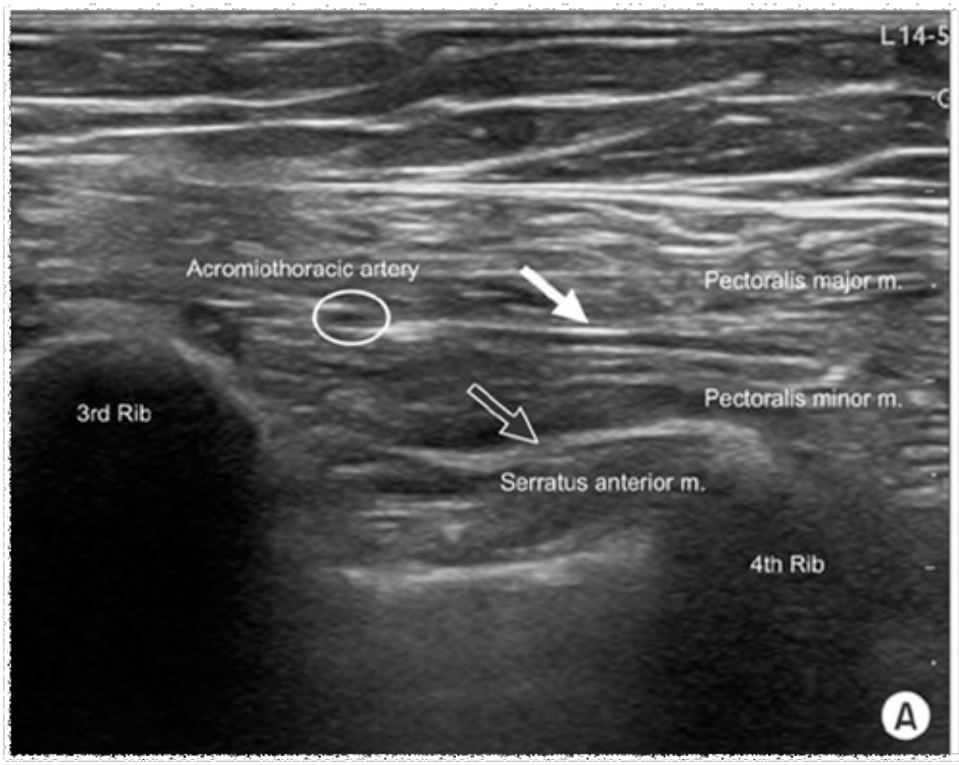
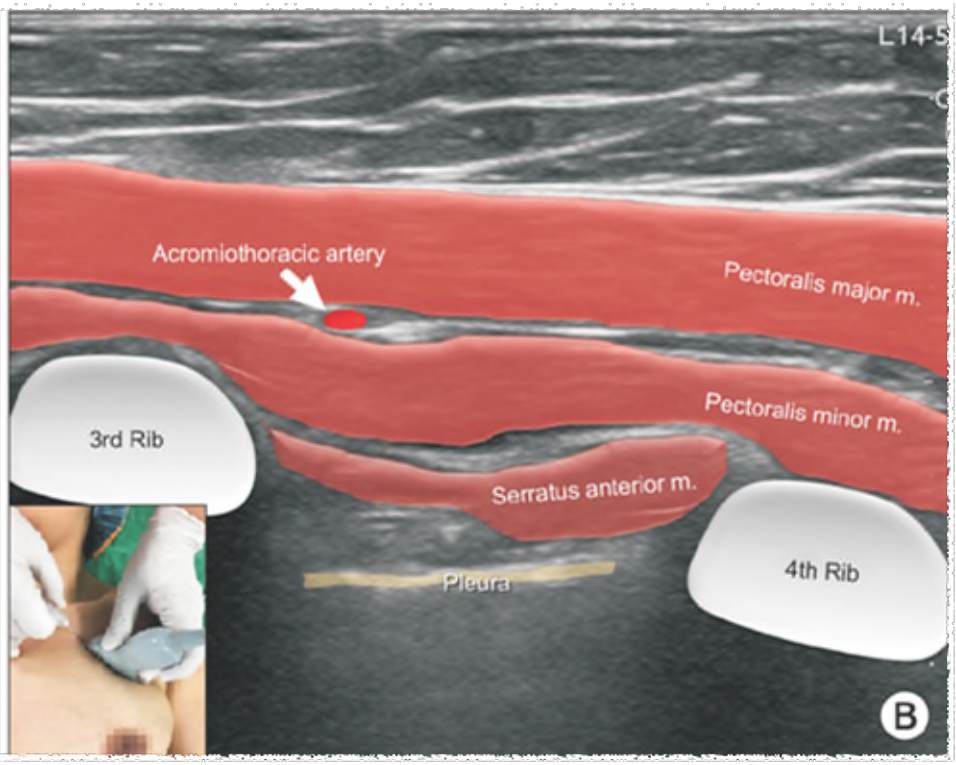

L14-5
Acromiothoracic artery
Pectoralis major m.
Pectoralis minor m.
3rd Rib
Serratus anterior m.
4th Rib
A


L14-5
Acromiothoracic artery
Pectoralis major m.
Pectoralis minor m.
3rd Rib
Serratus anterior m.
Pleura
4th Rib
B

# serratus plane block: a novel ultrasound-guided thoracic wall nerve block

R. Blanco, T. Parras, J. G. McDonnell and A. Prats-Galino

Anesthesia 2013

Blockade of lateral cutaneous branches of the thoracic intercostal nerves T2- T12

Analgesia to the antero-lateral chest wall

Progression from PEC 1 and PEC 2 blocks

Revealed 2 potential spaces, above and below the serratus anterior muscle

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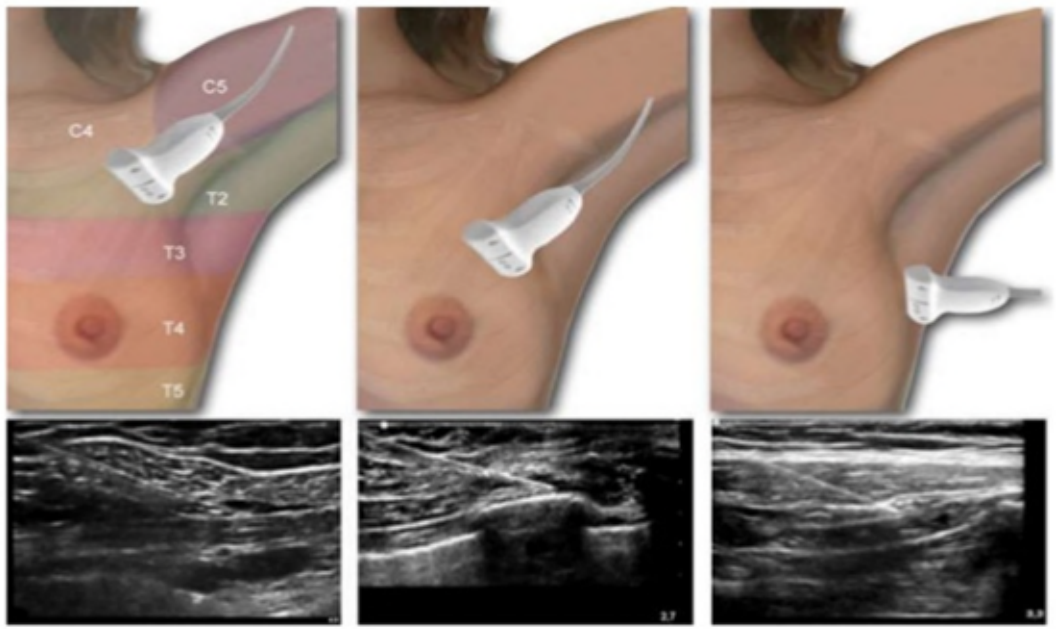
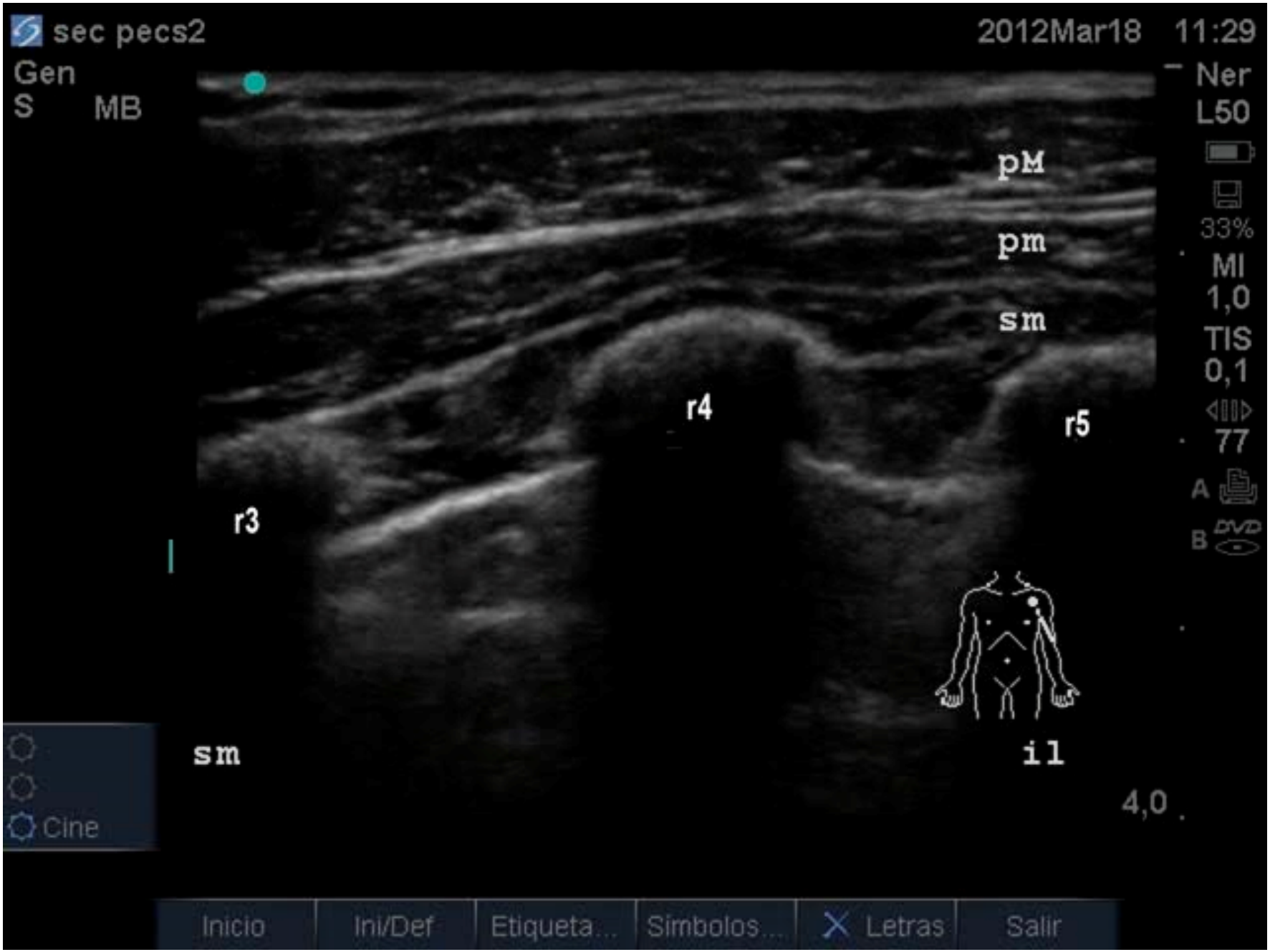

C5
C4
T2
T3
T4
T5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Cine
Inicio
Ini/Def
Etiqueta...
Simbolos...
Letras
Salir

# Conclusion

Dermatomal Paresthesia from T2 to T9

Injection of LA superficial or deep to Serratus anterior provides predictable regional anesthesia

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# “A Tale of Two Planes”
# Deep Versus Superficial Serratus Plane Block for Postmastectomy Pain Syndrome

Mohammad M. Piracha, MD,* Stephen L. Thorp, MD,* Vinay Puttanniah, MD,† and Amitabh Gulati, MD†

Reg Anesth Pain Med 2017

Case series

3 of them had superficial SAP without efficacy

Performed Deep SAP block

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# Discussion

Improved and longer duration of relief

- Scarring of the plane between the latissimus dorsi and SA - thickened fascial plane
- Typically, SSPB results in predictable spread of the anterior plane as described by Blanco et al
- However, when scar is present, adequate spread may not occur
- Also spares the long thoracic nerve which would occur with SSPB

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# Ultrasound-Guided Serratus Plane Block for Treatment of Postmastectomy Pain Syndromes in Breast Cancer Patients: A Case Series

Jennifer A. Zocca MD Grant H. Chen MD Vinay G. Puttanniah MD Joseph C. Hung MD Amitabh Gulati MD
*Memorial Sloan Kettering Cancer Center*
*Pain Practice, 2017*

Superficial Serratus plane block

Most appropriate for anterior chest wall/breast pain

Technically challenging in patients with scarring from RT or ALND

Proposed utilizing deep serratus plane block in these subset of patients

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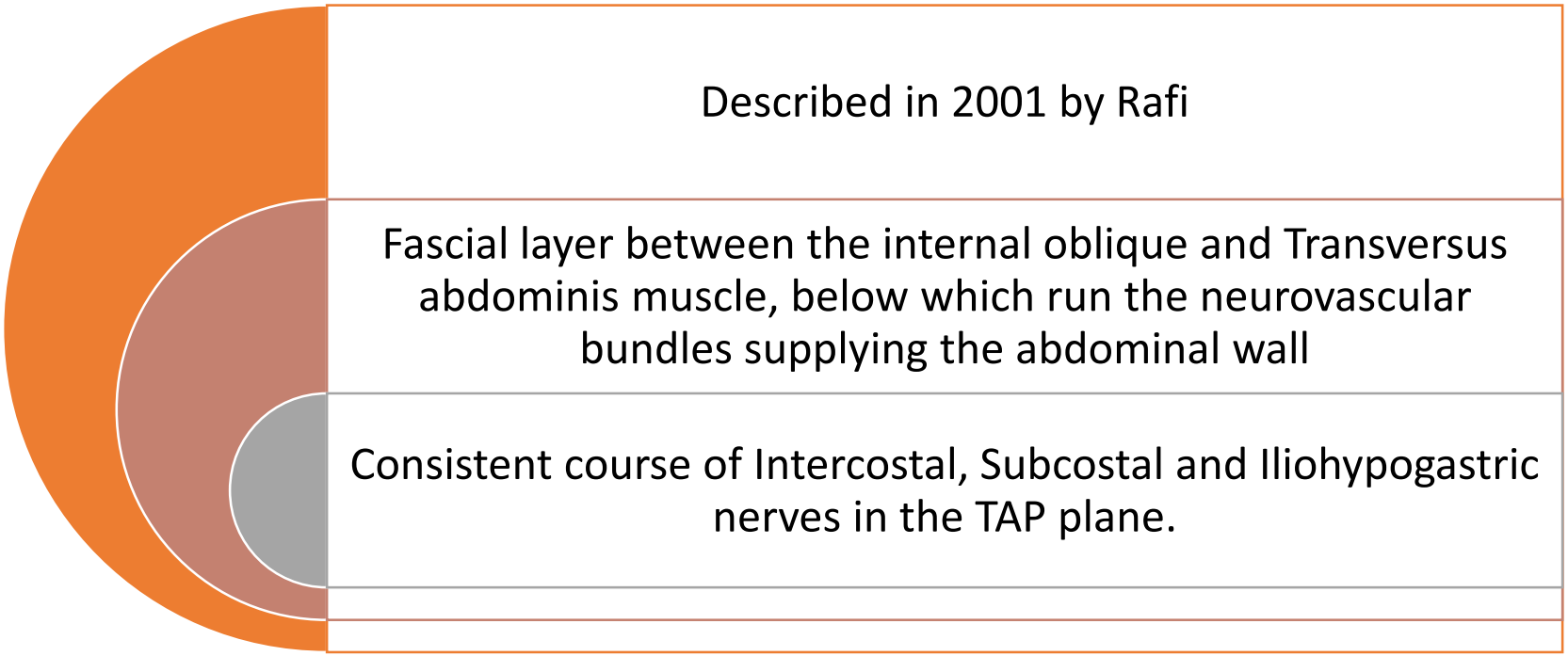
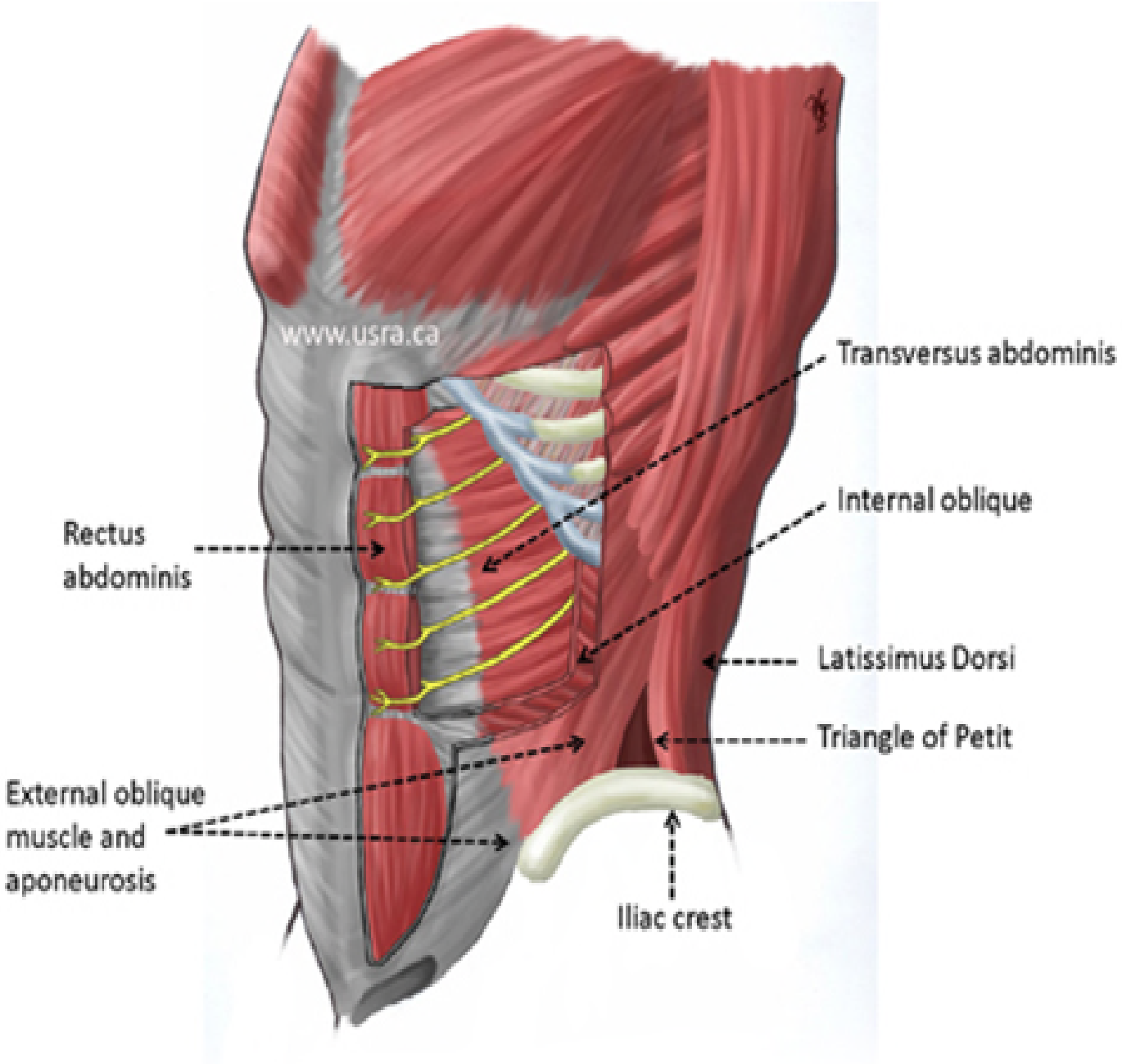
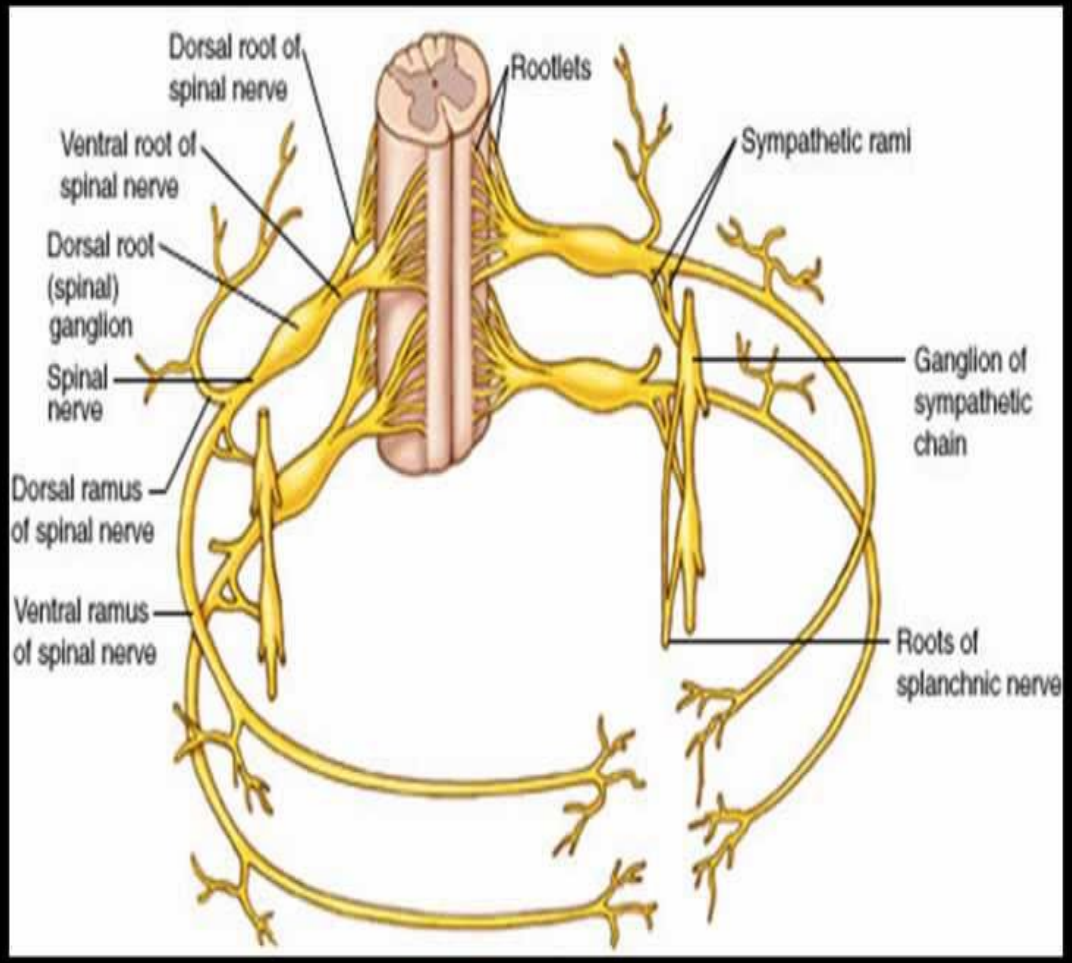
# Trasversus Abdominis Plane (TAP) Block



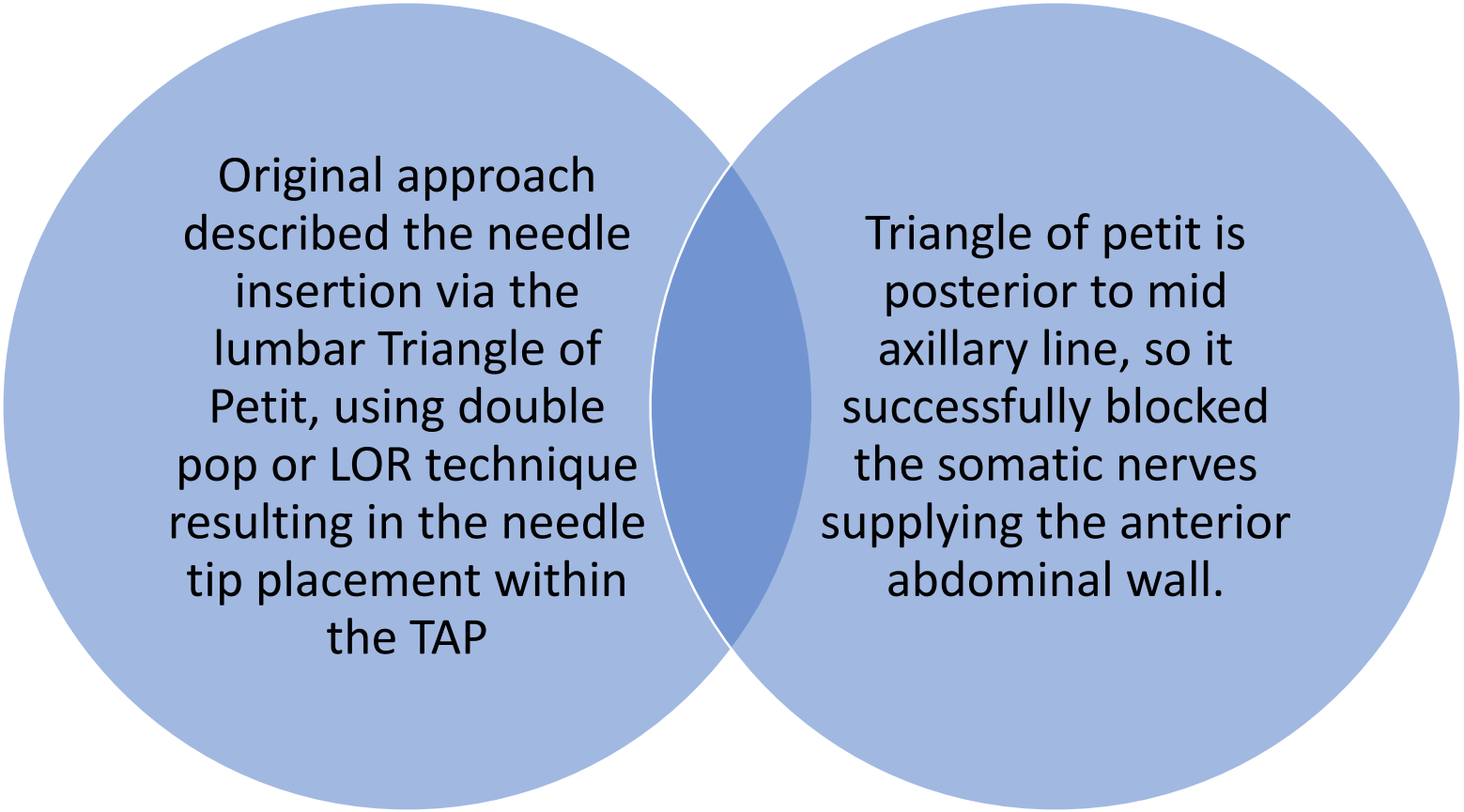

www.usra.ca
Transversus abdominis
Internal oblique
Rectus abdominis
Latissimus Dorsi
Triangle of Petit
External oblique muscle and aponeurosis
Iliac crest

# Segmental spinal nerves



# Transversus abdominis plane block

Olivia Finnerty[a,b] and John G. McDonnell[a,b,c]




CL-TAP
Gen
MB
Patient
Auto Gain
Gen
Clip
Page 1/3
EO
IO
TA
PC
Medial
Gain
Depth
Freeze
Save
Optio

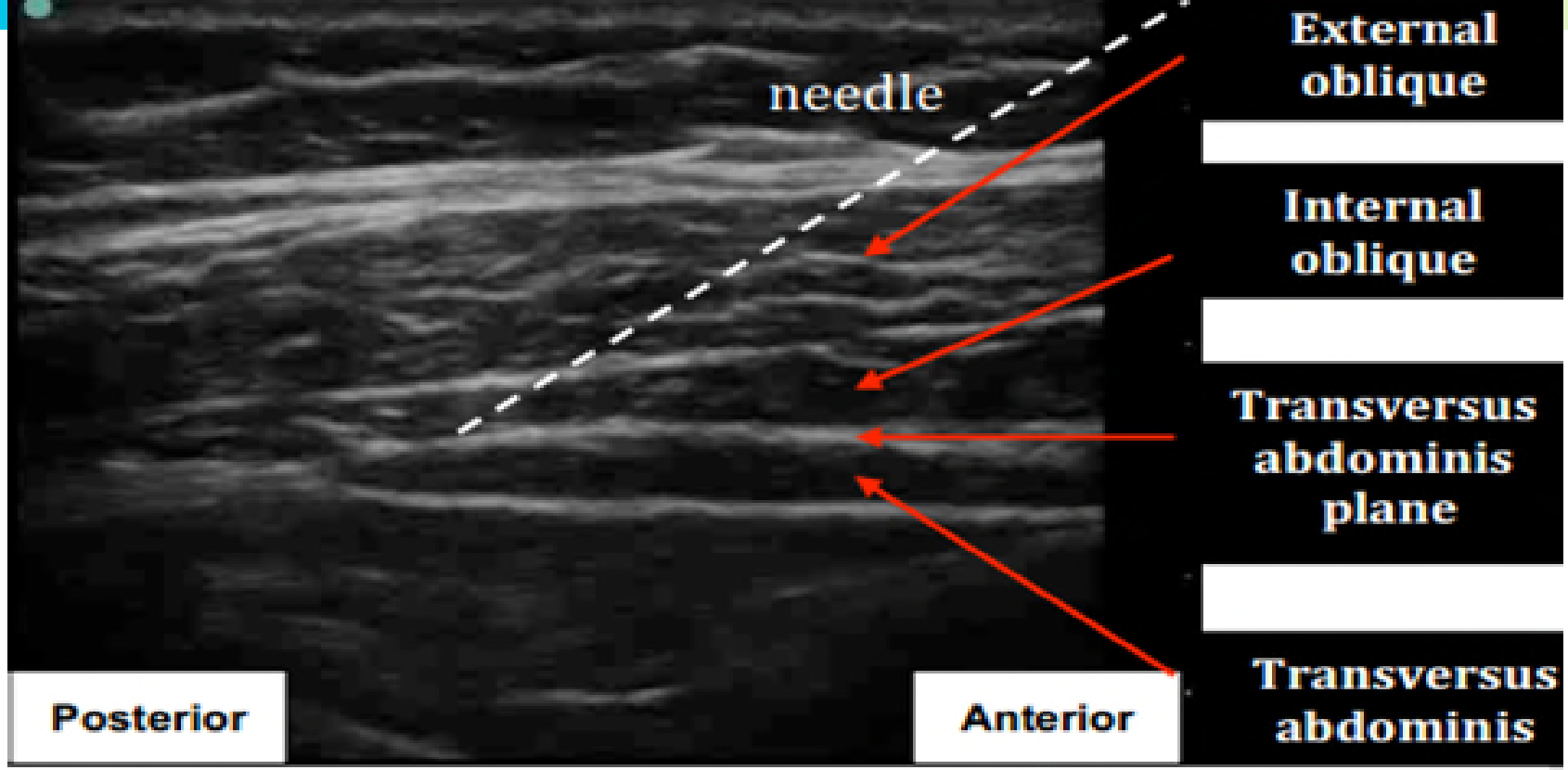
# Anatomy

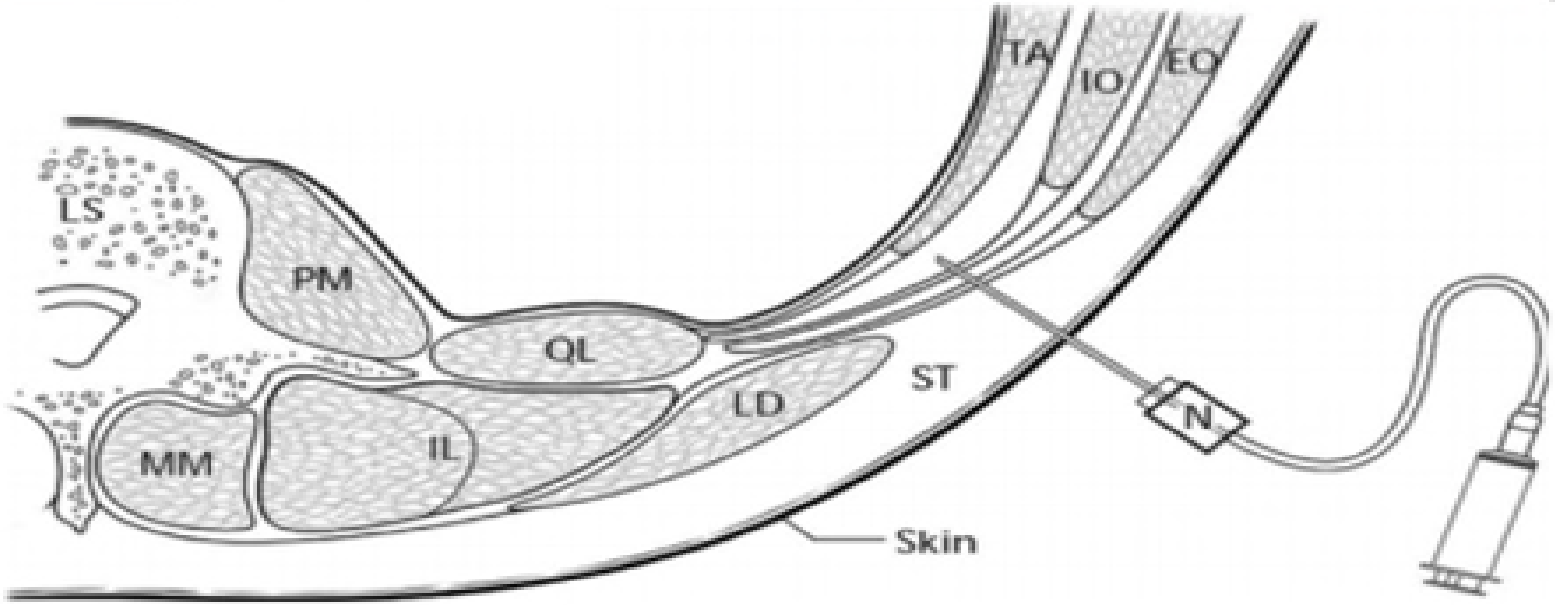
Initial concept of TAP block was that this was a FIELD BLOCK or a RAFI

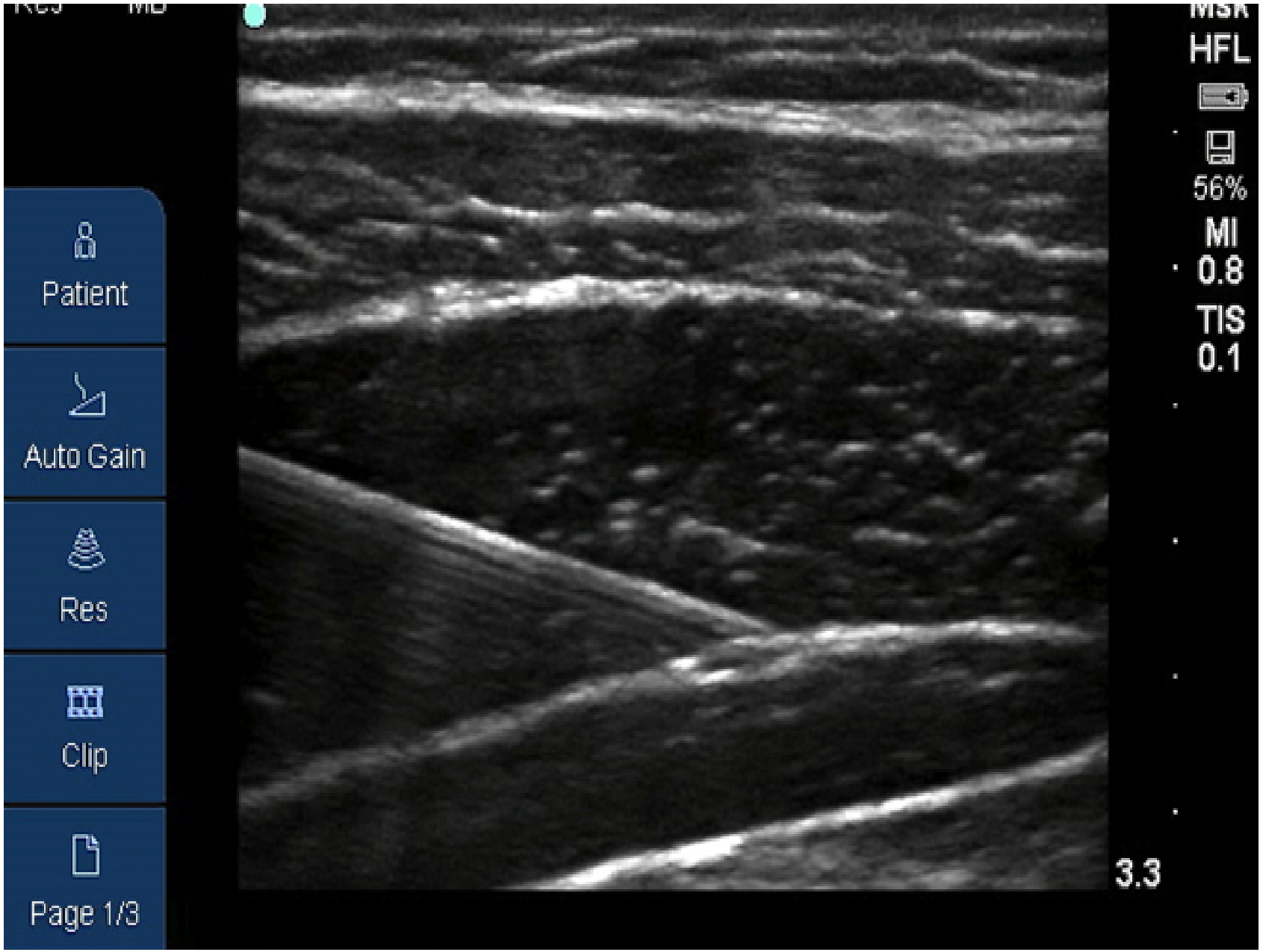
( Regional abdominal field infiltration ) block

Belief was that the analgesic profile was obtained by blockade of nerves lying within the TAP plane by the spread of LA within it

Various studies showed CONSISTENT spread of contrast from iliac crest to the costal margin on CT imaging and serial MRIs over 4 hours


needle
External oblique
Internal oblique
Transversus abdominis plane
Transversus abdominis
Posterior
Anterior


TA
IO
EO
LS
PM
QL
LD
ST
MM
IL
N
Skin


MSK
HFL
56%
MI
0.8
TIS
0.1
3.3
Patient
Auto Gain
Res
Clip
Page 1/3


EO
IO
TA
Local anesthetic
splitting transversus

# Different approaches

Tran et al, USG guided TAP blocks, they found the dye spread between the iliac crest, costal margin and rectus muscle with an average area of 45 cm2 and involved the nerves T11 to L1

Barrington et al, USG guided insertion of dye at the subcostal TAP region in cadavers. On dissection, involved more nerves T8-11 and had larger area of spread 90 cm2

# Visceral Cancer Pain

- Celiac Plexus Block
- Ganglion Impar block
- Lumbar Sympathetic Block
- Superior Hypogastric Plexus Block
- Stellate Ganglion Block

# Celiac Plexus Block- An old technique with New Developments

Celiac plexus is the largest visceral plexus

Celiac plexus relays pain signals from upper abdominal organs to the CNS

Position varies from T12-L2 disc space

Lies in the retroperitoneum and anterolateral to the abdominal aorta

# history

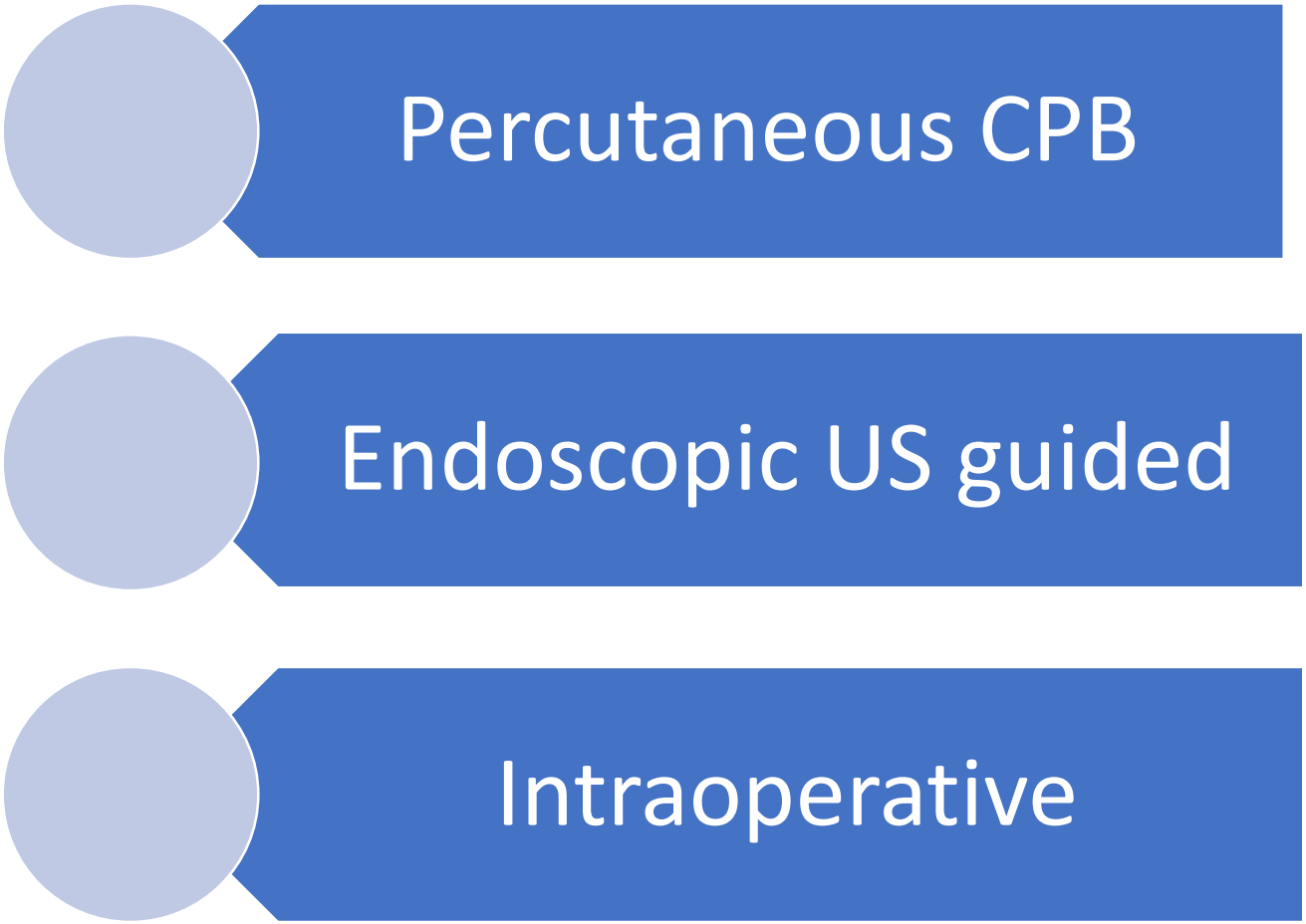
First described in 1914 for surgical anesthesia

Not until 1957, it was used to treat pain secondary to malignancy

1979, first Fluoroscopy guided CPB was described

1996, Endoscopic US guided CPB was described

# Modern day practice



# Review

Partial to complete pain relief in approx. 90% of patients at 3 months and 70% until death beyond 3 months.

Reduces healthcare costs

Most common side effect after neurolysis- transient local pain

Rare- kidney puncture, peritonitis, pneumothorax, retroperitoneal hematoma ( image guidance has reduced the risk of improper needle placement)

Celiac trunk thrombosis, celiac artery vasospasm- bowel infarction

Diarrhea and hypotension from unopposed PNS after sympathetic block

# What we Know

CPB is an efficacious modality of pain relief for Head of Pancreas related malignancy

Efficacy on opioid sparing and level of pain relief is maximum when given early in the disease trajectory

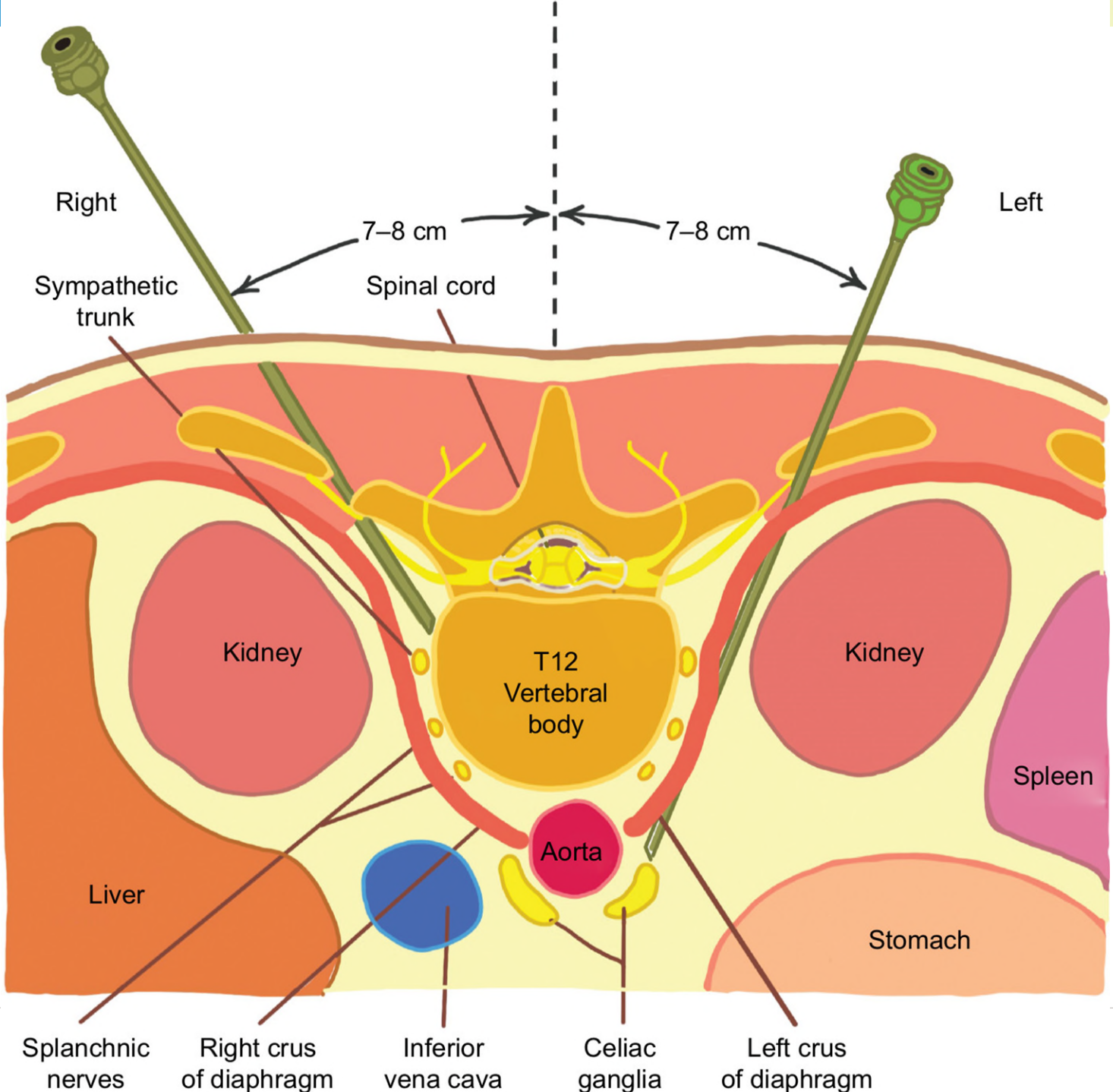
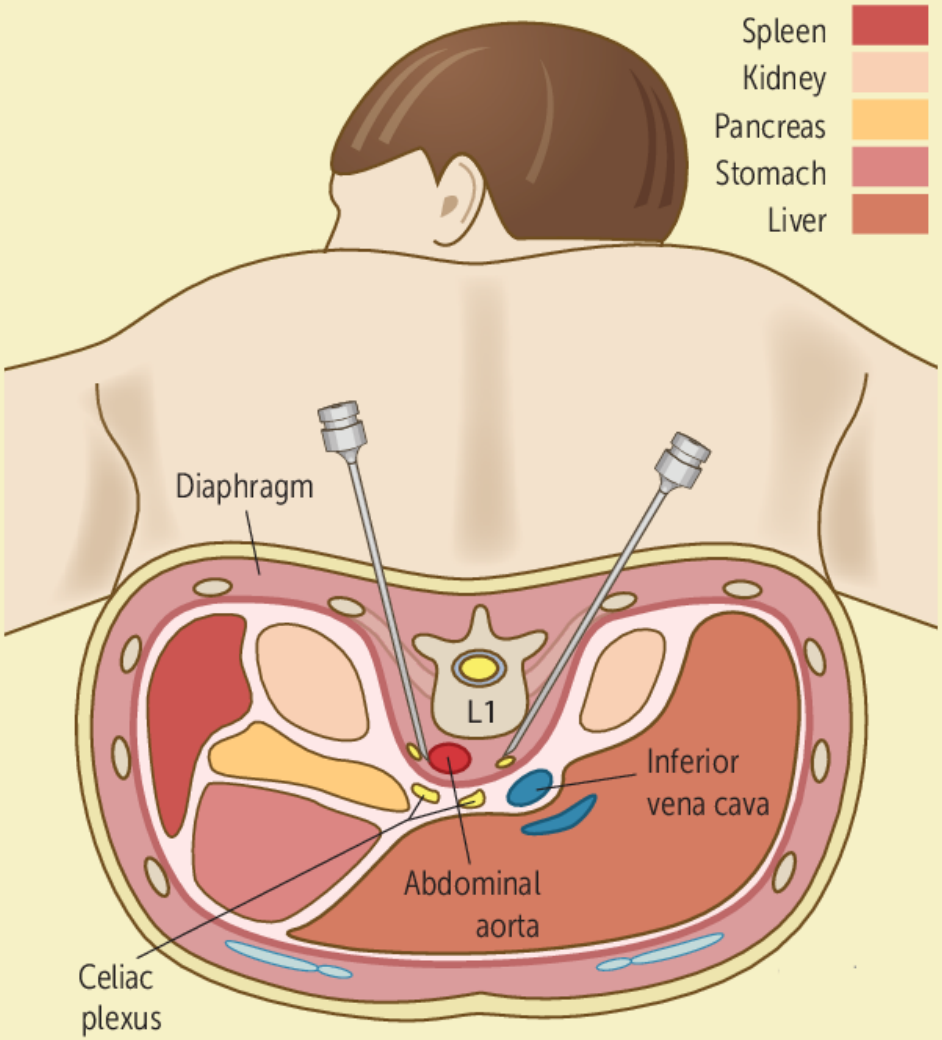
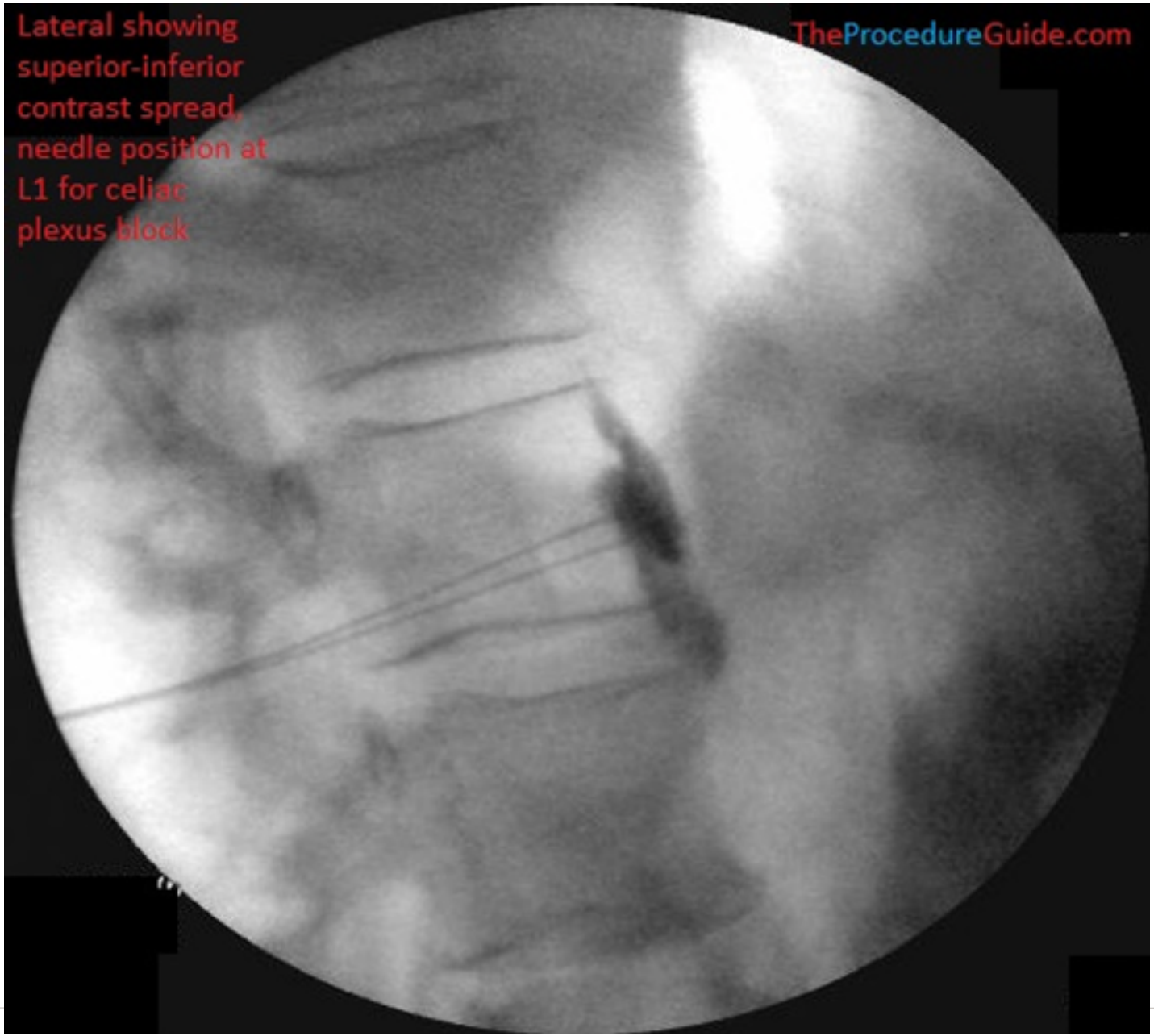

Right
Left
7–8 cm
7–8 cm
Sympathetic trunk
Spinal cord
Kidney
T12 Vertebral body
Kidney
Spleen
Aorta
Liver
Stomach
Splanchnic nerves
Right crus of diaphragm
Inferior vena cava
Celiac ganglia
Left crus of diaphragm

**FIGURE 1.**

PERCUTANEOUS-GUIDED CELIAC PLEXUS BLOCK




**Note.** Image courtesy of Oncolex. Used with permission.


Lateral showing superior-inferior contrast spread, needle position at L1 for celiac plexus block
TheProcedureGuide.com

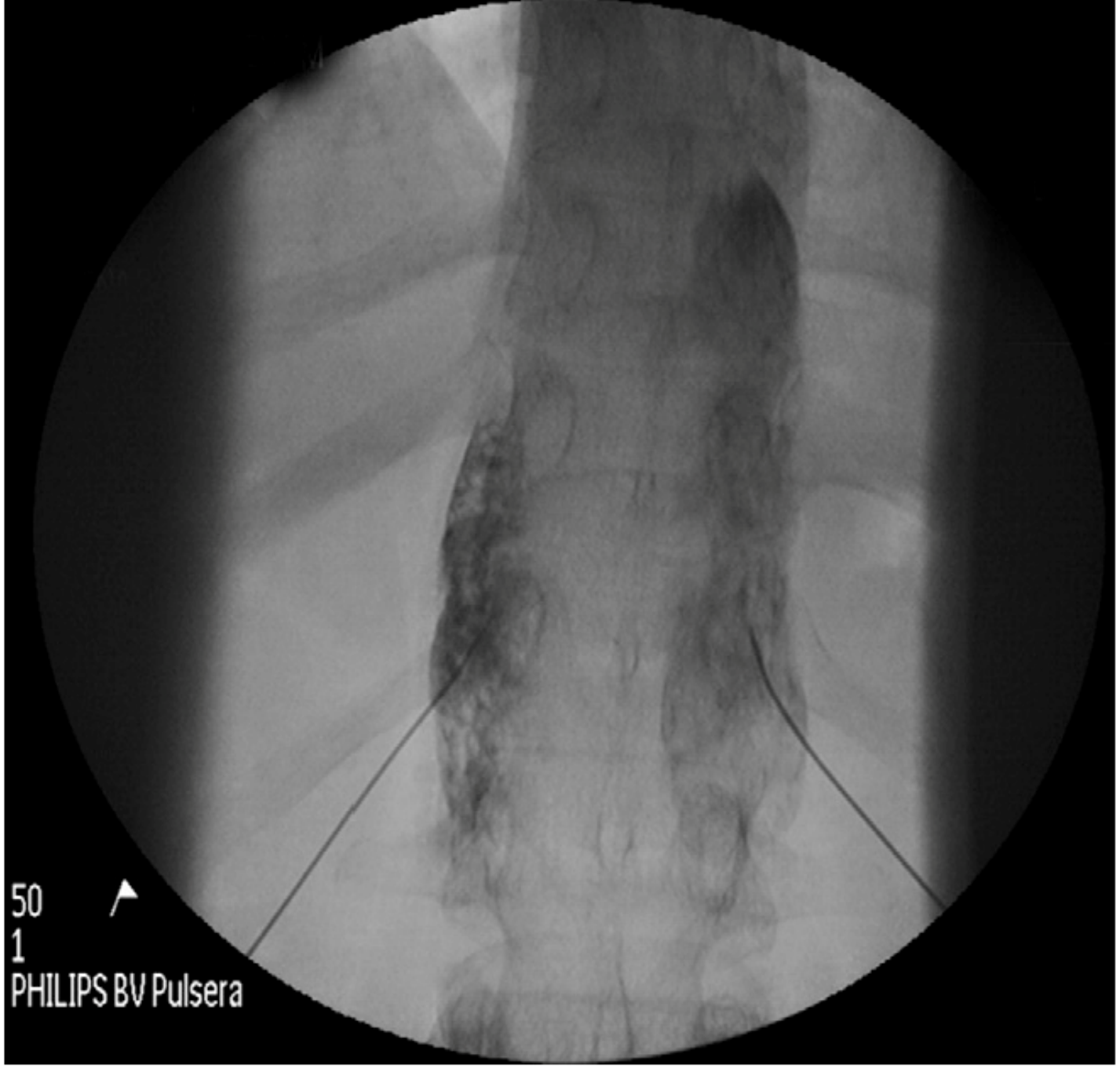
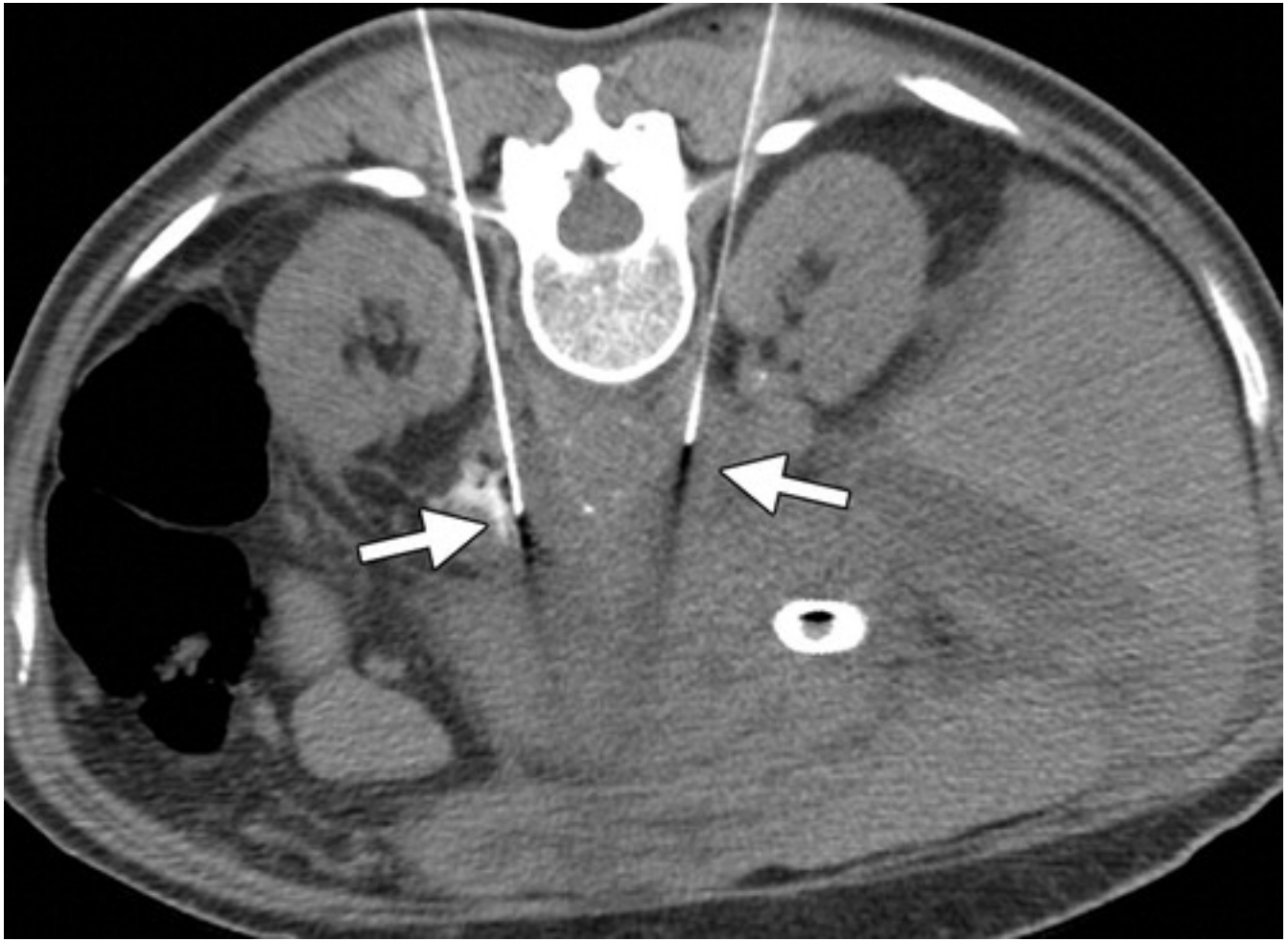



**Fig 2** Anteroposterior fluoroscopic view of final bilateral needle



# EUS Trans gastric approach

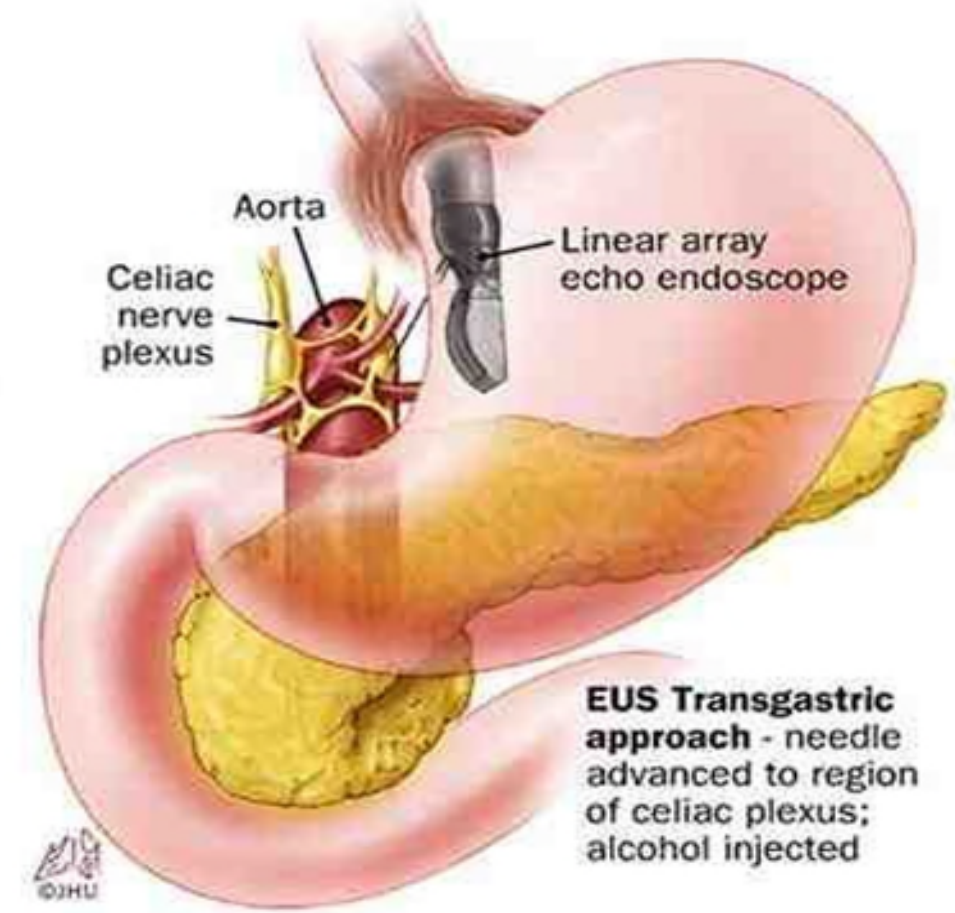
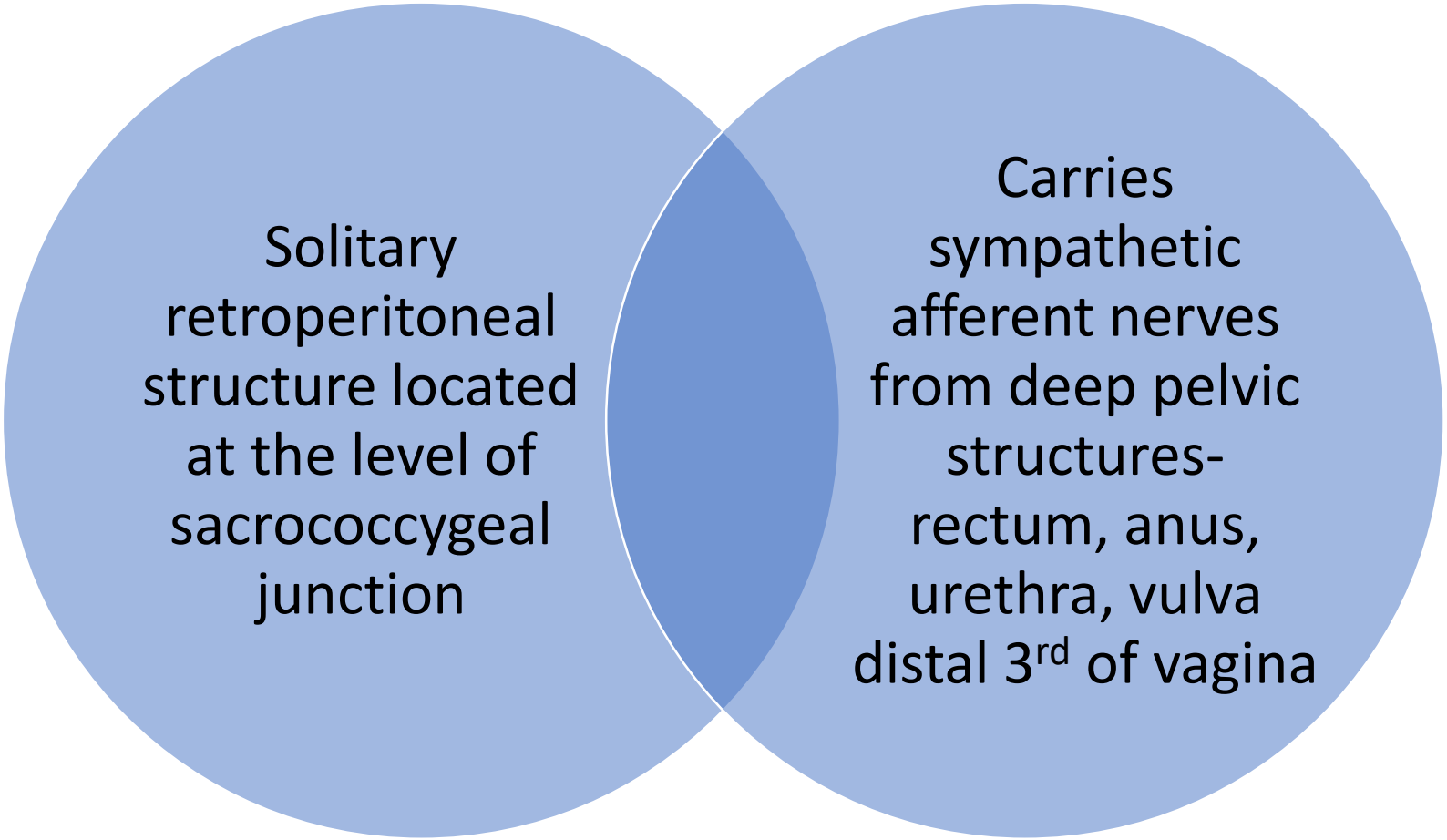
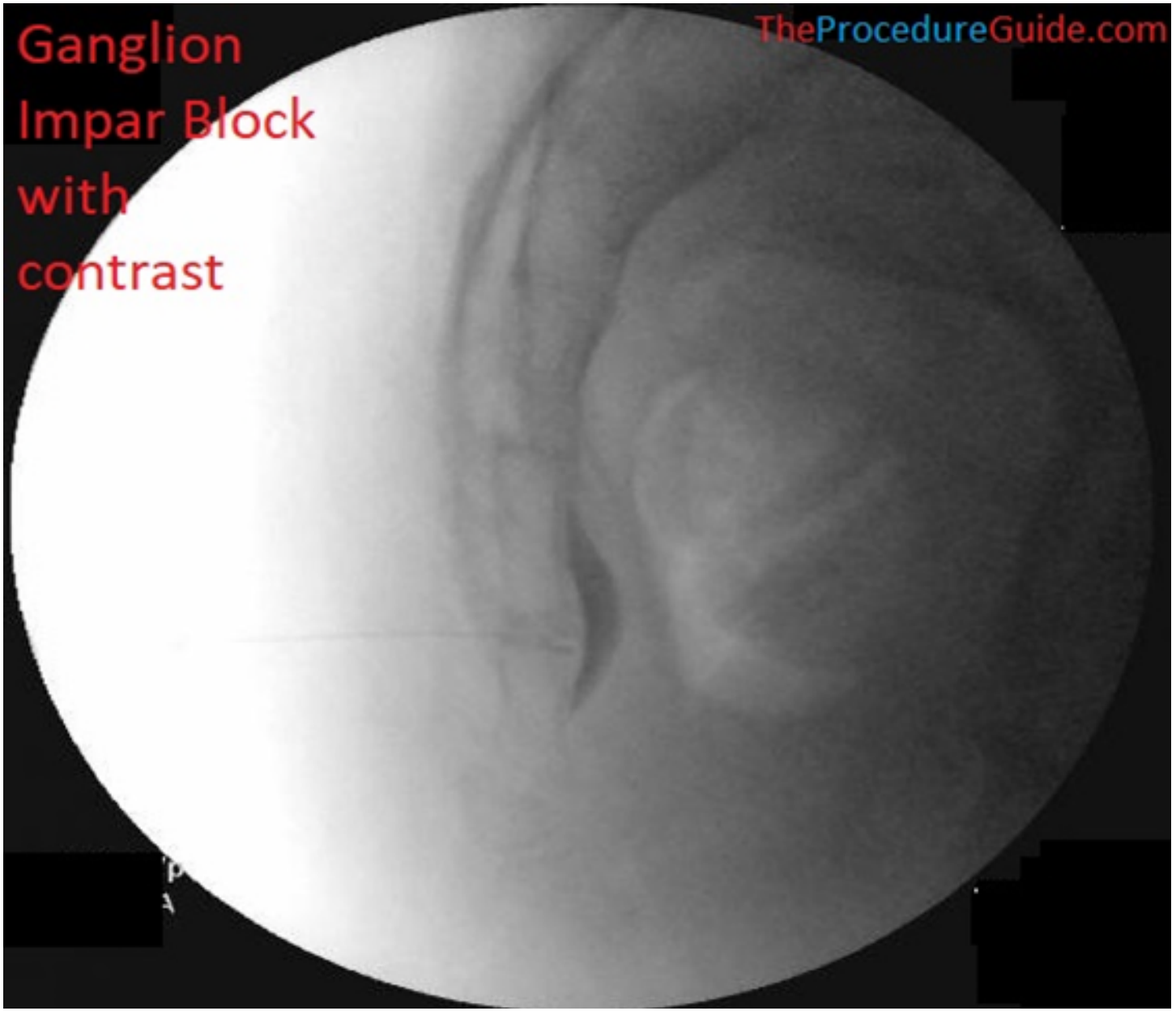
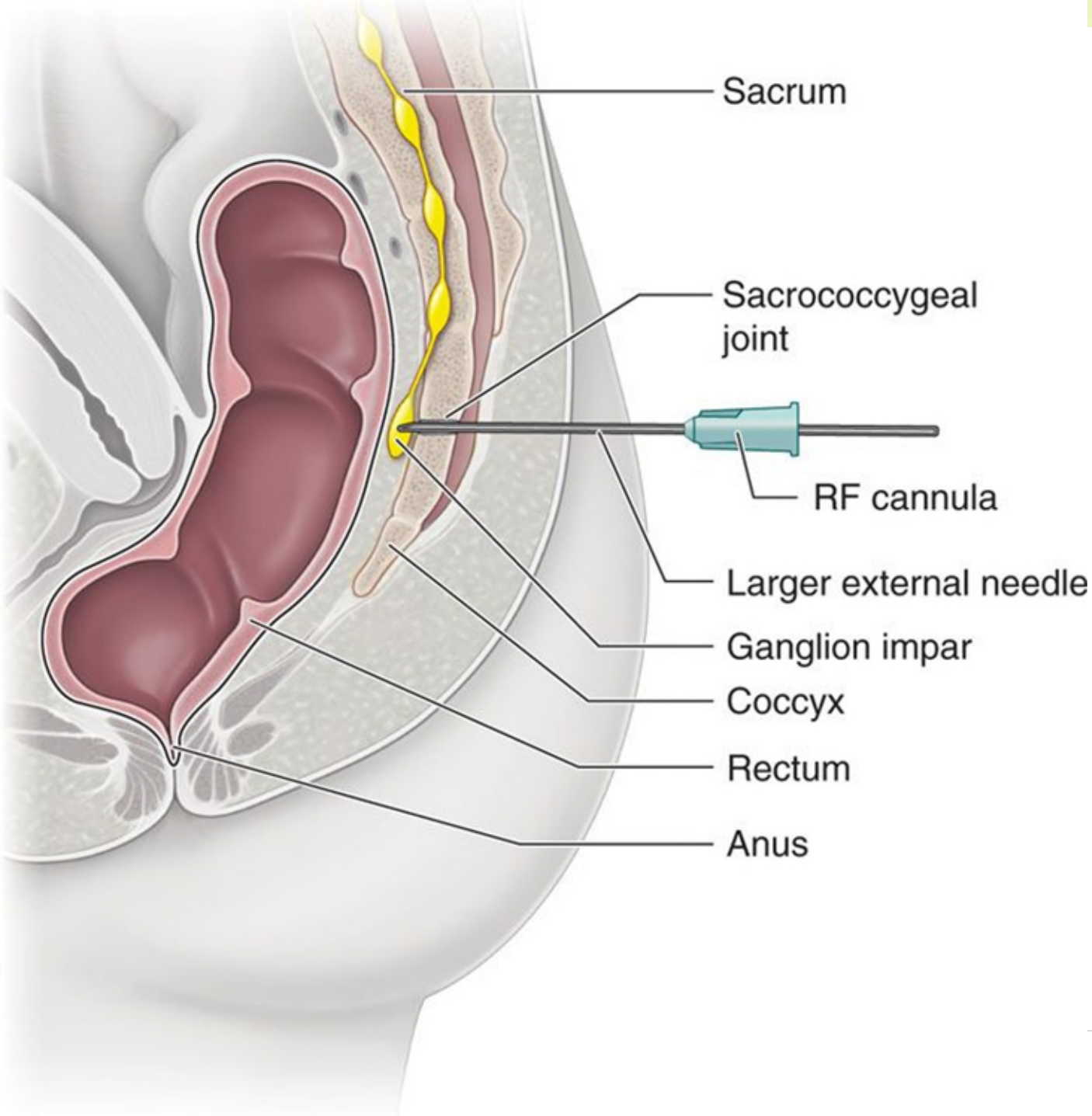



**Figure 25C** - Transgastric celiac plexus nerve block

# Ganglion impar block




Ganglion
Impar Block
with
contrast
TheProcedureGuide.com


Sacrum
Sacrococcygeal joint
RF cannula
Larger external needle
Ganglion impar
Coccyx
Rectum
Anus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# Intrathecal Drug Delivery - IDD

- Targeted and continuous drug infusion directly into the intrathecal space, thus bypassing BBB
- Since the drug is in the vicinity of the action site, much lower dose is required
- Consequently, opioid serum levels are minimal
- Patients with IDD have fewer inpatient visits, inpatient days and ED visits compared to patients on CMM

Ist documented injection into CSF was in 1898.

Wasn't until 1973 that opioid receptors were discovered on the spinal cord

1979, Ist successful injection of Morphine in the spinal canal for refractory cancer pain

Absence of respiratory depression, sedation

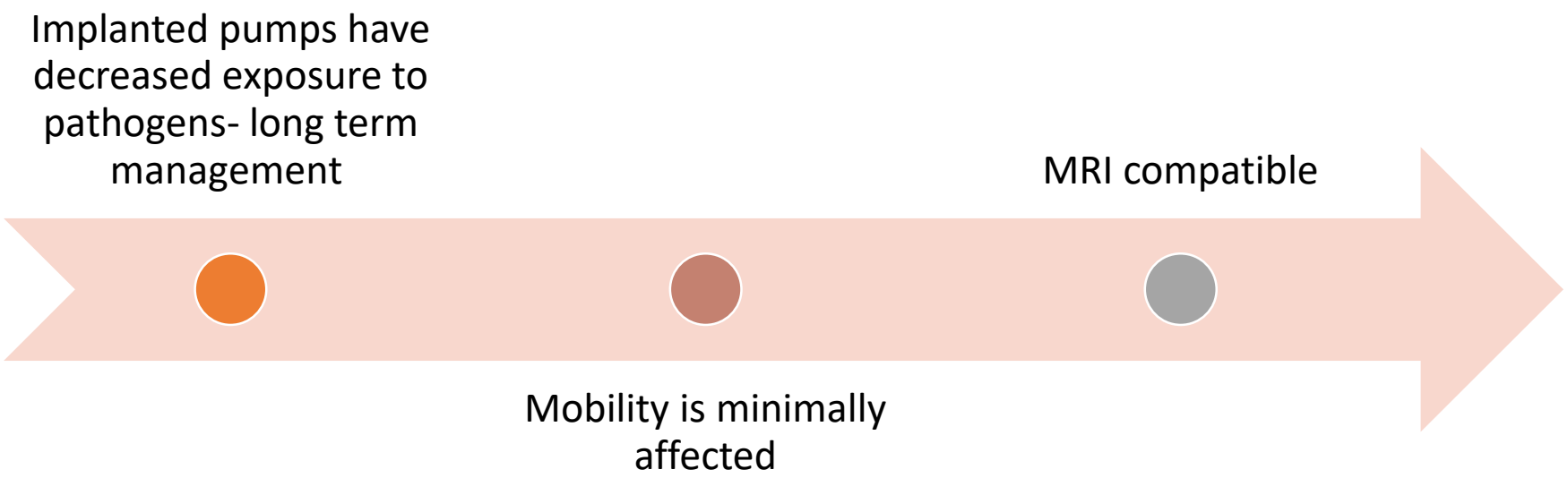
1981, Ist Intrathecal drug delivery device was introduced into clinical use

# FDA approved

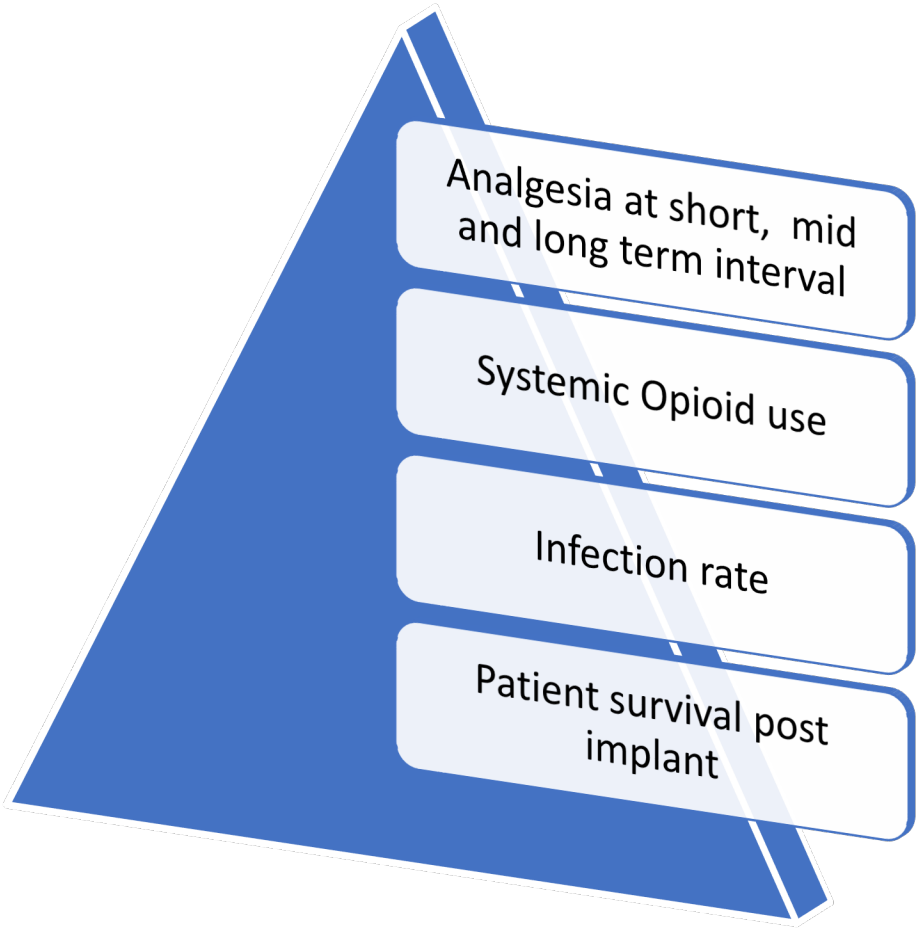
Implanted programmable intrathecal pump ( Medtronic)

Implanted programmable intrathecal pump ( Flowonix)

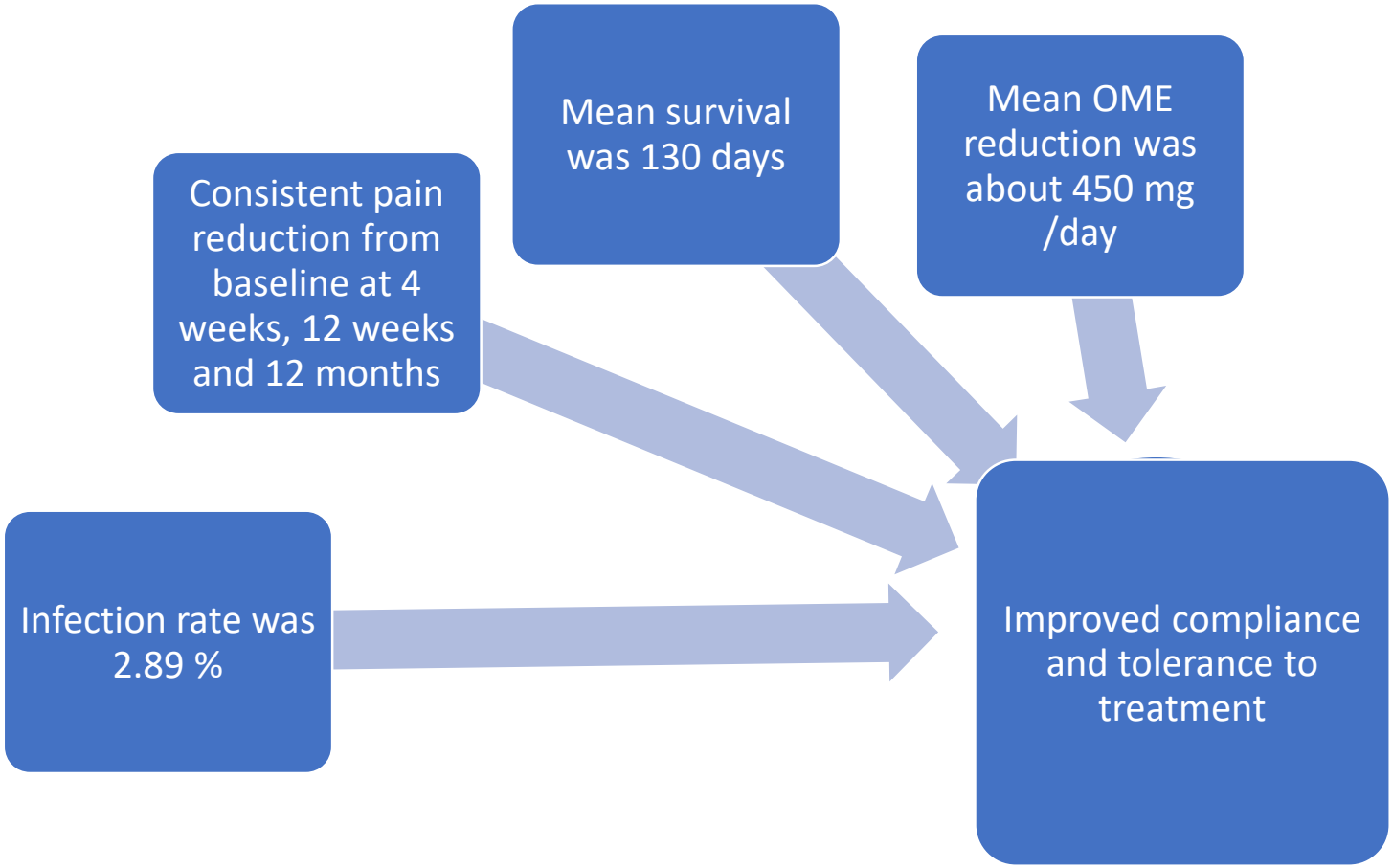
- Differ in the volume of the reservoir
- Programmable characteristics


Implanted pumps have decreased exposure to pathogens- long term management
MRI compatible
Mobility is minimally affected

# Meta-analysis



# Results

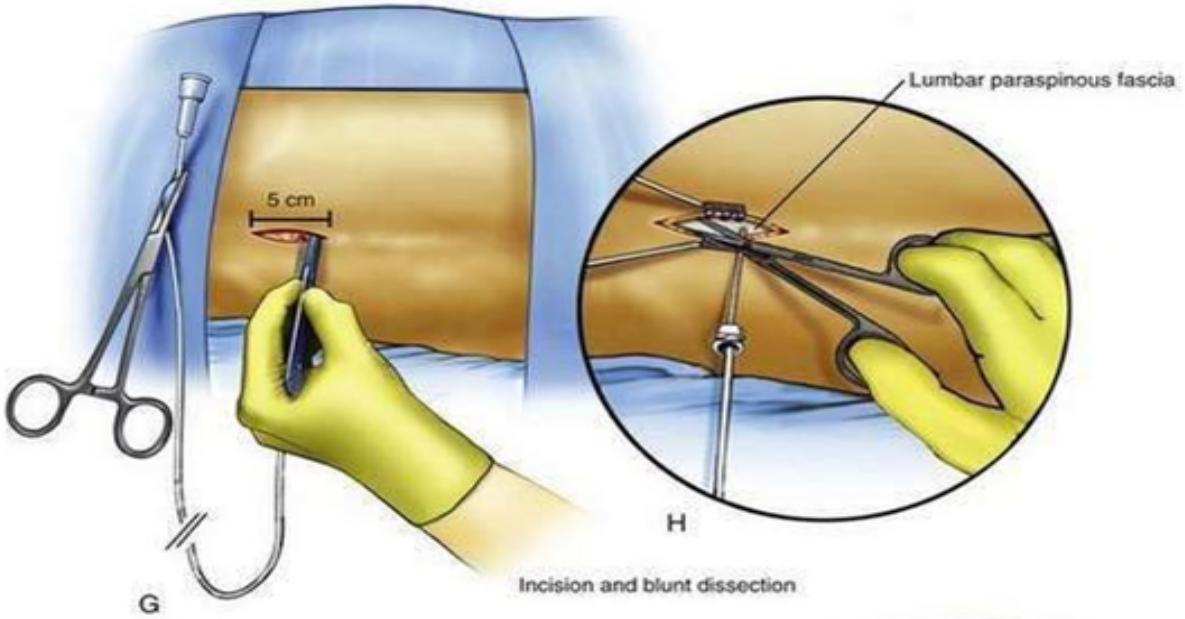

Mean survival was 130 days
Mean OME reduction was about 450 mg /day
Consistent pain reduction from baseline at 4 weeks, 12 weeks and 12 months
Infection rate was 2.89 %
Improved compliance and tolerance to treatment

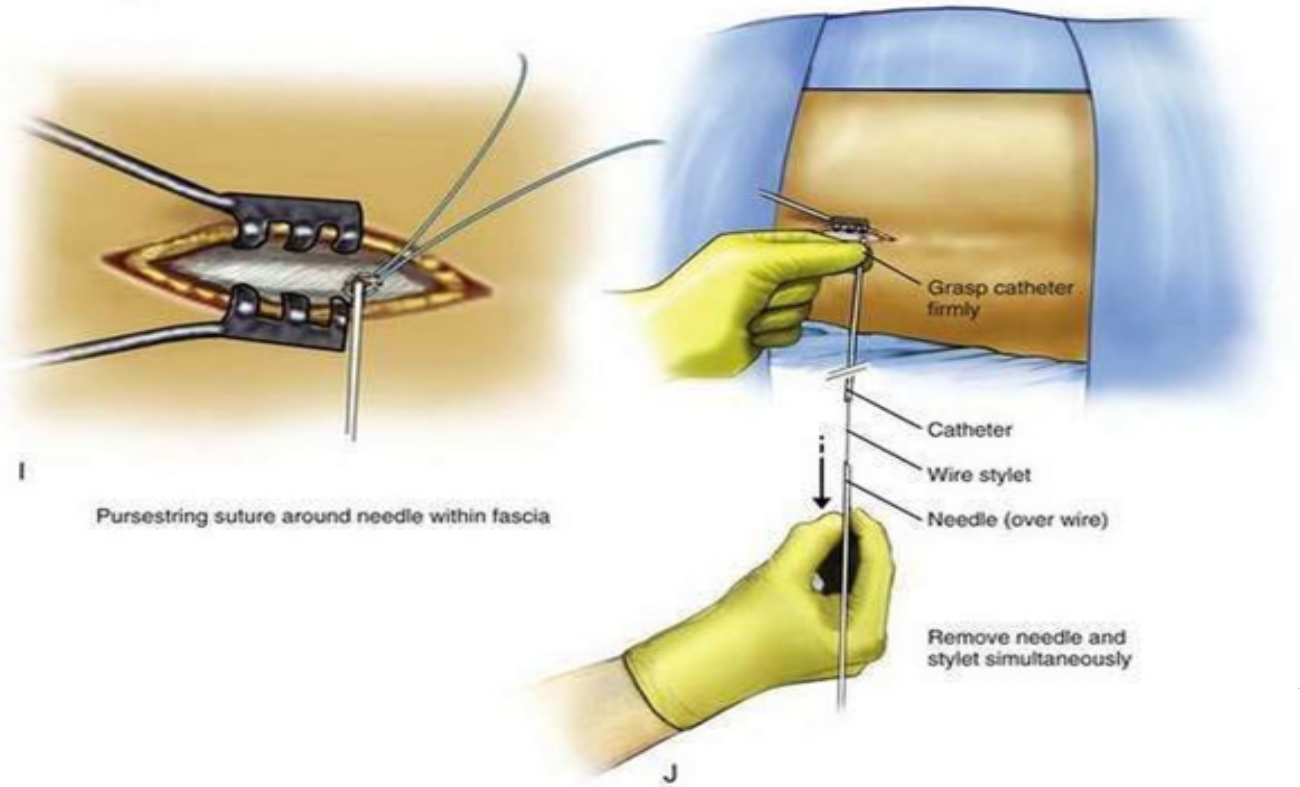
# IDD

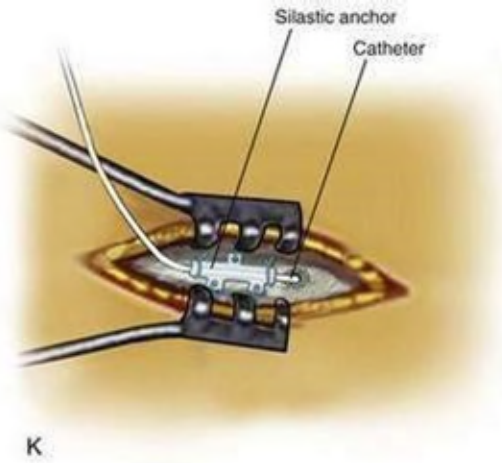
The flexible spinal catheter is placed percutaneously and tunneled to connect to the reservoir and pump.

The pump is controlled by an external programming device

Patient is a given a handheld device to allow for intermittent bolus dosing

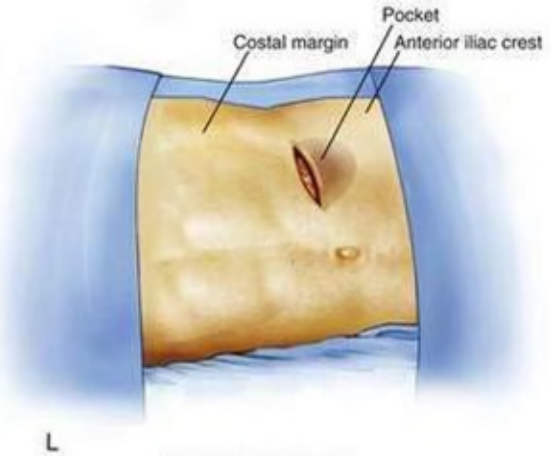

5 cm
G
Lumbar paraspinous fascia
H
Incision and blunt dissection


I
Pursestring suture around needle within fascia
Grasp catheter firmly
Catheter
Wire stylet
Needle (over wire)
Remove needle and stylet simultaneously
J



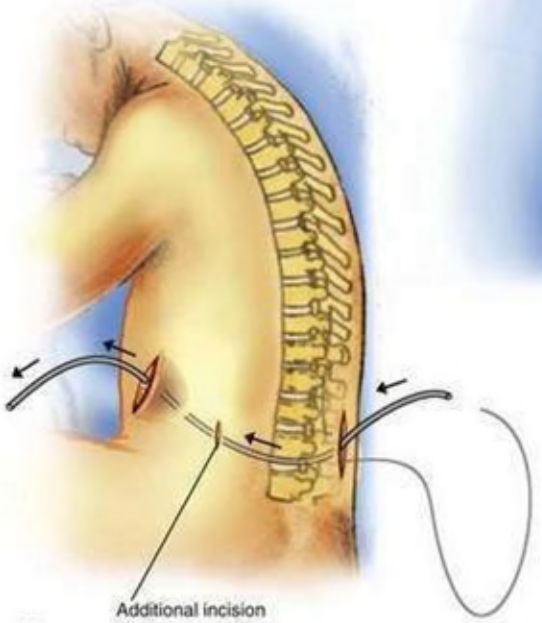

K

Secure catheter with Silastic anchor and sutures



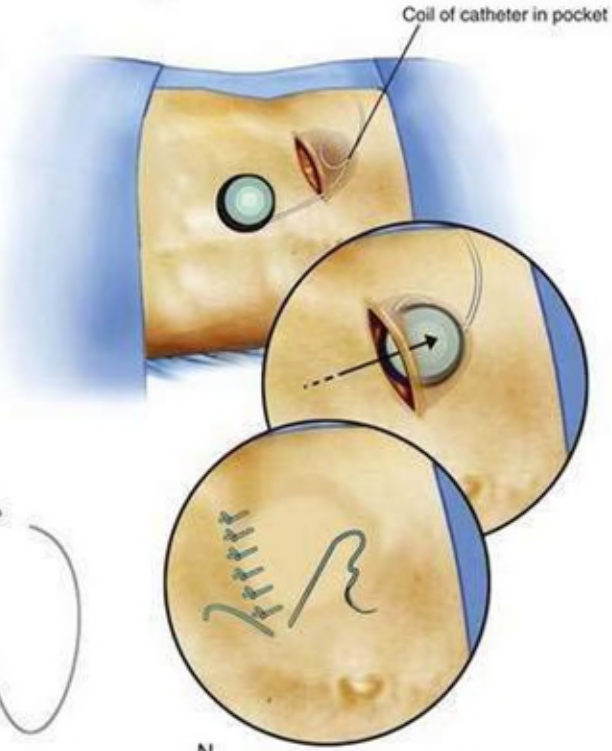

L

Create pocket for pump



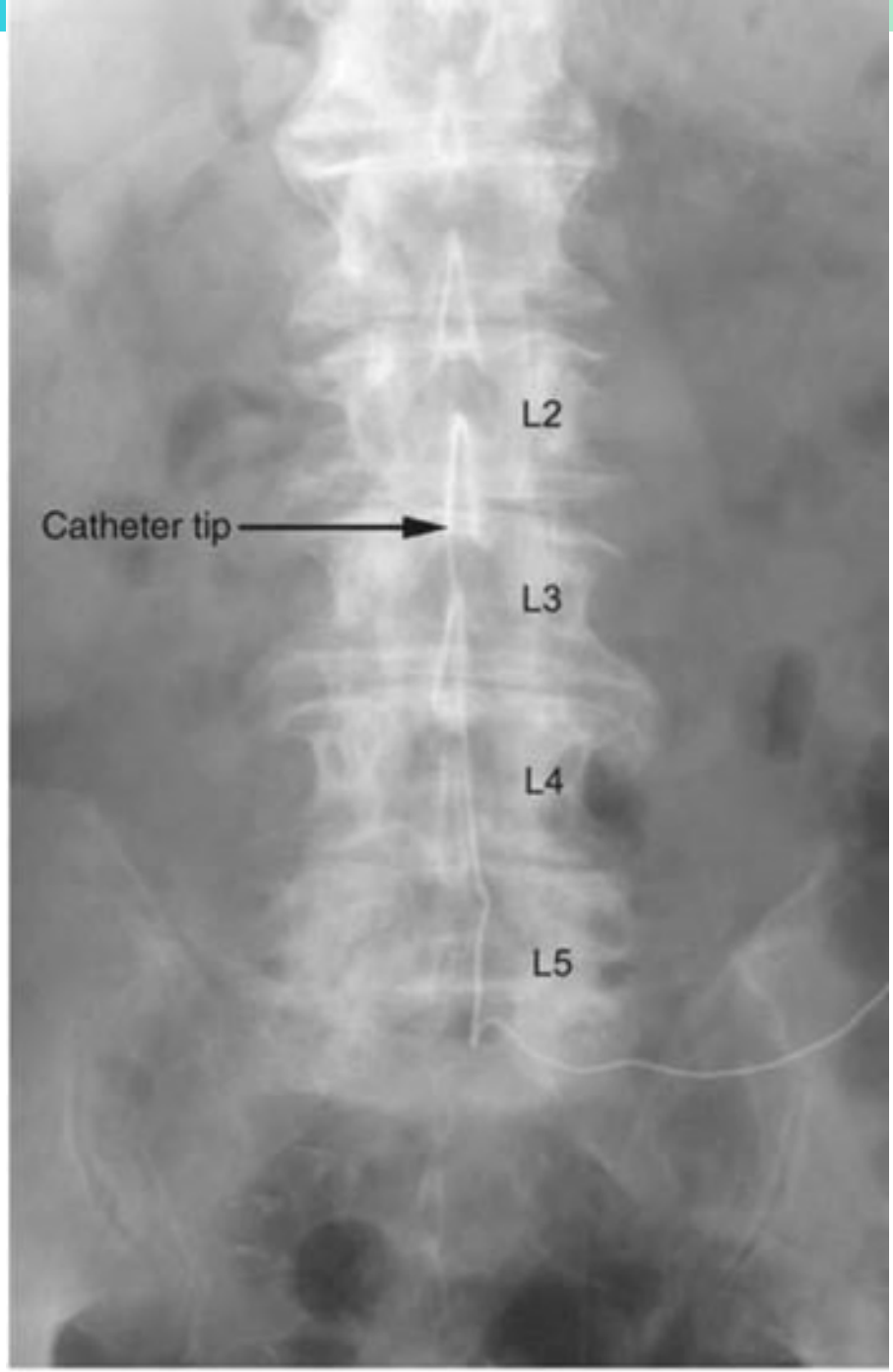

M

Extend tunneling device through subcutaneous tissues and then tunnel catheter through device

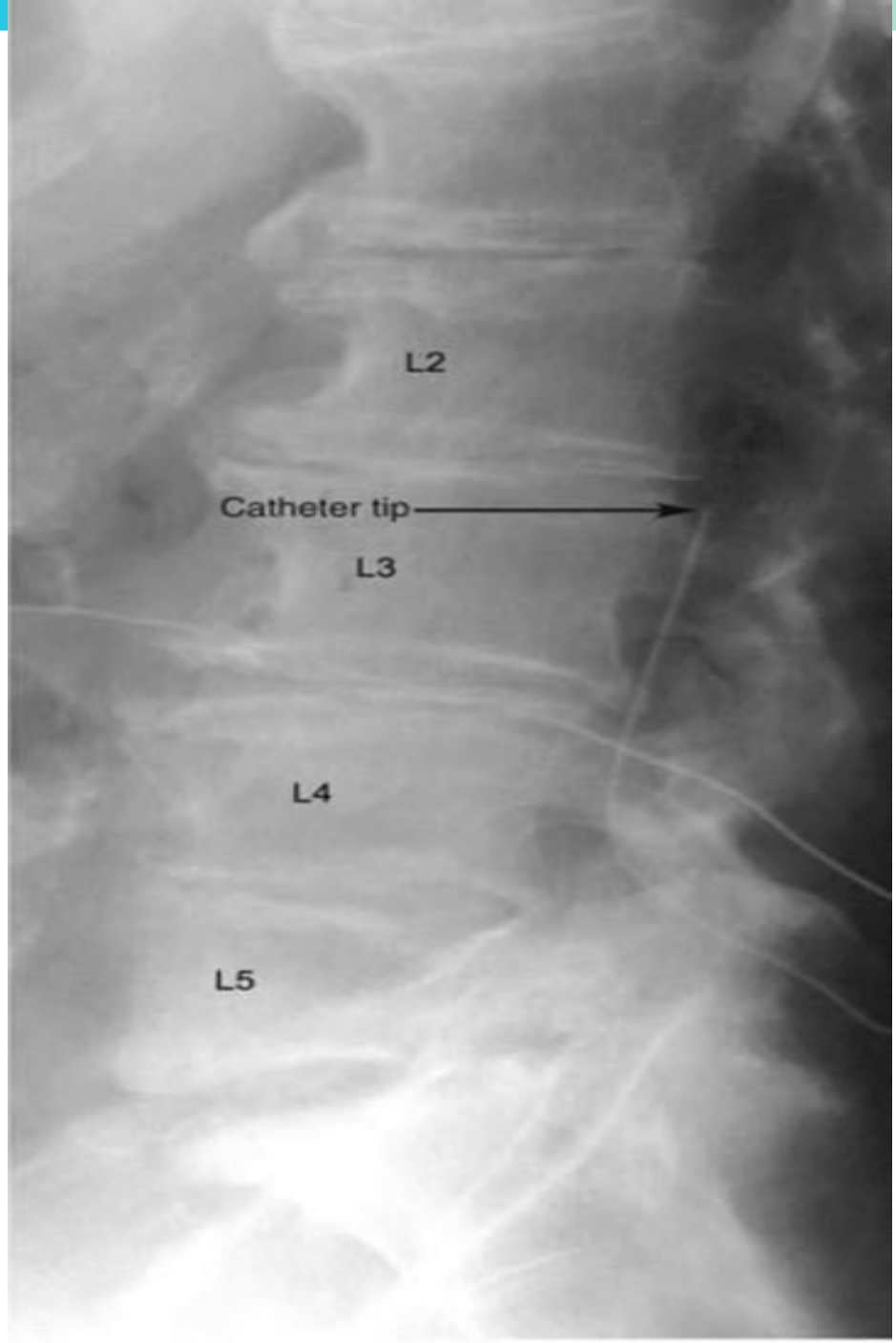



N

Coil catheter into pocket, place pump inside, and suture closed

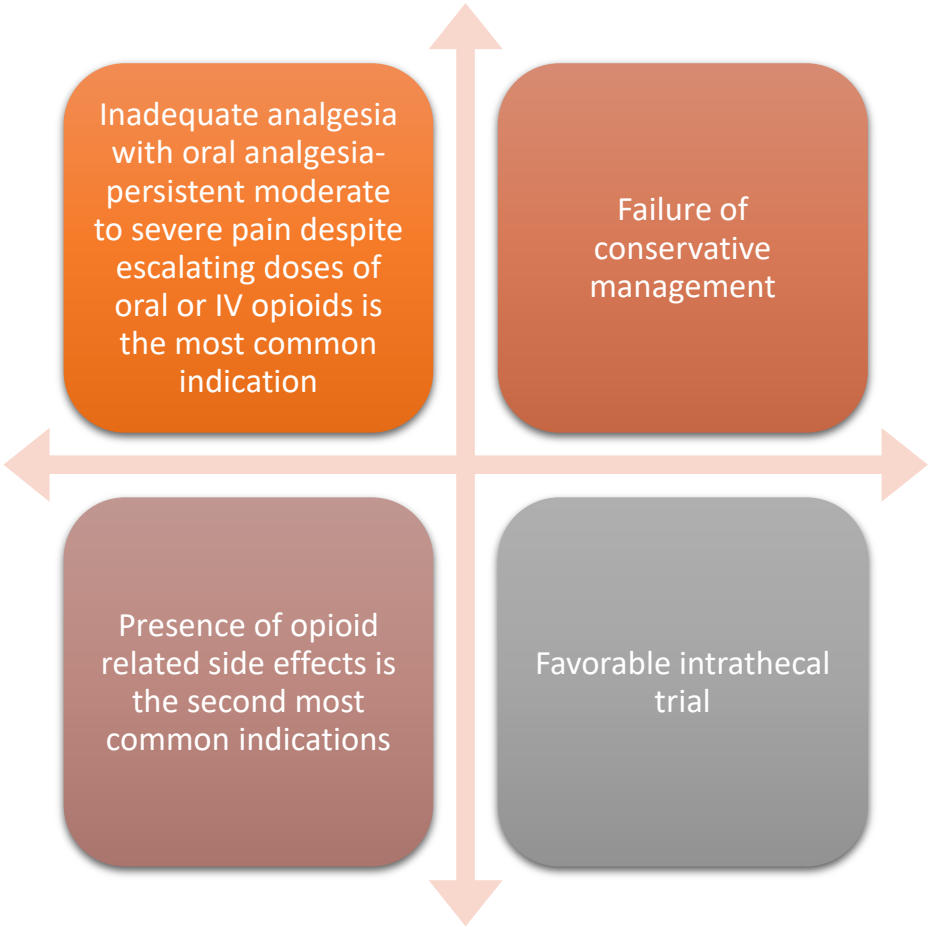



D

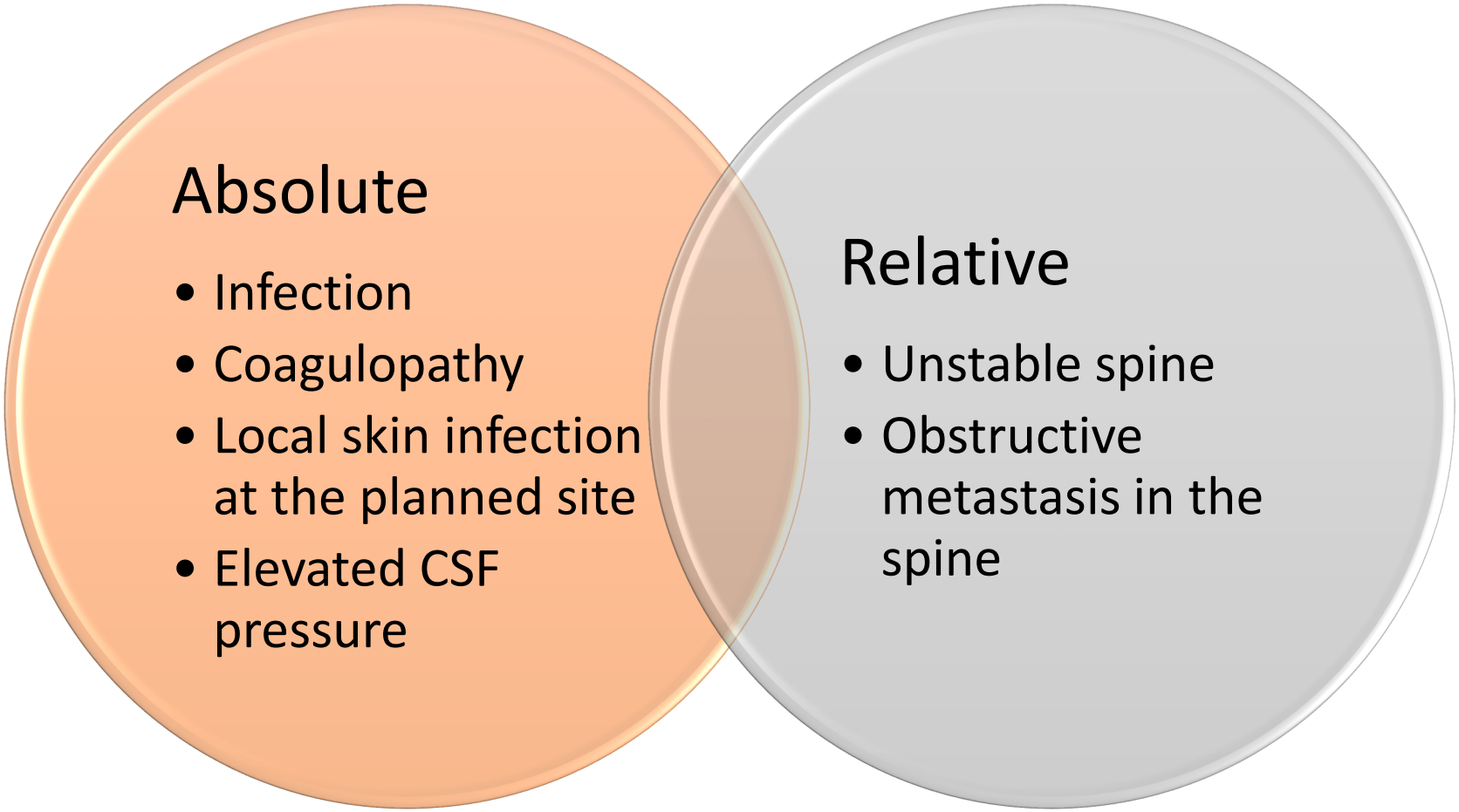



E

# Indications



# Contraindications



# All that glitters is not GOLD

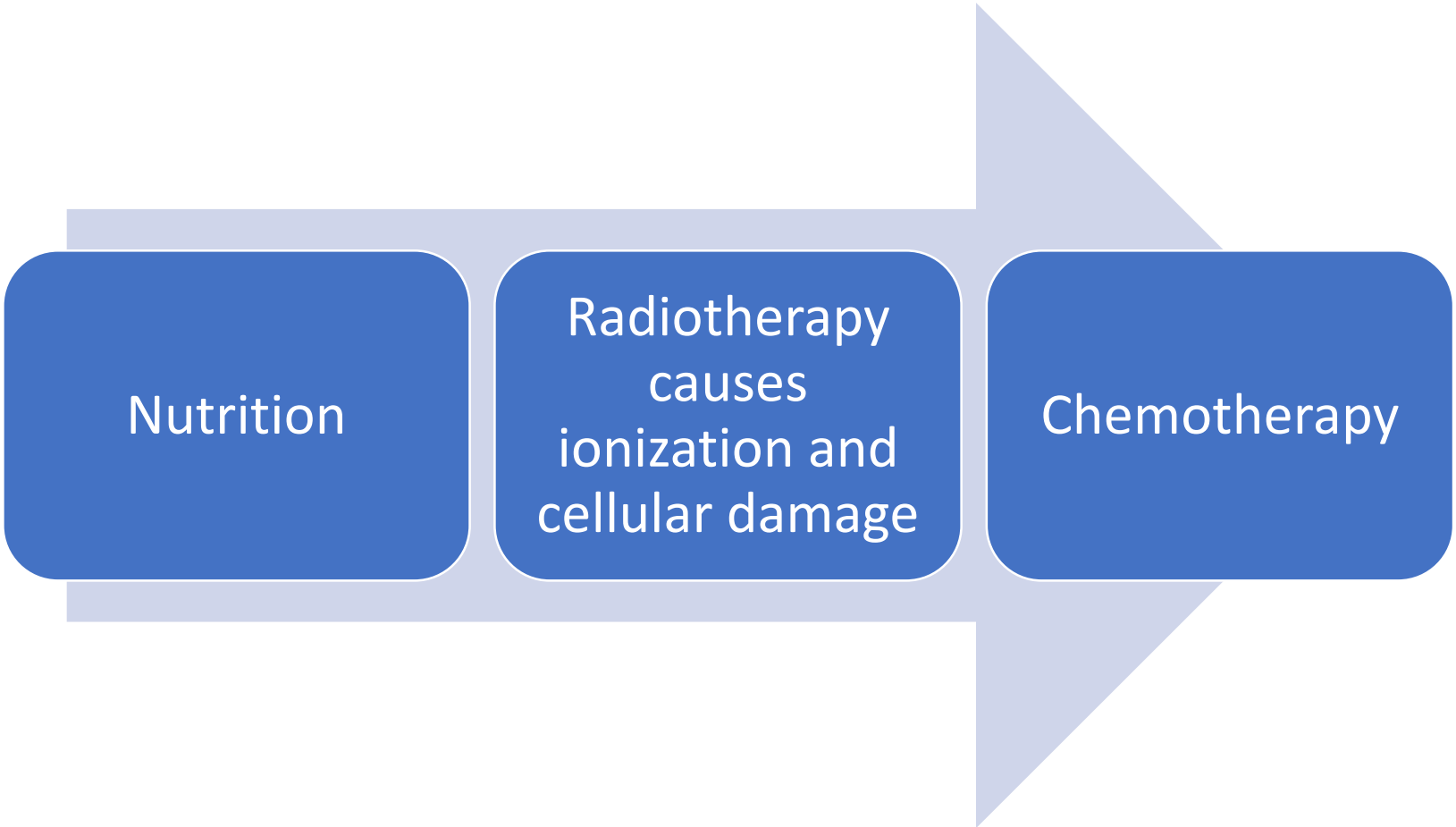
# Risk Factors

Immunosuppression

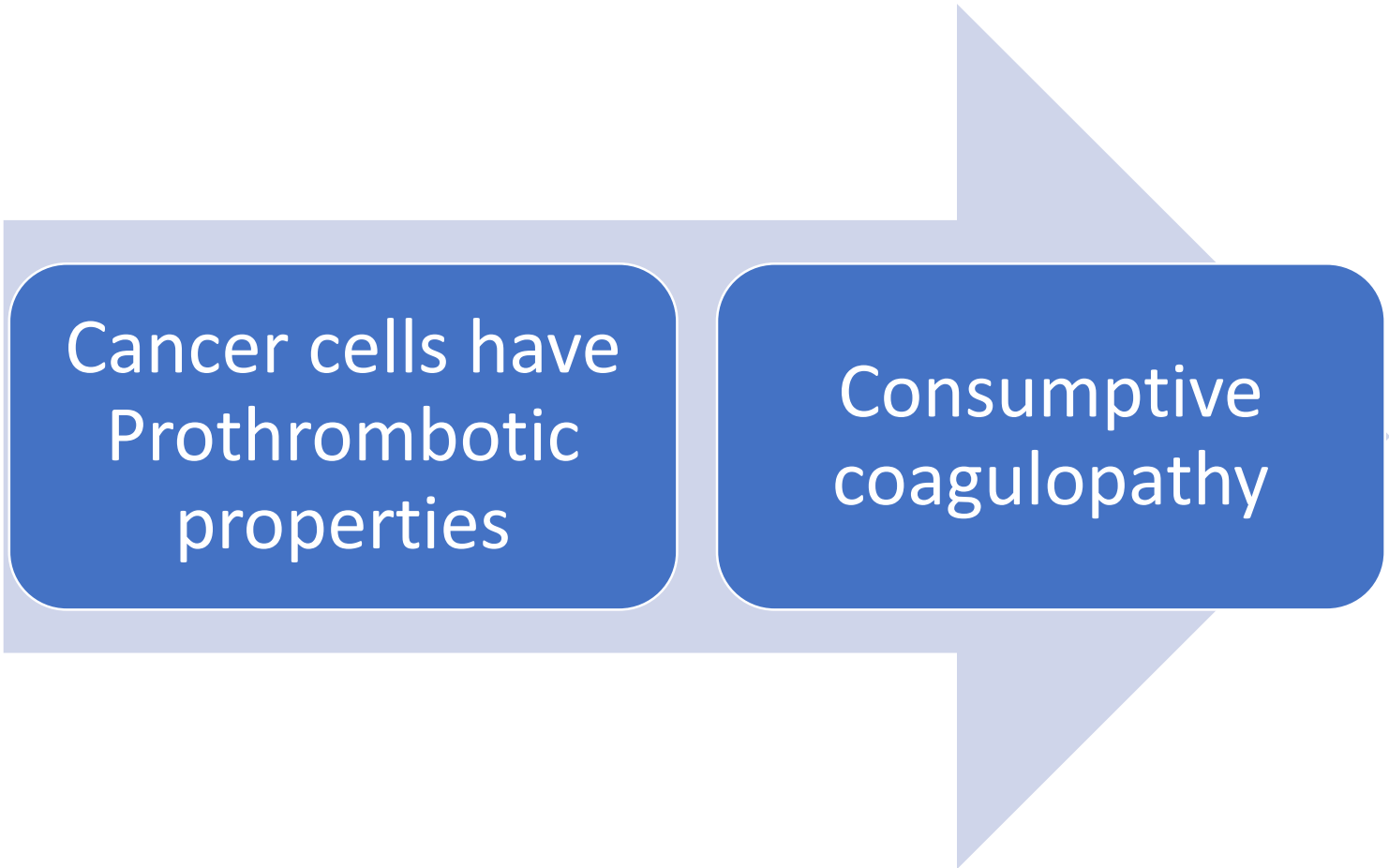
Coagulopathy

Compromised Wound healing

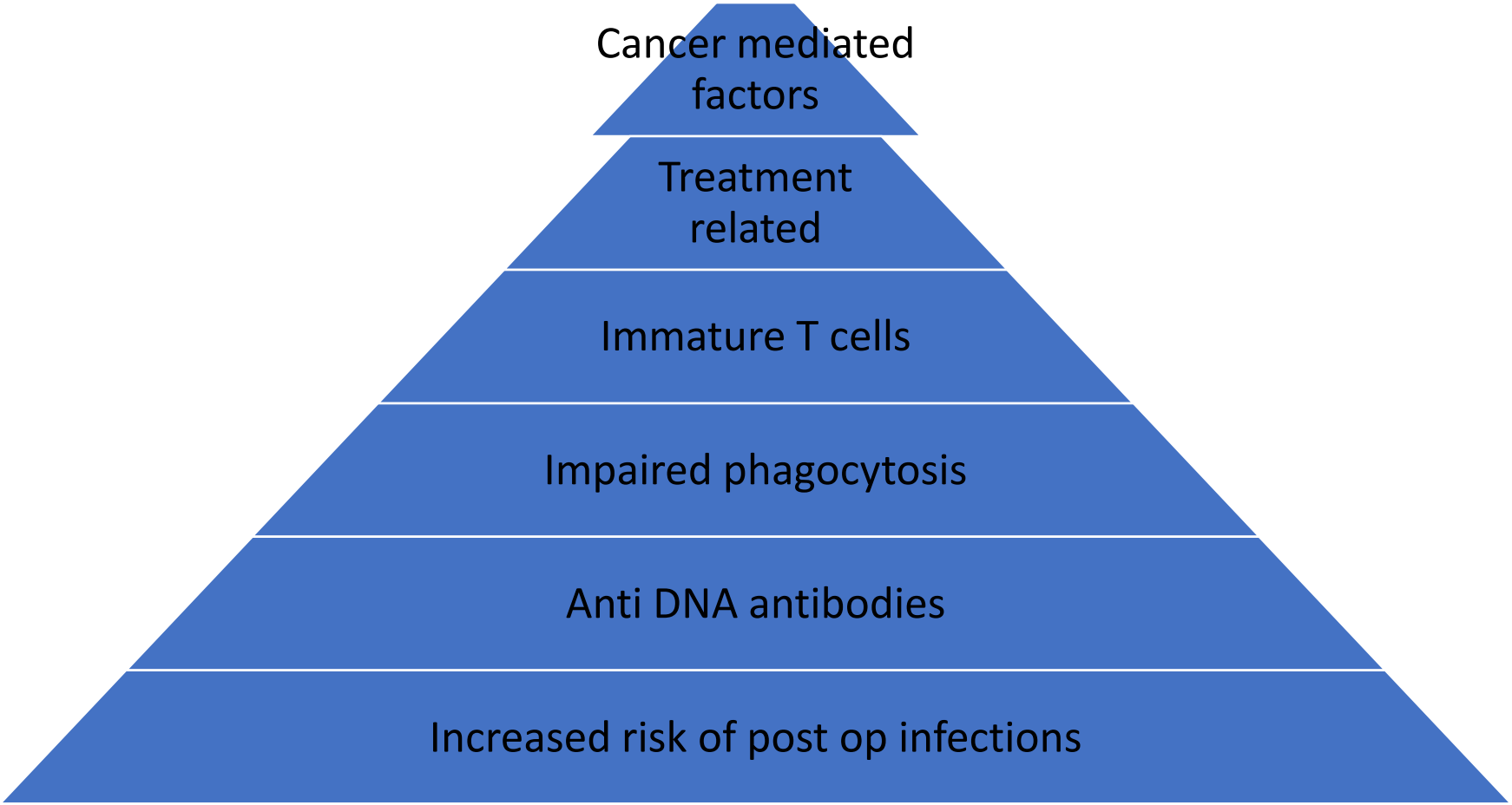
# Wound healing



# Coagulopathy



# Immunosuppression



# Summary

- Interventional pain techniques are a core component in the WHO analgesic ladder
- Should not be reserved for refractory pain or as the last resort
- Interventions should be evaluated as an early option
- Should be considered as a central component of a multidisciplinary approach to treating pain in cancer patients.

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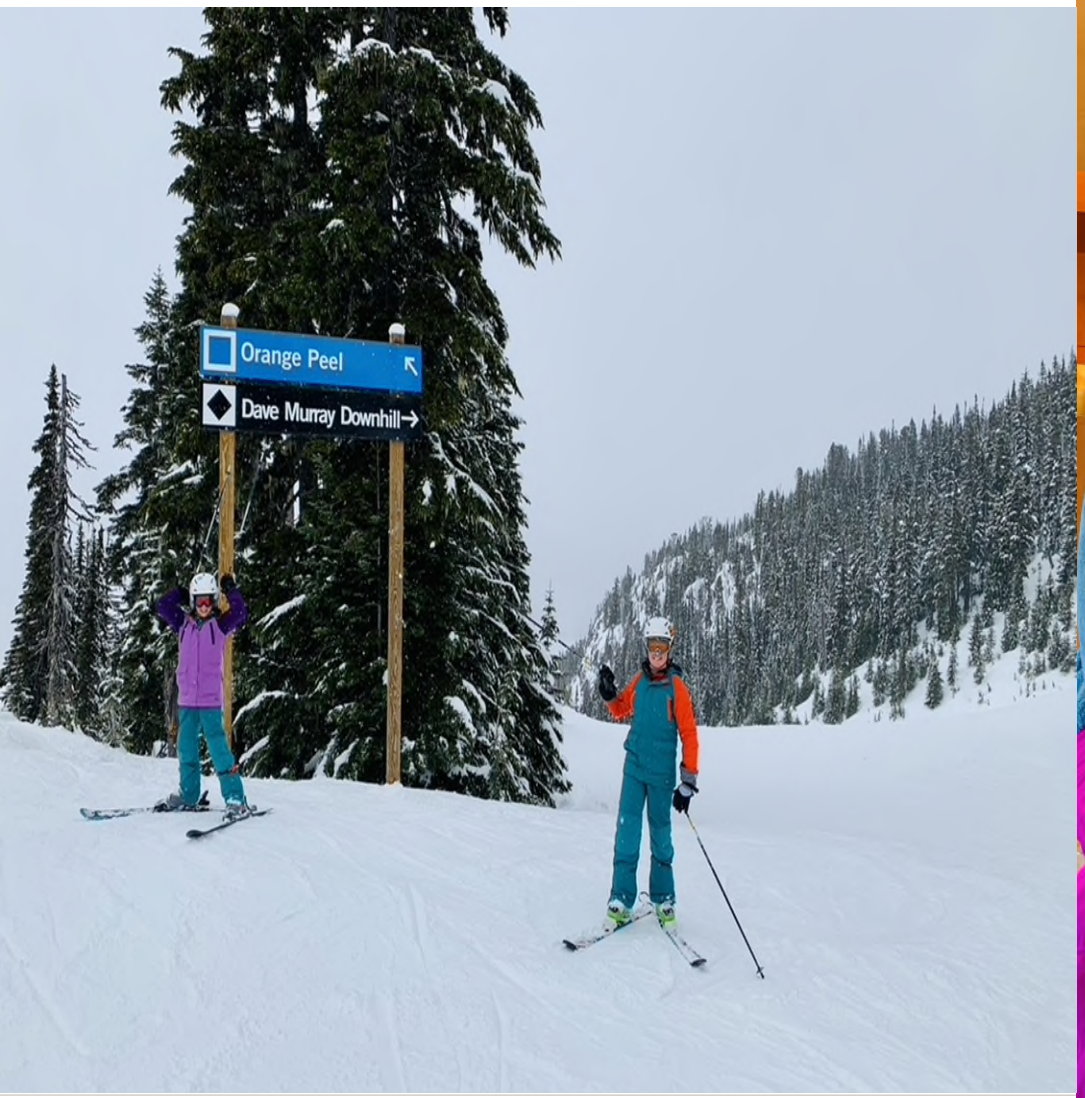
# Thank you


Orange Peel
Dave Murray Downhill