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# Acute postoperative pain and post-toracotomy pain syndrome

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***Thoracotomy is among the surgical procedures that have the greatest incidence of chronic postoperative pain and disability.***

*Kehlet H, Jensen TS, Woolf CJ. Persistent postsurgical pain: risk factors and prevention. Lancet 2006; 367:1618–1625.*

*Brit. J. Anaesth.* (1967), 39, 695

## THE INCIDENCE AND SEVERITY OF POSTOPERATIVE PAIN

BY

W. B. LOAN AND J. D. MORRISON

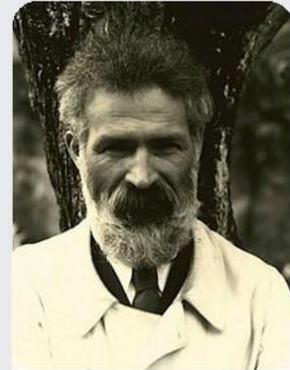
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Loan and Dundee (1967) in a series of 1,220 general surgical patients also found that in the immediate postoperative period the proportion of patients requiring relief of pain depended on the site of operation. Their incidence of patients requiring analgesics was as follows: thoracotomy, 74 per cent; upper abdominal operations, 63 per

”In pain there is always a thrill of pleasure”

[citatepedia.info](http://citatepedia.info)

In durere exista,  
intotdeauna, un fior de  
placere.



Constantin Brancusi

# DEFINITION

The International Association for the Study of Pain defines chronic post-thoracotomy pain as pain that recurs or persists along a thoracotomy scar >2 months after surgery

When such chronic pain occurs, it may be termed chronic post-thoracotomy pain (CPTP) or post-thoracotomy pain syndrome (PTPS)

*International Association for the Study of Pain,  
Subcommittee of Taxonomy. Classification of chronic  
pain. Pain 1986;(suppl 3): S138–S139.*

# INCIDENCE

- The syndrome was first described during the WWII at the american soldiers who were undergoing thoracotomy

*Blades B, Dugan DJ. War wounds of the chest observed at the Thoracic Surgery Center, Walter Reed General Hospital. J Thorac Surg 1944; 13: 294-306.*

- Reported incidence varies widely, as investigators did not use a standardized set of criteria to classify subjects as having post-thoracotomy pain and also due to the patients subiectivity (up to 80%!!)
- Overall incidence probably around 52% (32% mild, 16% moderate, and 3% severe chronic postoperative pain)

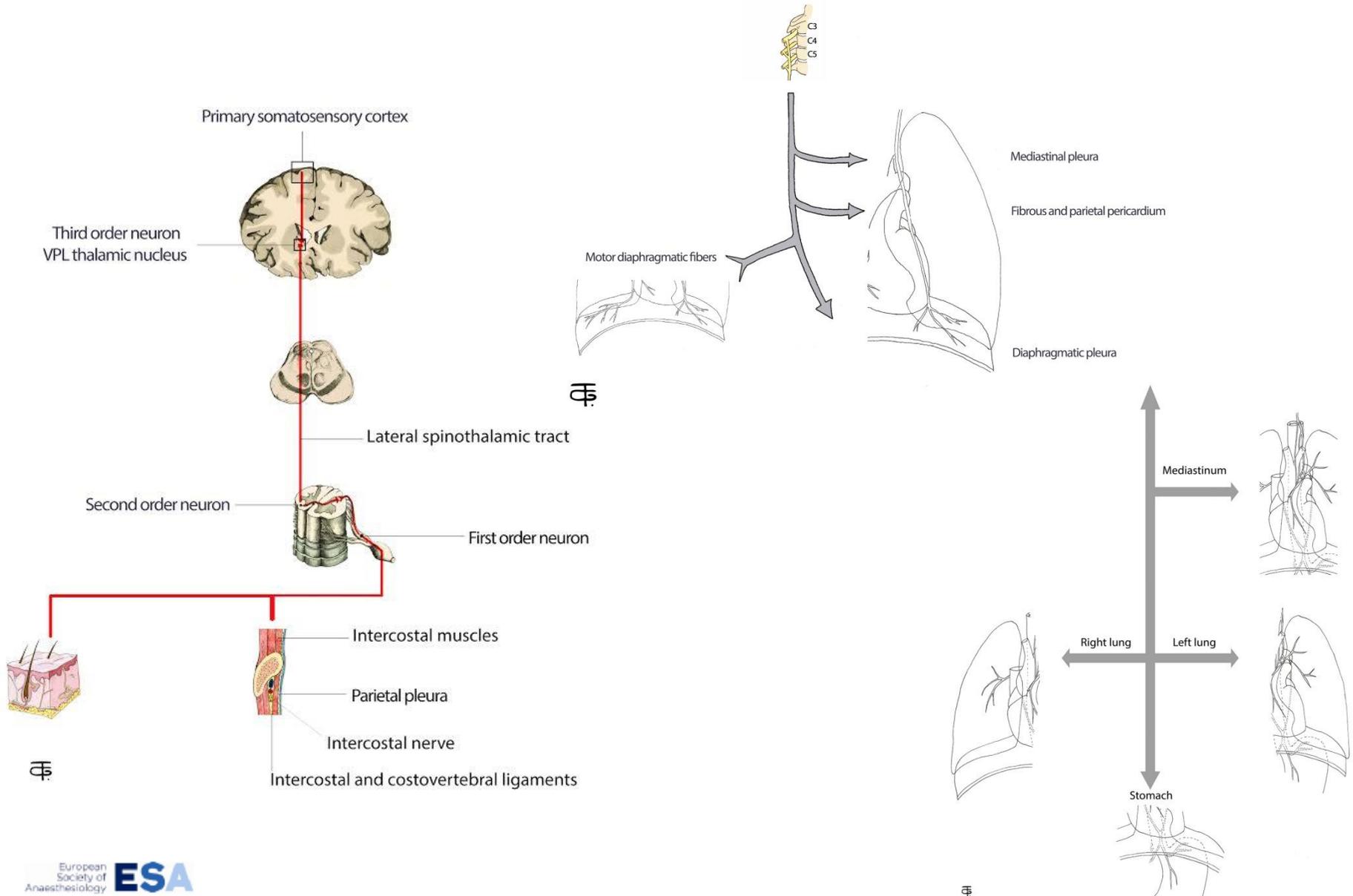
*Pluijms WA, Steegers MA, Verhagen AF, et al. Chronic post-thoracotomy pain: a retrospective study. Acta Anaesthesiol Scand 2006; 50: 804–808.*

# Description

- allodynia- sensation of pain to a non-painful stimulus
- majority report aching or tenderness
- hypersthesia
- dysthetic burning
- lancinating
- combination of above

***localized to the area of incision***

# Thoracic nociceptive pathways



# Pathophysiology

- Neuropathic pain (peripheral and probably central)
- Not fully understood
- The direct damage of intercostal nerves and the consequent effect on pain transmission seems to play a primary role
- **Peripherally**, ephaptic conduction or “cross-excitation” generated by neurons linked to injured nerves may trigger a distorted pathway of nociceptive stimuli which may be clinically relevant for the ongoing neuropathic pain. Another important role may be played by direct coupling of the sympathetic nerve system and the sensory nervous system in the dorsal root ganglionic
- **Central mechanisms:** The nerve injury is coupled to a considerable degree of spinal cord reorganization. Peripheral nerve injury, similarly to chronic inflammation, is coupled to a persistent state of hyperexcitability of the dorsal horn neurons, a process called “central sensitization”

***Although studies on preventing PTPS cover a limited number of patients, early postoperative pain seems to be the only factor that significantly predicted long-term pain and, implicitly, a stricter control of postoperative pain would be the main method of preventing PTPS.***

1. Sentürk M, Ozcan PE, Talu GK, Kiyani E, Cami E, Ozyalcin S, Dilege S, & Pembeci K. The effects of three different analgesia techniques on long-term postthoracotomy pain. *Anesth Analg* 2002;94:11-15
2. Katz J, & Seltzer Z. Transition from acute to chronic postsurgical pain: risk factors and protective factors. *Expert Rev Neurother* 2009;9:723-744.

# Preoperative factors for PTPS

- Female gender
- Age under 60 years
- Genetic factors (genetic control of pain)
- Psychological factors: anxiety, depression, malignant disease and social status
- Preoperative pain and analgesic consumption

***However, no study has specifically investigated the impact of age and sex on the risk of development of PTPS. The degree to which genetics, preoperative pain, and psychosocial factors impact the risk of PTPS is unknown, and more studies are needed to clarify what role, if any, these factors play in the development of PTPS***

## Surgical

- Type of incision posterolateral, muscle-sparing posterolateral, axillary, anterior clemmshell or hemiclemshell) : *A subanalysis from a prospective study found no difference in PTPS based on incision type*

*Ochroch EA, Gottschalk A, Augostides J, et al. Longterm pain and activity during recovery from major thoracotomy using thoracic epidural analgesia. Anesthesiology 2002; 97: 1234–1244.*

- Sternotomy less painfull.
- Video-assist thoracic surgery (VATS): Conflicting results. *Two prospective trials found no differences in the incidence of PTPS (!)*

*Furrer M, et al. Thoracotomy and thoracoscopy: postoperative pulmonary function, pain and chest wall complaints. Eur J Cardiothorac Surg 1997; 12: 82–87.*

- Other: harvesting an intercostal muscle flap, free dissection of intercostal nerves, and the use of intracostal sutures for closing the incision.

## **Anesthetic factors:**

- **Preemptive analgesia: treatment that is initiated before in contrast to after the surgical procedure replaced**
- **Preventive analgesia—the assumption that the only way to prevent central sensitization might be to completely block any pain and afferent signals from the surgical wound from the time of incision until final wound healing**

*Dahl JB. Kehlet H. Preventive analgesia. Curr Opin Anaesthesiol 2011; 24: 331–338.*

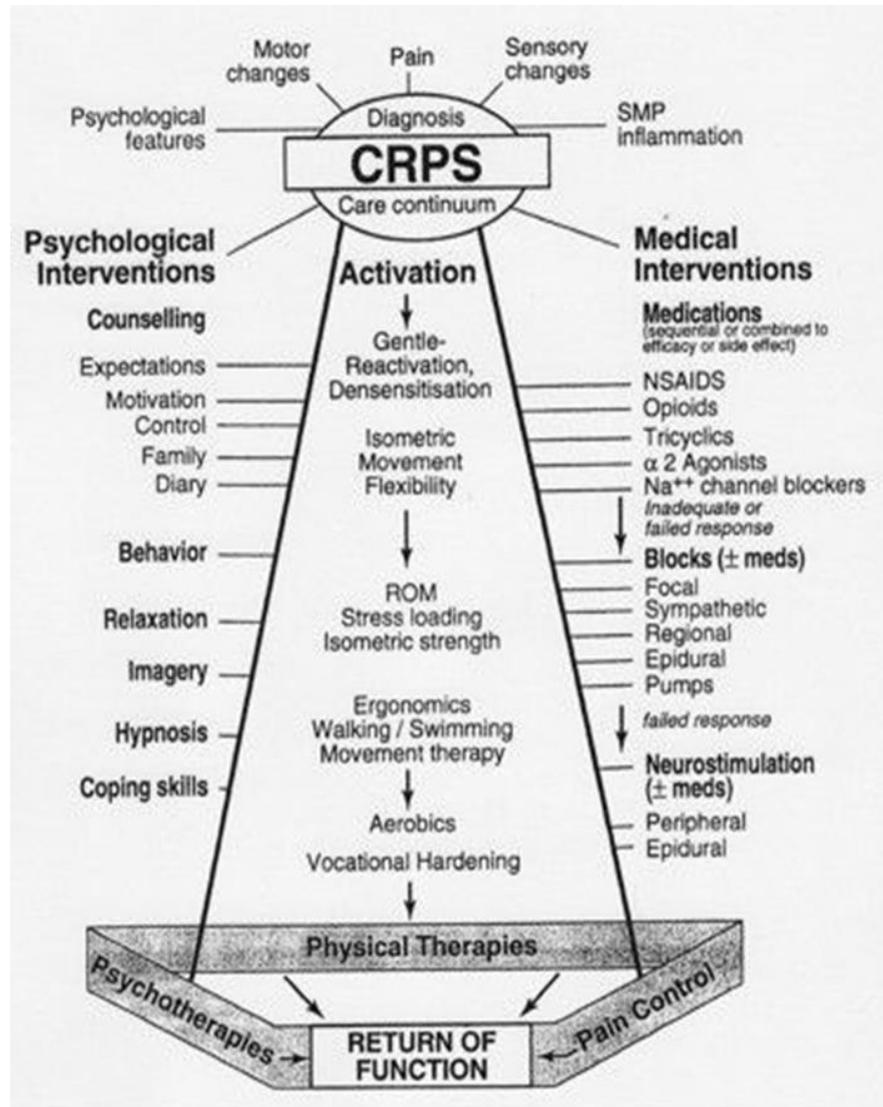
***These techniques include thoracic epidural analgesia (TEA), paravertebral block and intercostal nerve block, cryoanalgesia, and various pharmacologic treatments.***

## ***Preventive analgesia:***

**Employing multimodal pain management for a longer duration and combining multiple analgesic treatments reduces untoward side effects, allowing more rapid recovery and earlier discharge from hospital**

*Buvanendran A, Kroin JS. Multimodal analgesia for controlling acute postoperative pain. Curr Opin Anaesthesiol. 2009;22:588–593.*

# Complex Regional Pain Syndrome (CRPS)



# Multimodal (“balanced”) methods

<b>Pharmacological</b>	<b>Regional analgesia</b>	<b>Others</b>
Nonsteroidal Anti-inflammatory Drugs (NSAIDs) Paracetamol, Acetaminophen $\alpha$ 2 Adrenergic Agonists Gabapentin, Pregabalin Ketamine Magnesium Opioids	Tissue infiltration Intercostal nerves block Paravertebral block Epidural block Interpleural block	Cryoablation TENS...

# Thoracic epidural

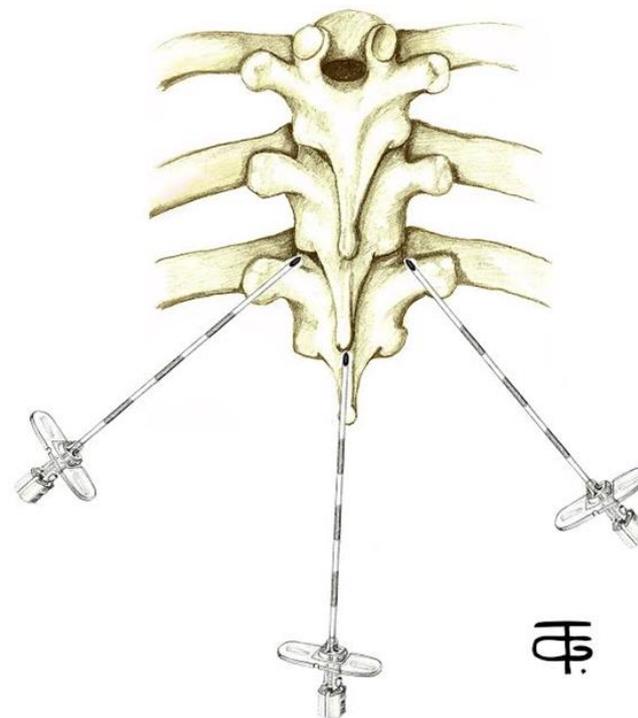
## Patient position & landmarks

**Position :** Sitting or lateral decubitus, with kyphotic attitude supported by an attendant.



**Landmarks :**

- Spinous processes along the midline
- Tip of scapula : T10
- Paramedian line 2.5 cms lateral to midline



## The Use of Ultrasound to Measure the Depth of Thoracic Epidural Space

Issam Khayata\*, Gustavo Angaramo, Robert Lee, Costin Negroiu, Alexander Zilber, and Patty Amelin

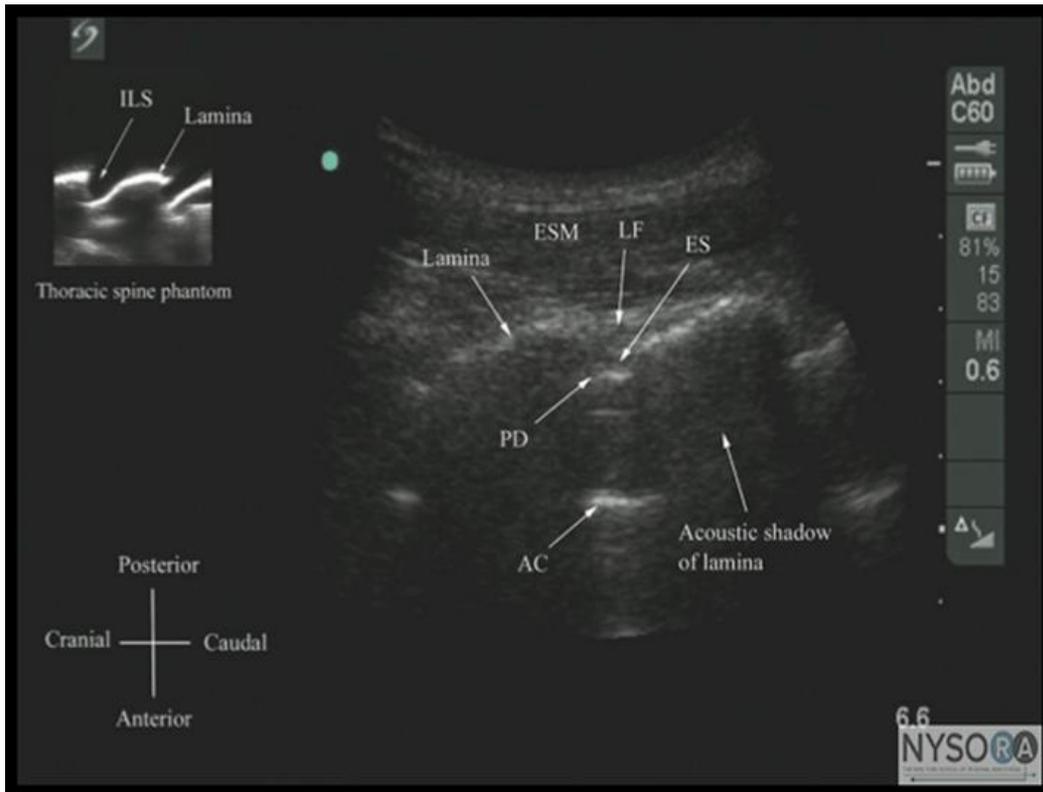
Department of Anesthesiology, UMass Memorial Medical center, USA

### Abstract

The use of ultrasound to aid in regional blocks has increased in recent years as a result of improvement in ultrasound technology. Ultrasonography can be used to measure the depth of thoracic epidural space with a good correlation with the actual depth as detected by the loss of resistance technique.

### Conclusion

Ultrasonography can be used to measure the depth of thoracic epidural space with a good correlation with the actual depth as detected by the loss of resistance technique. More studies need to be in order to determine whether the use of ultrasound can improve the success of epidural catheter placement.



# Thoracic epidural (T<sub>2</sub>-T<sub>7</sub>)

- **Advantages**

- “Gold standard” of analgesia
- Low toxicity
- Low incidence of complications (epidural hematoma, between 0.02% and 0.0007%, failure to correctly insert the thoracic epidural catheter, up to 15%)

- **Precautions**

- 12h from last administration of LMWH (Insertion and removal)
- 24 h in a twice-daily schedule (ESA rec)
- 24-48h neurologic monitoring after suppression
- The local anesthetics dosages are reduced by up to 40% in the elderly

Technique	Drug	Regimes	Observation
<b>Epidural</b>	Bupivacaine: 0.1-0.25% or Ropivacaine: 0.15-0.2% or	Continuous 4-9ml/h Continuous 4-9ml/h	± 7 ml bolus dose ±7ml bolus dose (reduce dose in elderly!)
	Levobupivacaine: 0.1% + Fentanyl 2-10mcg/ml or Sufentanil 1mcg/ml or	Continuous 4-9ml/h	± 7ml bolus dose ± 7ml bolus dose
	Hydromorphone 10-25 mcg/ml + Clonidine + Epinephrine		± 0.4-0.8 mg bolus Hypotension and bradycardia Decrease plasma concentrations of Fentanyl

# Impact of TEA on PTPS

- Senturk et al.(Anesth Analg 2002) conducted a randomized, prospective study involving 69 patients, which compared the effects of 3 different analgesia techniques on post-thoracotomy pain: (1) TEA initiated preoperatively (group pre-TEA), (2) TEA initiated postoperatively (group post-TEA), and (3) intravenous patient-controlled analgesia (group IV-PCA)
- Obata et al. (Can J Anaesth 1999) conducted a double-blinded study in which 70 patients were assigned to randomly receive continuous epidural block with mepivacaine 1.5% either 20 minutes prior to surgical incision (Pre group) or at the completion of surgery (Post group).

- **Results:**

***Epidural blockade initiated prior to surgery may reduce the incidence of postthoracotomy pain.***

- Ochroch et al. randomized 157 patients undergoing elective major open thoracotomy (either classic posterolateral or a muscle-sparing incision) to receive thoracic epidural analgesia initiated prior to incision or at the time of rib approximation. Pain and activity scores were obtained at 4, 8, 12, 24, 36, and 48 weeks after surgery.
- **Results:**

*Overall, there were no differences in pain scores between the control and treatment groups during hospitalization ( $P > 0.165$ ) or after discharge ( $P > 0.098$ )*

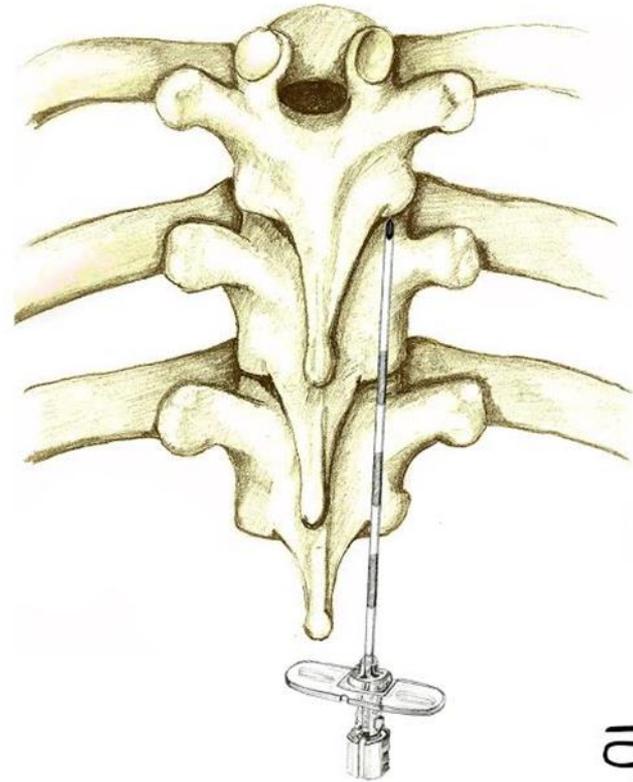
## CONCLUSION

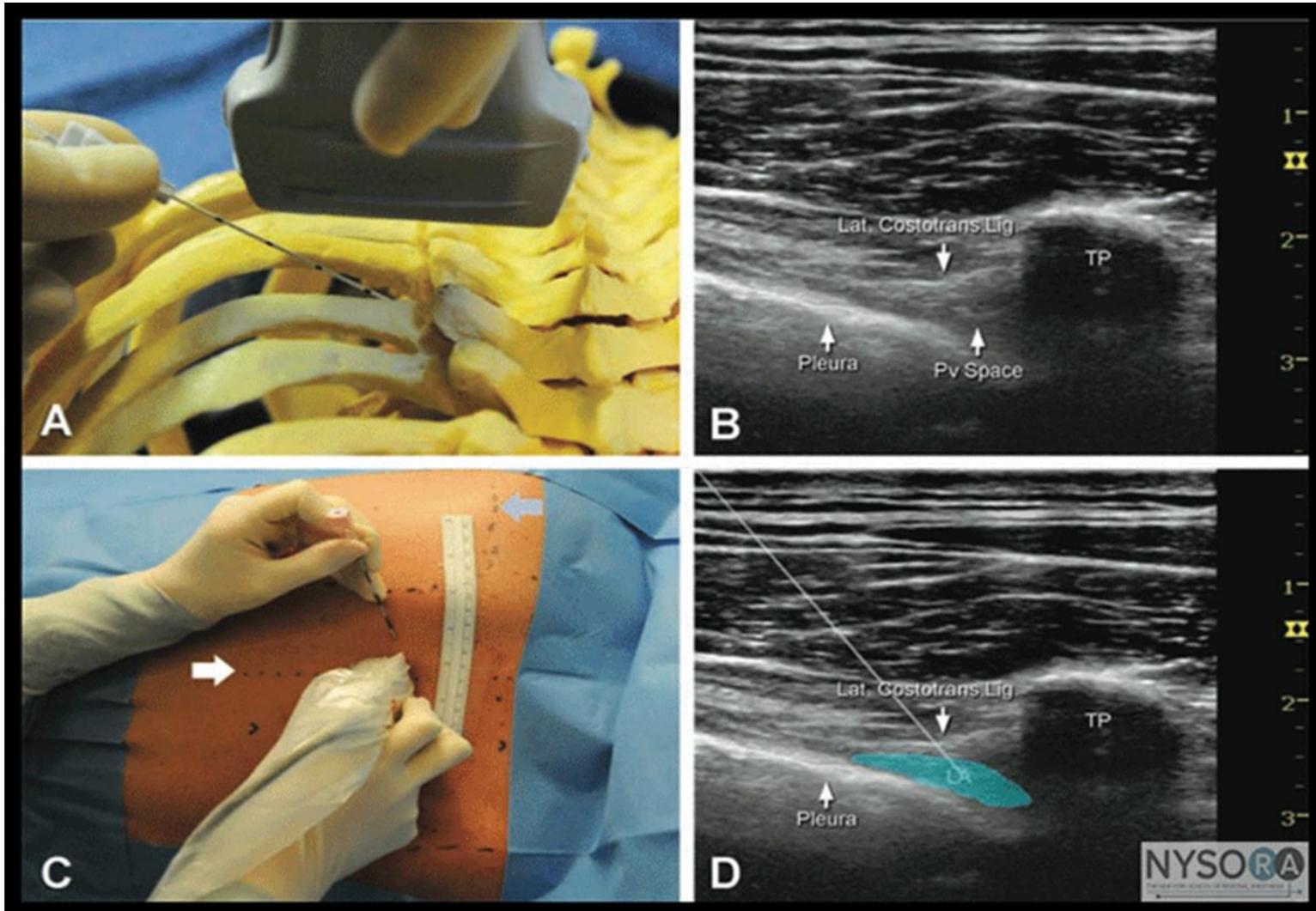
Overall, it appears that TEA may be effective at reducing post-thoracotomy pain syndrome; however, the timing of initiation of TEA may not be of clinical significance.

Kelminsky I , Naro CJ, Preventing Post-Thoracotomy Pain Syndrome MOUNT SINAI JOURNAL OF  
MEDICINE 79:133–139, 2012

# Thoracic paravertebral block (TPVB)

- **Insertion of catheter:**
  - Percutaneously, “classic blinded” ( $\pm$  ic nerve stimulation with 2,5mA)
  - With ultrasonography
  - Open method with intrathoracic (thoracoscopic or thoracotomy) guidance





- **Advantages:**

- TPVB produces unilateral, segmental, somatic, and sympathetic nerve blockade in multiple adjacent thoracic dermatomes after injection of a local anesthetic
- Less neurologic complications
- Many think is superior to TEA
- Less hemodynamic side effects and hemorr. complications

- **Precautions**

- Toxicity of local anesthetics
- In up to 40% migrate epidural!!
- Pneumothorax, local pain, Horner syndrome and insufficient analgesia.

## **UK: 2 out of 3 anesthetists prefer TEA versus TPBV**

*Shelley B, Macfie A, Kinsella J. Anesthesia for thoracic surgery: a survey of UK practice. Journal of Cardiothoracic and Vascular Anesthesia 2011;25:1014-1017.*

## CONCLUSION

**There is some evidence that use of paravertebral blocks may decrease the incidence of chronic pain after breast surgery, which is similar to PTPS due to the predominance of neuropathic features. However, the role of paravertebral blocks in preventing PTPS has not been investigated, but should be considered as a topic for future research**

*Kelminsky I , Naro CJ, Preventing Post-Thoracotomy Pain Syndrome MOUNT SINAI JOURNAL OF MEDICINE 79:133–139, 2012*

## Other options

- Subarachnoid analgesia (intrathecal): single 5-20 mcg/kg dose of morphine good analgesia up to 48h
- Intercostal nerves block, interpleural block or wound infiltration
- Transcutaneous electrical nerve stimulation (TENS), cryoablation, acupuncture techniques
- Pharmacologic: NSAIDs, ketamine, acetaminophen, etc

***Good adjuvants for immediate, acute pain but with no impact on PTPS***

# PTPS Treatment

***Gabapentin*** is safe and effective in the treatment of PTPS with minimal side effects and a high patient compliance

Needs multidisciplinary study confirmation

*Solak O., et al. Effectiveness of gabapentin in the treatment of chronic postthoracotomy pain. Eur J Cardiothorac Surg 2007; 32: 9–12*

Pregabalin, tricyclic antidepressants, serotonin-norepinephrine reuptake inhibitors, lidocaine patches, and tramadol may be generally employed in the treatment of neuropathic pain.

***When medical therapy fails to provide relief, minimally invasive interventional techniques, such as intercostal nerve blocks and pulsed radiofrequency of the dorsal root ganglion, may be useful, but definitive studies are lacking.***

*Goyal GN, et al. Peripheral nerve field stimulation for intractable post-thoracotomy scar pain not relieved by conventional treatment. Pain Pract 2010; 10: 366–369.*

**Finally, *the reduced ability of opiates in relieving neuropathic pain*** is widely accepted but the exact extent of this phenomenon is controversial. The dose response function of opiates seems to be unfavorably shifted to the right. This clinical evidence may be explained by loss of peripheral opiate effect, loss of spinal opiate receptors and increased activity in physiological opioid antagonism system.

*Przewlocki R, Przewlocka B. Opioids in neuropathic pain. Curr Pharm Des 2005; 11: 3013–3025*

## First step:

- **Minor surgical interventions and in patients with low anesthetic-surgical risk:** *pharmacological approach* (NSAIDs, Ketamine, acetaminophen etc)

## Second step

- **The type of incision and anesthetic-surgical risk:**

TEA or TPVB in case of thoracotomy in patients with a risk of stay >24h in postoperative care.

TPVB or intercostal nerve block in patients with VATS and low anesthetic-surgical risk.

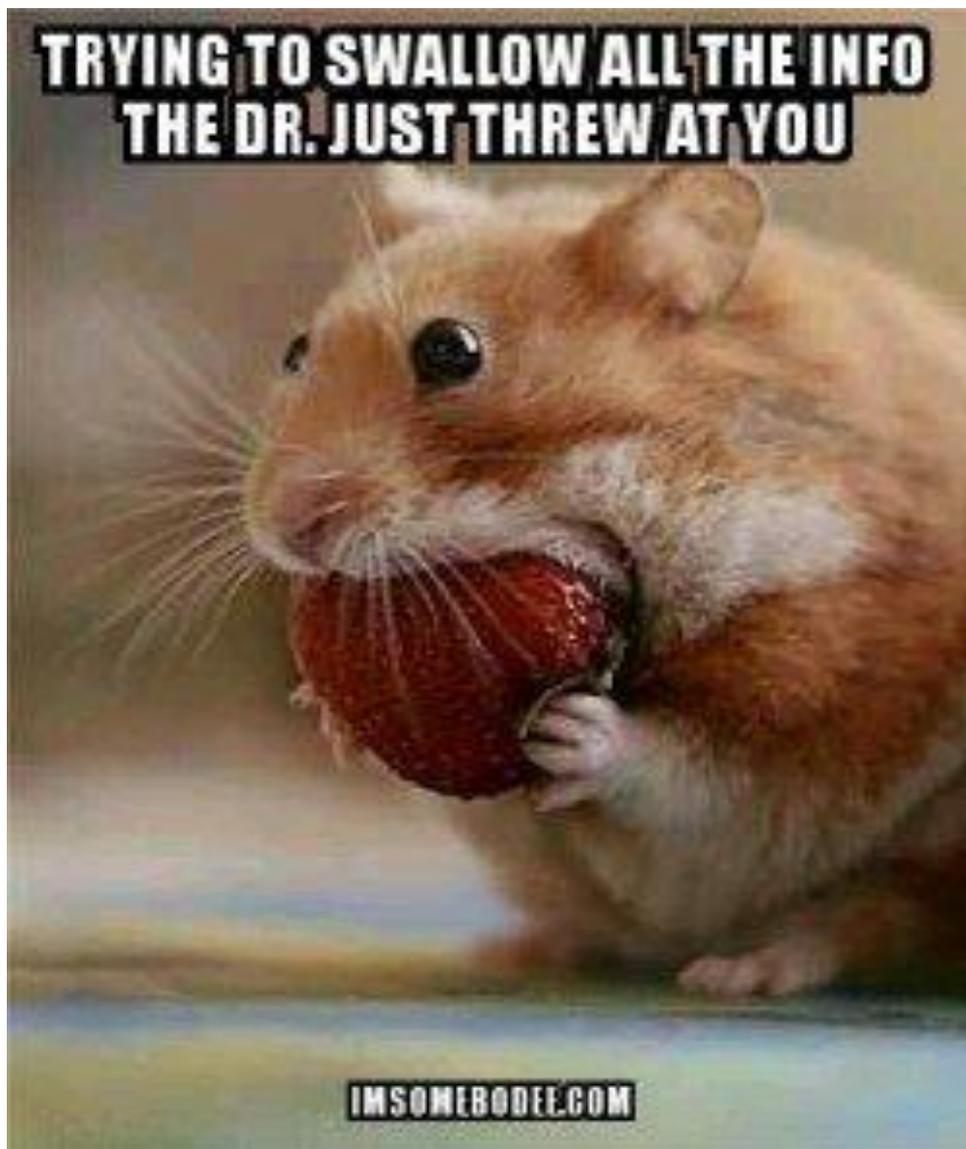
*Parenteral opioids and non-opioids, depending on the level of analgesia we aim for, can be added to this algorithm.*

## Other

# CONCLUSIONS

- **PTPS, frequent, with impact on the quality of life of patients after thoracic surgery**
- **Early postoperative pain seems to be the only factor that significantly predicted long-term pain**
- **The modern approach of pain after thoracic surgery should consider:**
  - **The surgical technique**
  - **The patient profile**
  - **Multimodal therapy that combines analgesic techniques and pharmacological regimens, while being customized on a case-by-case basis.**

# Va multumesc!



***Pain pays the income of each  
precious thing.***

William Shakespeare (1564-1616)