Ultrasound-guided Pain Management Injections

Clermont Ferrand
2011

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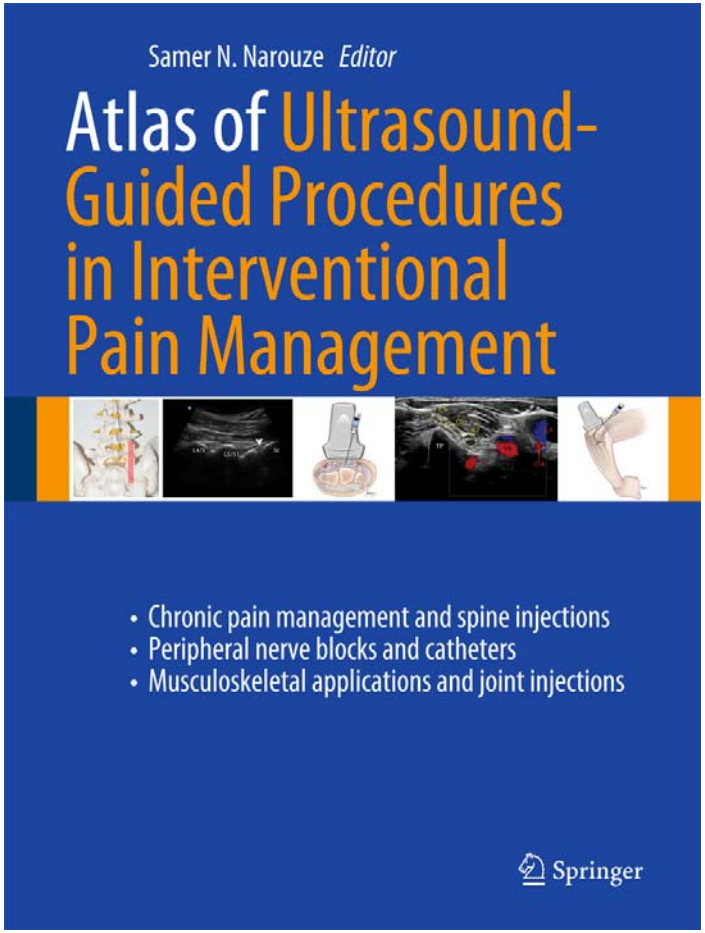
Disclosure

- Book royalty from Springer for “Atlas of Ultrasound guided interventional pain procedures”
- Philips: consultant



USRA & USPM

- **<u>USRA</u>:**
- **Ultrasound vs other nerve localization techniques (blind, surface land marks, nerve stimulation)**
- **Better combining US with nerve stimulation**

- **<u>USPM</u>:**
- **Ultrasound vs other imaging**
- **Better combining US with Fluoroscopy**

Advantages of USPM

- No radiation exposure to clinicians and patients
- Visualization of soft tissues; nerves, vessels, muscles,.. and bony surfaces.
- Allows real-time needle advancement and monitor the spread of injectate.
- Diagnosis of various joint/soft tissue disorders, nerve entrapment syndromes, …..

Shortcomings of USPM

- Visualization of deep small structures is suboptimal.
- Visualization of deep spine structures when an acoustic shadow artifact is produced by bone which has a high attenuation coefficient
- Limited visualization of thin needle or needle inserted at a steep angle
- Obesity, obesity, obesity

US Applications in Chronic Pain

- **Lumbar spine injections**: lumbar MBNB, lumbar facet injection, lumbar periradicular injections, caudal epidural,..
- **Cervical spine injections**: cervical nerve root injections, third occipital nerve block, cervical facet injections
- **Trunk injections**: cervical sympathetic block, intercostal nerve block, abdominal wall injections, TAP.
- **Peripheral nerve blocks**: greater occipital, suprascapular, lat. Cut. Femoral nerve, pudendal, ….
- **Intra-articular injections**: SIJ, hip, shoulder,..
- **Musculoskeletal (MSK) ultrasonography**: TPI, Joints, tendons, muscles (Piriformis, psoas,…)

US guided/assisted Epidurals

Pain management:

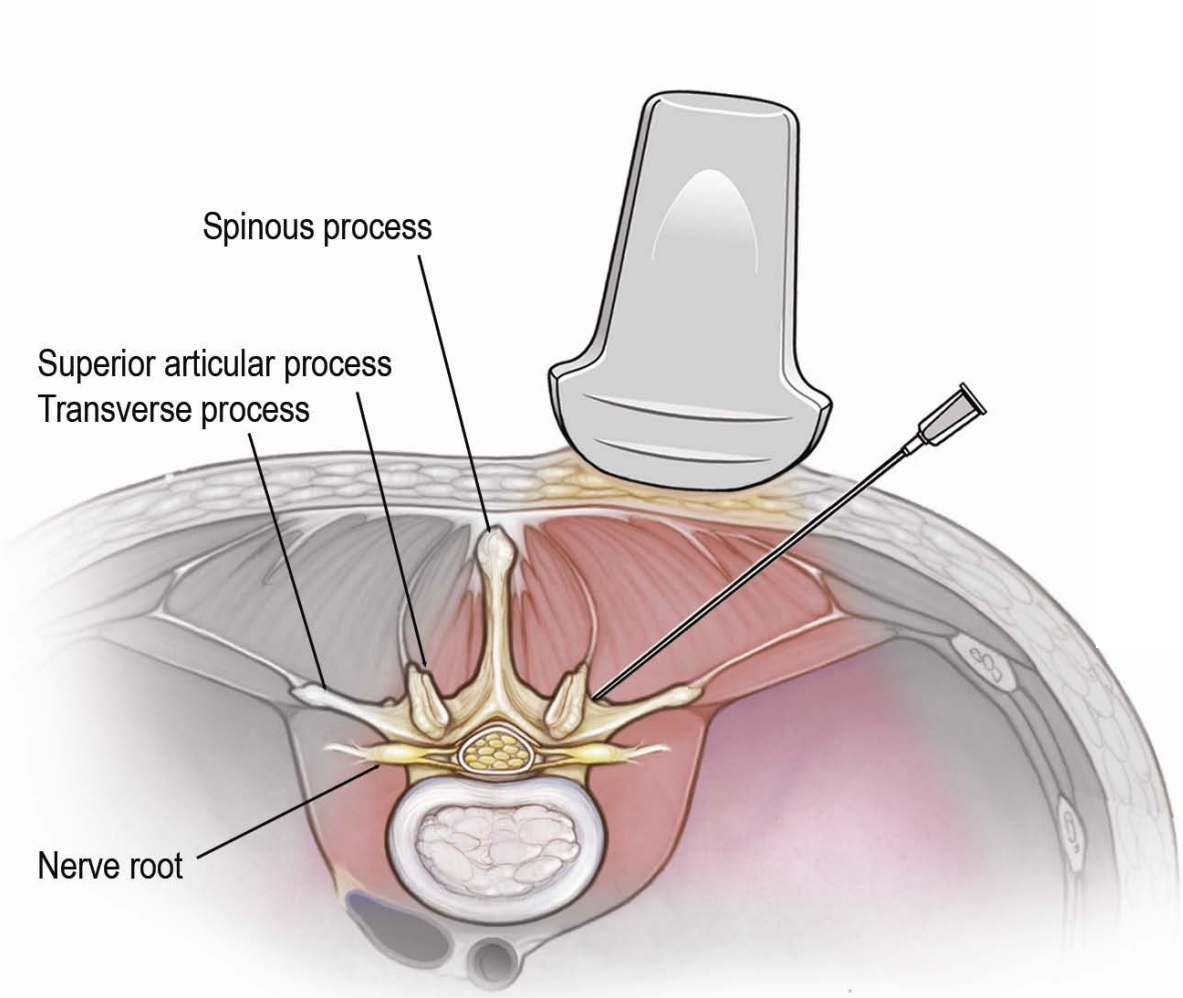
- No role… Inferior to flouroscopy
- Can not see tip of the needle once deep to bone
- Can not see spread of injectate
- Can not role out intravascular spread

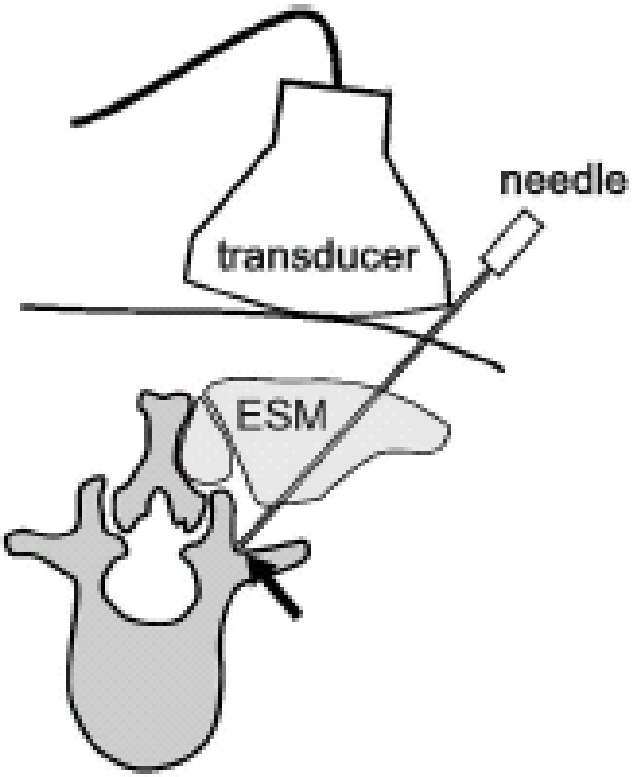
Regional Anesthesia

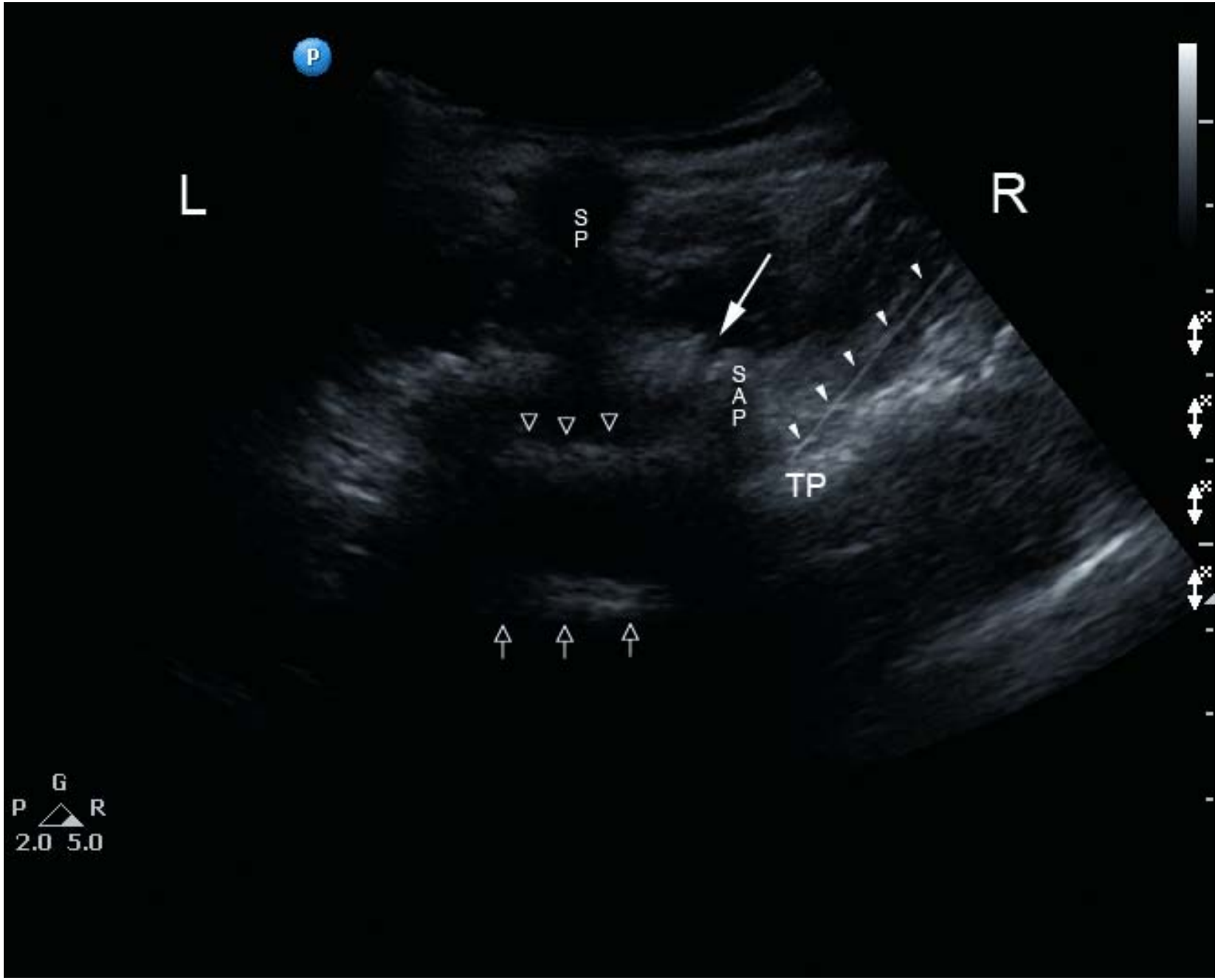
- More helpful than the traditional blind technique
- Obstetrics
- Pediatrics

Narouze. Pain Practice 2008

Lumbar Facet MBNB



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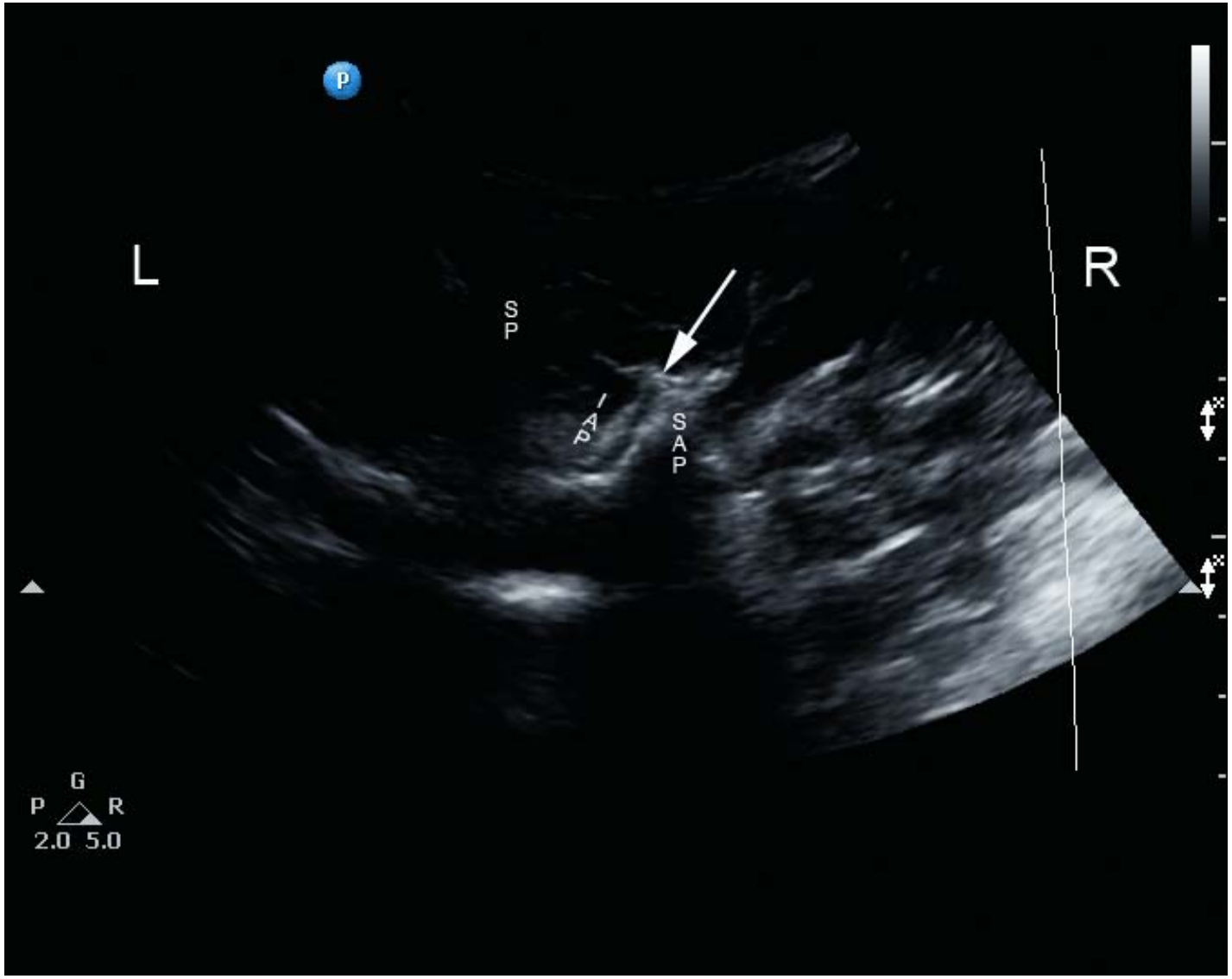
US guided Lumbar Facet intraarticular



Evidence Based Medicine

Ultrasound guided lumbar median branch nerve block

1. Greher M, Scharbert G, Kamolz LP, Beck H, Gustorff B, Kirchmair L, Kapral S. Ultrasound-guided lumbar facet nerve block. A sonoanatomic study of a new methodologic approach. Anesthesiology 2004; 100: 1242-8

2. Greher M, Kirchmair L, Enna B, Kovacs P, Gustorff B, Kapral S, Moriggl B. Ultrasound-guided lumbar facet nerve block. Accuracy of a new technique confirmed by computed tomography. Anesthesiology 2004; 101: 1195-200

3. Shim JK, Moon JC, Yoon KB, Kim WO, Yoon DM. Ultrasound-guided lumbar medial-branch block: a clinical study with fluoroscopy control. Reg Anesth Pain Med 2006; 31: 451-4

3- Shim et al. Reg Anesth Pain Med 2006

Nonrandomized Crossover Trial

- **They initially performed fluoroscopy guided medial branch blocks in 20 patients.**
- **1 month later the same patients received lumbar MBNB (101 blocks) with ultrasound guidance**
- **fluoroscopy to confirm placement.**
- **95% success rate.**
- **The time required for each needle placement was**

  5 ± 1 minute (mean ± SD).
- **The VAS scores of patients after US guided Lumbar MBNB compared with those after fluoroscopy guided blocks.**

Limitations

- **Weight: 51 ± 5 kg (mean ± SD)!!!!**
- **BMI: 22.8 ± 3.1 kg/m^2**
- **2 cases showed intravascular spread**
- **No mention of fluoroscopy time for comparison**
- **95% success rate vs 100% with fluoroscopy.**

Ultrasound-guided lumbar medial branch block in obese patients: a fluoroscopically confirmed clinical feasibility study

- **METHODS:**
- **84 medial branch blocks in 20 obese patients (body mass index, >30 kg/m2) using ultrasound.**
- **RESULTS:**
- **success rate was 62% (52/84 blocks)**
- **The needle advancement could not be tracked to the target.**
- **CONCLUSION:**
- **Medial branch blocks in obese patients cannot be performed by ultrasound guidance exclusively.**

Rauch et al RAPM 2009

Ultrasound guided lumbar facet intra-articular injection

1. Galiano K, Obwegeser AA, Bodner G, Freund M, Maurer H, Kamelger FS, Schatzer R, Ploner F. Ultrasound guidance for facet joint injections in the lumbar spine: a computed tomography-controlled feasibility study. Anesth Analg 2005; 101: 579-83

2. Galiano K, Obwegeser AA, Walch C, Schatzer R, Ploner F, Gruber H. Ultrasoundguided versus computed tomography-controlled facet joint injections in the lumbar spine: a prospective randomized clinical trial. Reg Anesth Pain Med 2007; 32: 317-22

Galiano et al. Reg Anesth Pain Med 2007

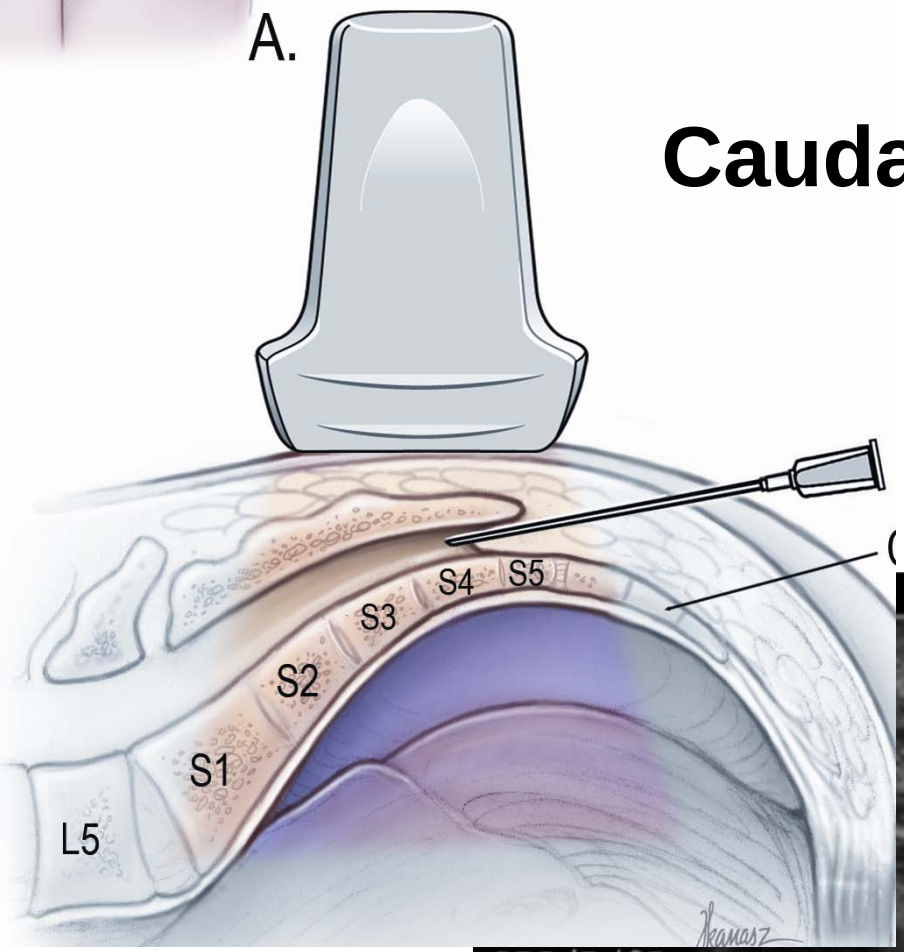
- The **first prospective randomized clinical trial** comparing ultrasound guided versus CT controlled lumbar facet injections
- 40 patients were consecutively enrolled and evenly assigned to an US or CT group.
- In the US group, a 4-9 MHz curved array probe was used.
- The needle was attempted to be placed within the facet joint or at least within 5 mm of the joint and verified by CT.
- In the US group 16 patients had facets joints well visualized with accurate needle placement.
- US guided needle placement was faster than with CT with much less radiation.
- There was no difference in benefit detected between the two groups.

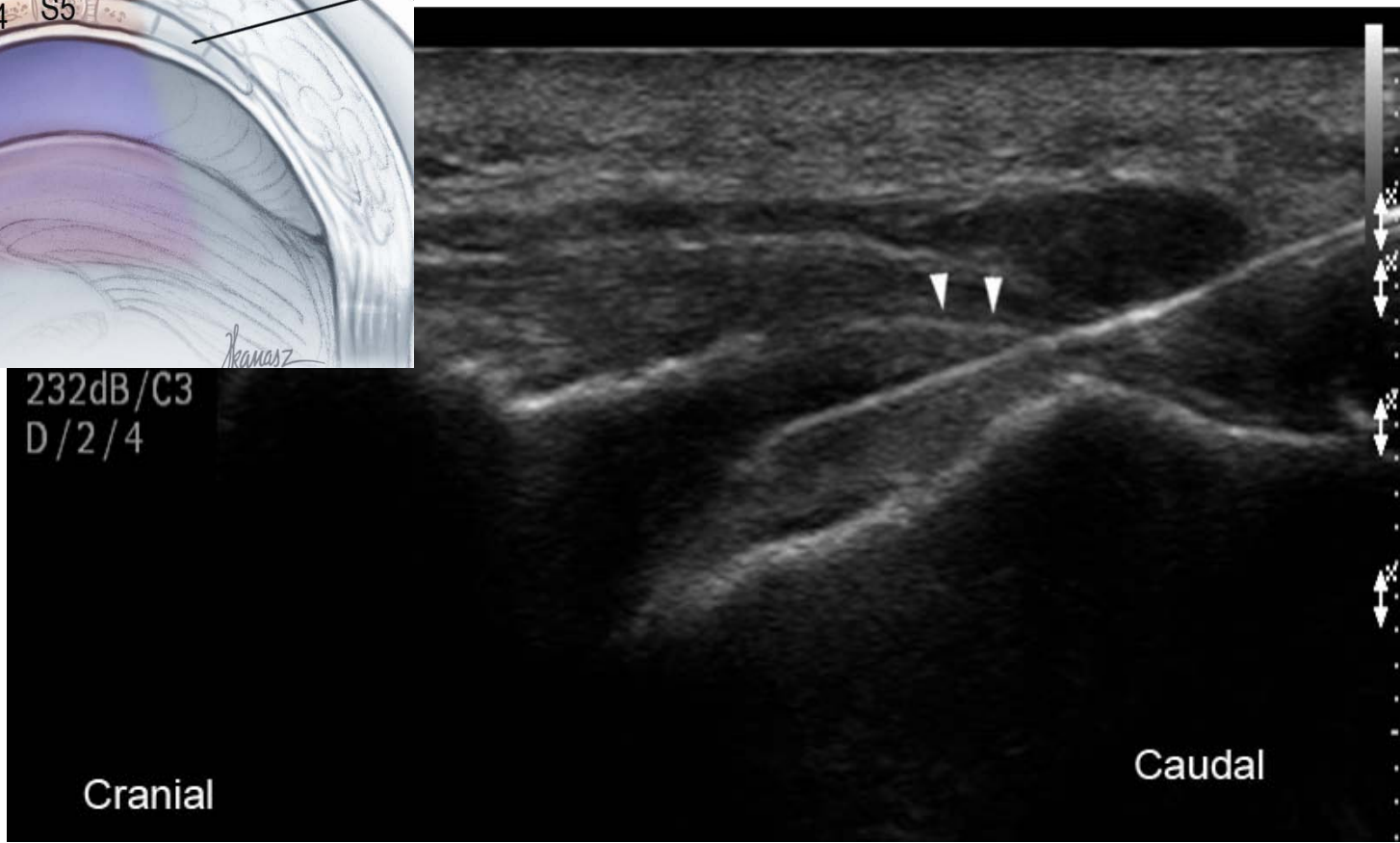
Limitations

- Small sample size
- Weight 83 ± 16 kg (mean ± SD).
- BMI: 27.4 ± 4.4 kg/m^2
- 2 patients the facet joints could not be visualized. BMI 28.3 and 32.9
- 94% success rate (17/18 pts.)
- Success rate **85%** (17/20) vs 100% with fluoroscopy
- Mean time for **single** joint 14.3 ± 6.6 min vs 22.3 ± 6.6 CT group. ?? Fluoroscopy time

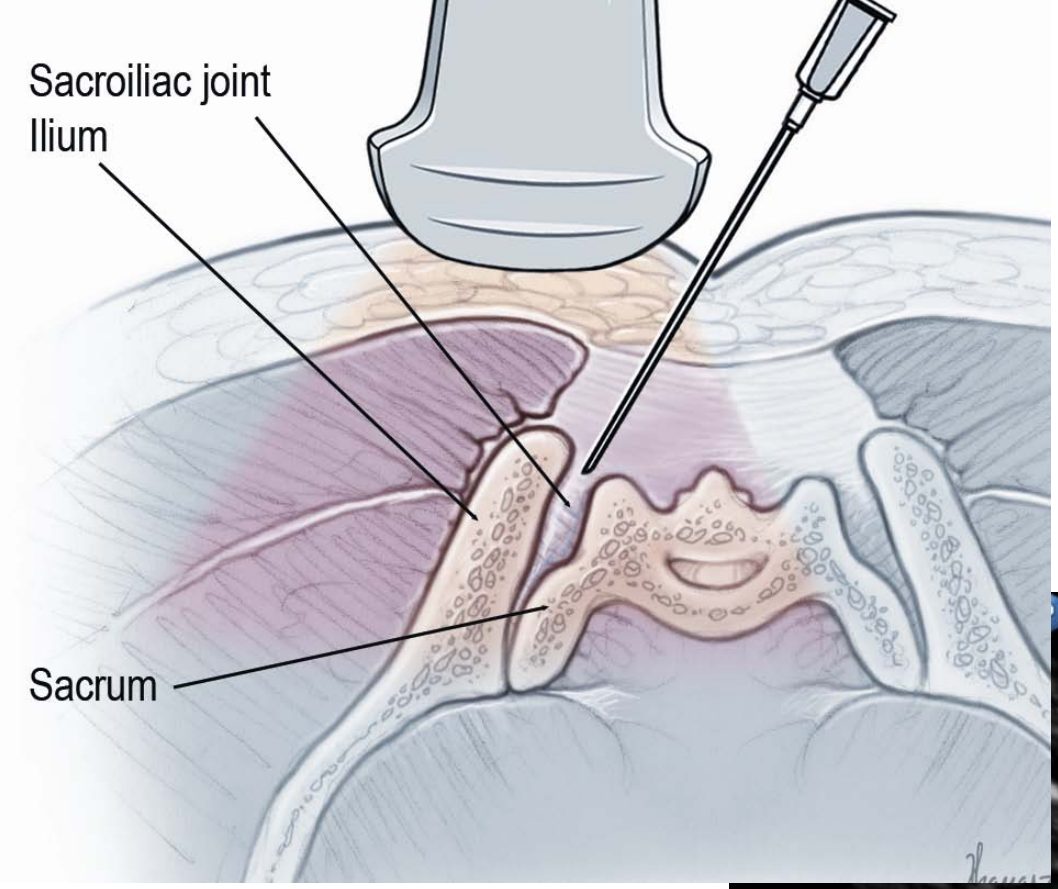
Caudal& SIJ Injections

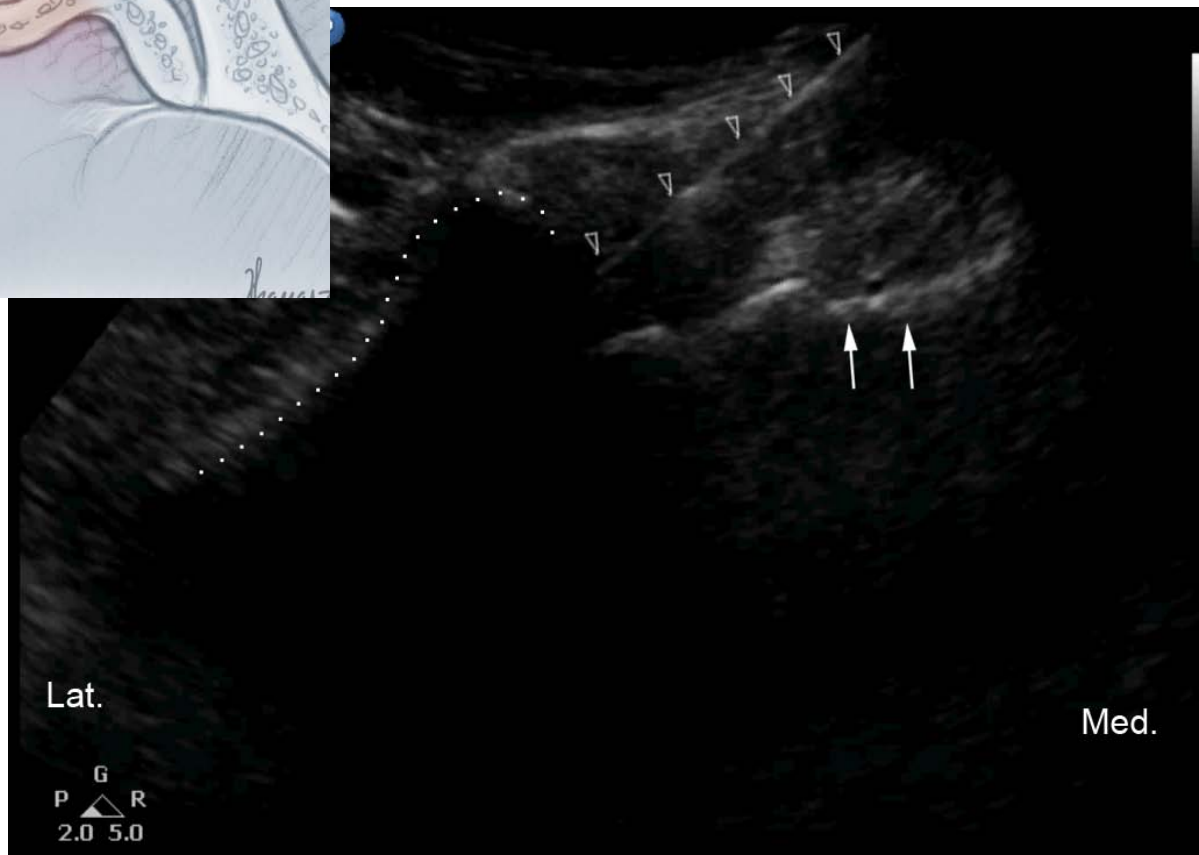
Caudal Epidural





SIJ Injection





Best Ultrasound-Guided Procedures

- Stellate Ganglion Block
- Cervical Selective Nerve Root &
  Cervical Transforaminal Injection
- Intercostal Nerve Block
- TAP block, IL, IH Nerve Block
- MSK applications (Shoulder,…….)

Ultrasound-Guided Cervical Injections

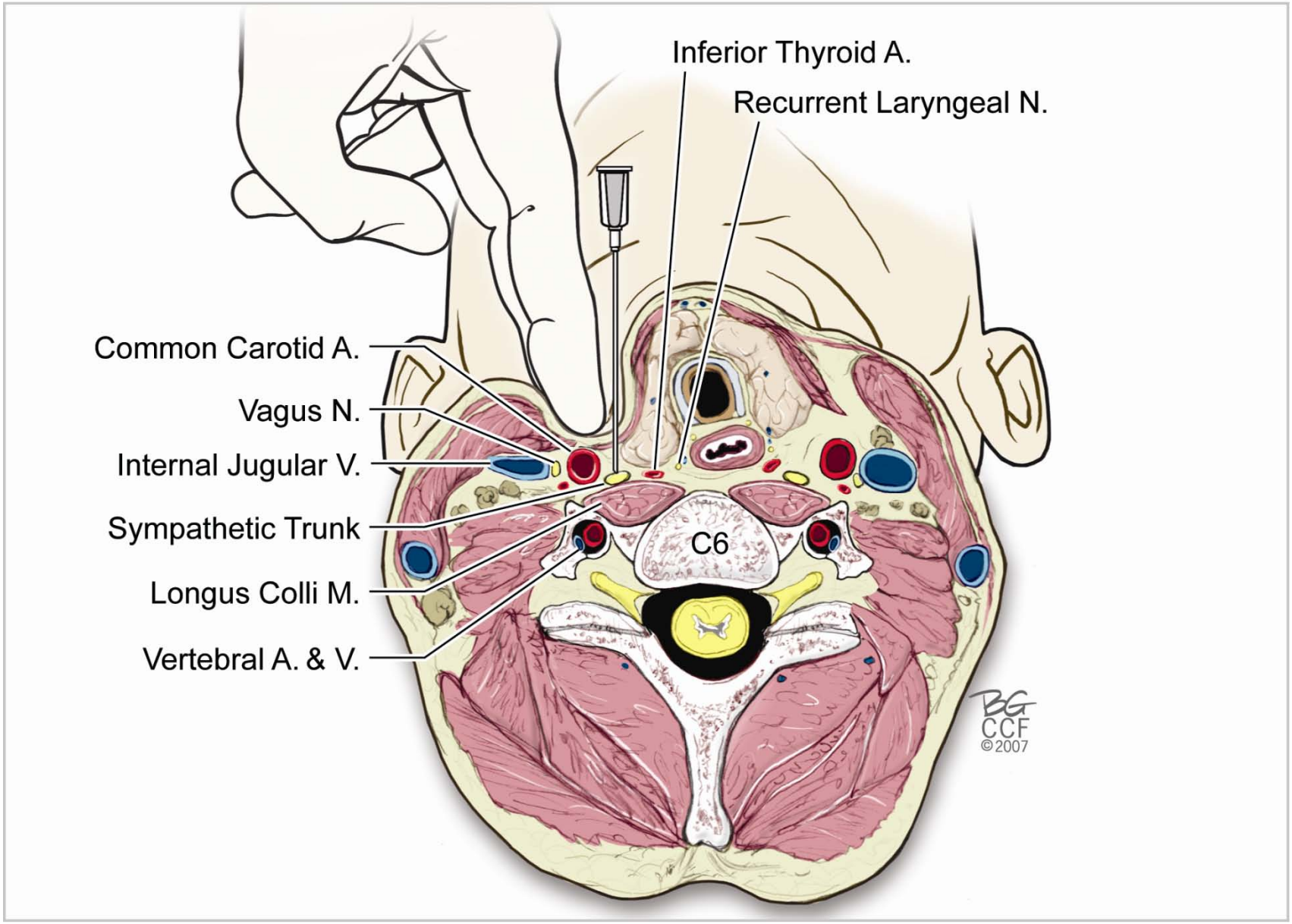
Why The Neck??

Many vital soft tissue structures compacted in a small area

Safer

Narouze. Pain Practice (editorial) 2008

Stellate Ganglion Block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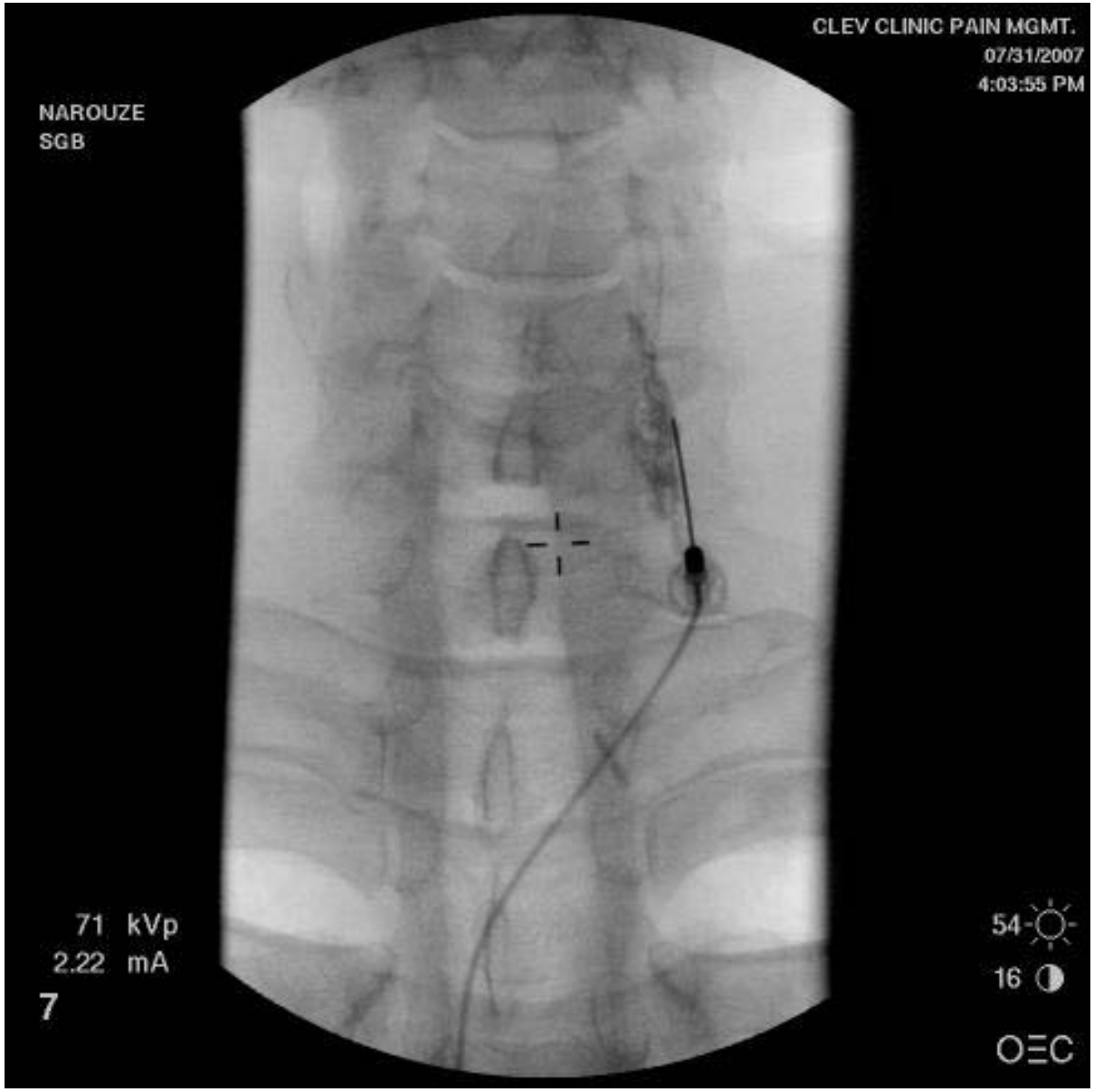
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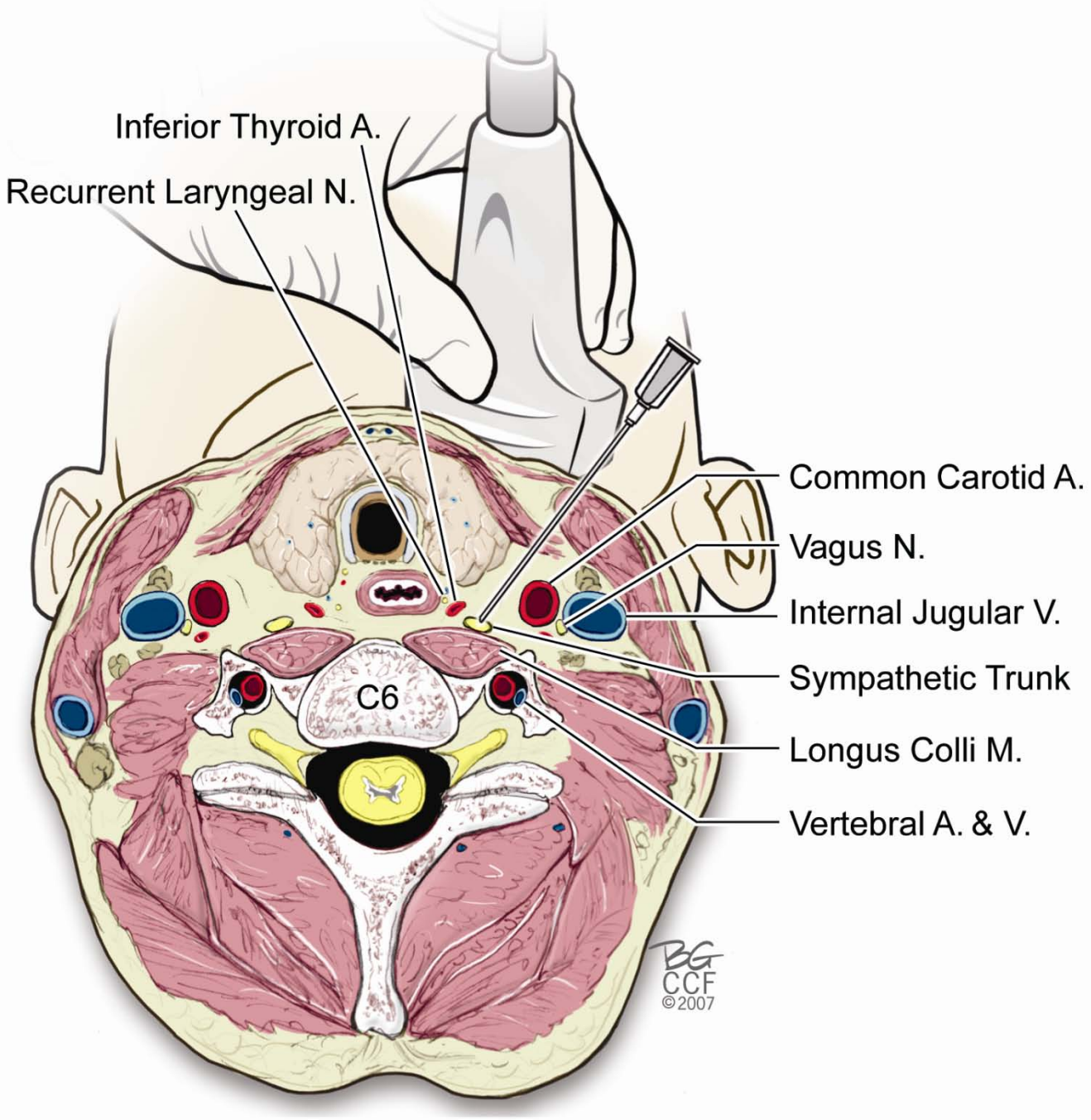
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Internal Jugular V.
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Longus Colli M.
Vertebral A. & V.
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©2007

Ultrasound imaging for stellate ganglion block: direct visualization of puncture site and local anesthetic spread

A pilot study

Kapral S, et al.
Department of Anesthesia and Intensive Care Medicine, University of Vienna, Austria

Reg Anesth. 1995 Jul-Aug;20(4):323-8

Advantages of US in SGB

1. Avoid injury to vascular structures; carotid, vertebral, and thyroid vessels.
2. Avoid injury to the esophagus
3. Avoid injury to neural structures
4. Allows for precise block with 5ml of LA
5. Allows for precise diagnostic block for CRPS patients. Avoid contamination of the brachial plexus.
6. Allows for monitoring of LA spread.
7. Predicts recurrent laryngeal nerve block
8. Prevents pneumothorax

Narouze et al. Pain Physician 2007

-Pain Physician 2007; 10:747-752 • ISSN 1533-3159

Technical Report

Ultrasound-guided Stellate Ganglion Block Successfully Prevented Esophageal Puncture

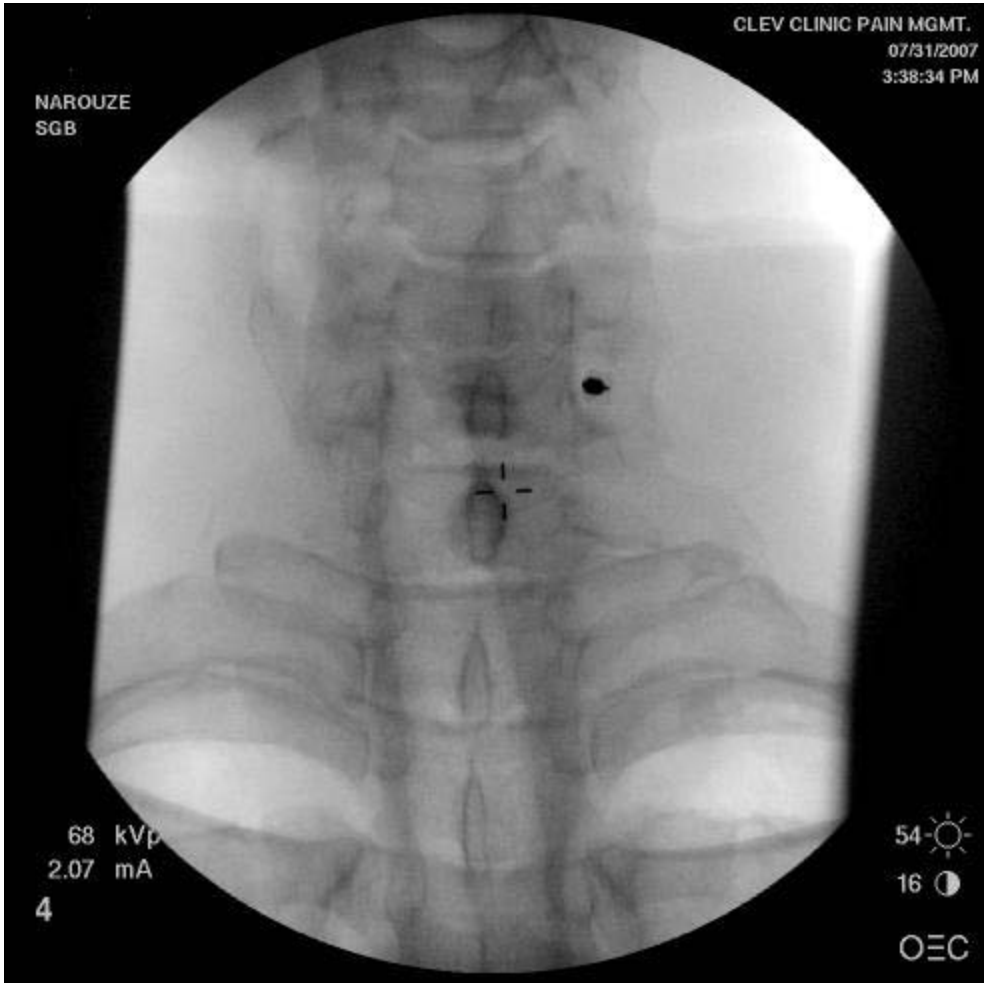
Samer Narouze, MD, Amaresh Vydyanathan, MD, and Nilesh Patel, MD

A patient with complex regional pain syndrome type I of the left upper extremity was scheduled for left stellate ganglion block with the anterior paratracheal approach under fluoroscopy. Real-time ultrasound imaging prevented inadvertent injury to the esophagus as well as the thyroid gland and vessels.

Ultrasound-guided block may improve patient safety by avoiding the soft tissue structures in the needle path that can't be readily seen by fluoroscopy. This may be particularly useful in the patient with asymptomatic pharyngoesophageal diverticulum (Zenker diverticulum).

Key words: Esophageal injury, stellate ganglion block, ultrasound-guided stellate ganglion block, Zenker diverticulum

Pain Physician 2007; 10:747-752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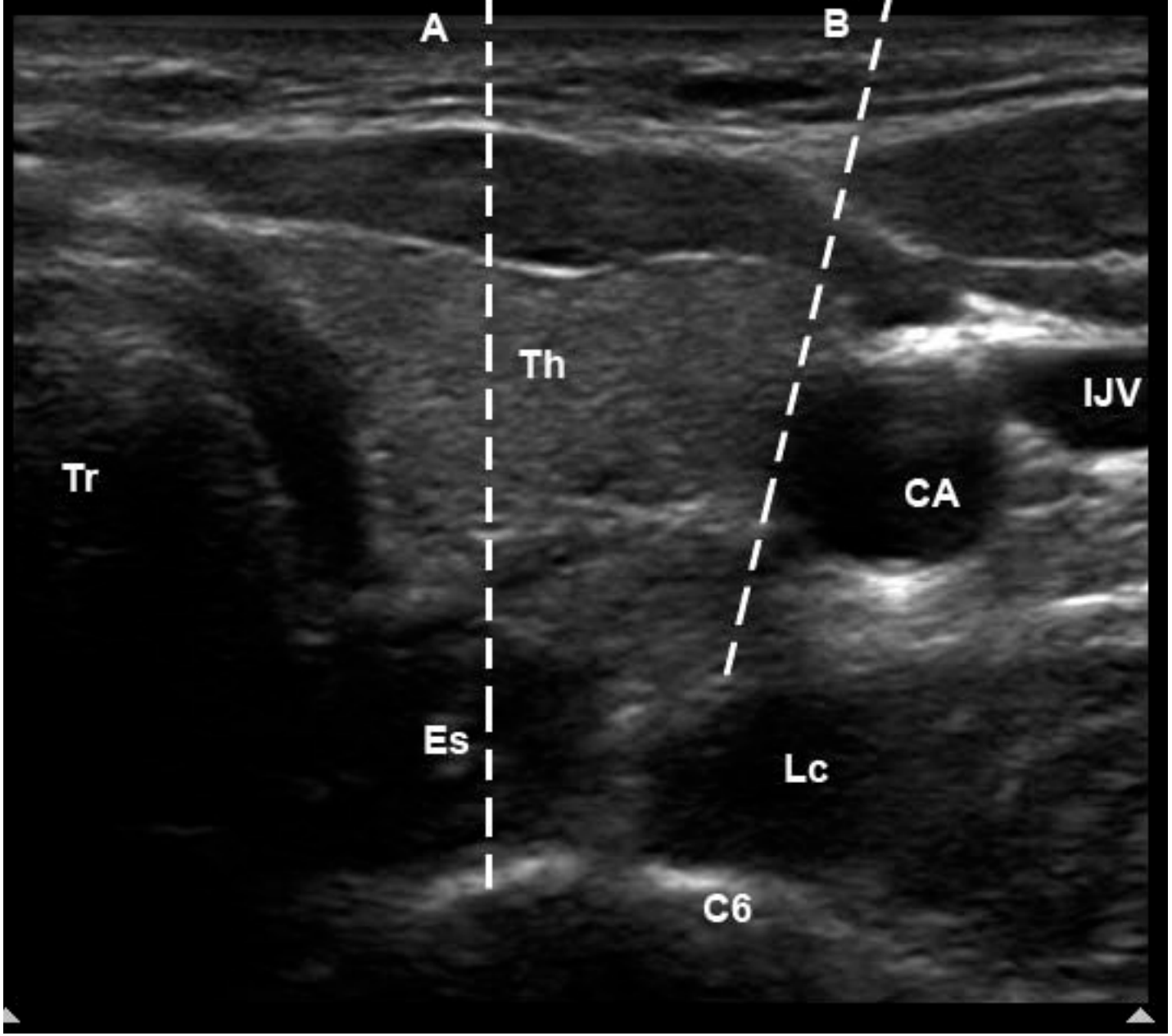
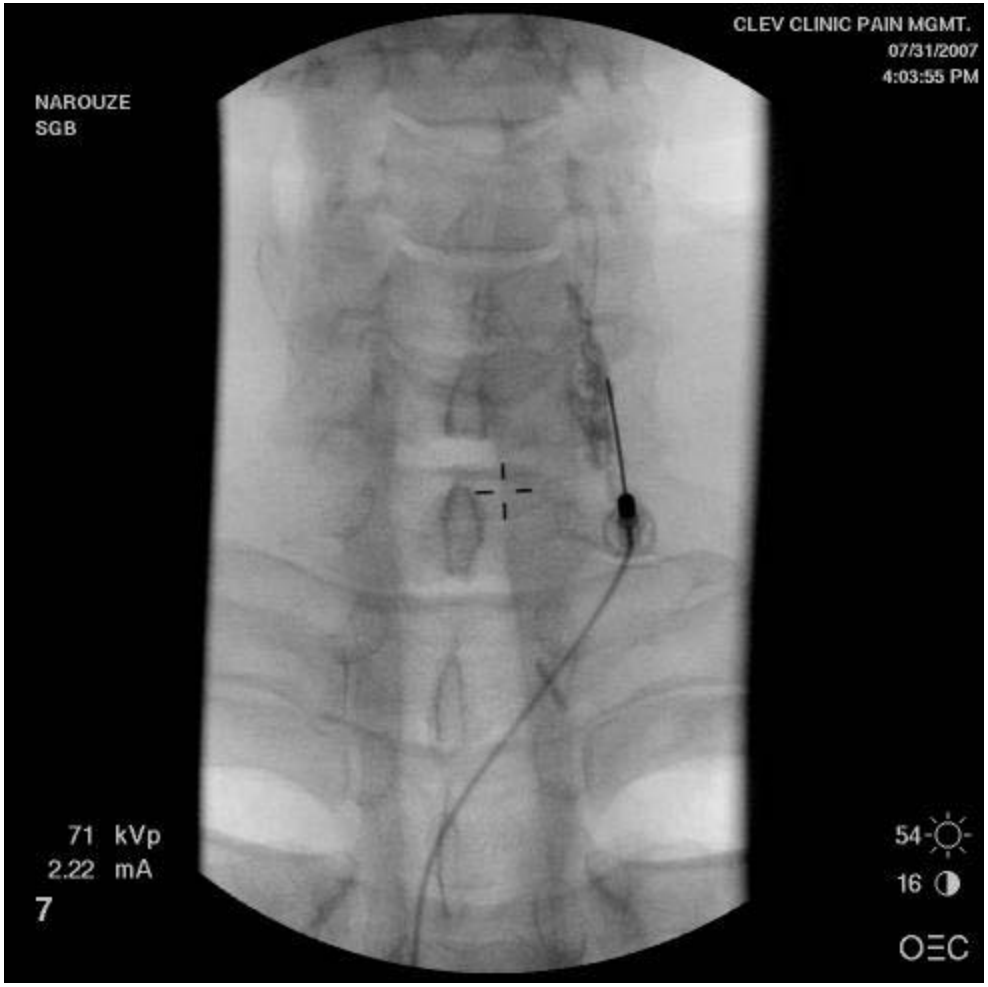


Narouze, et al. Pain Physician 2007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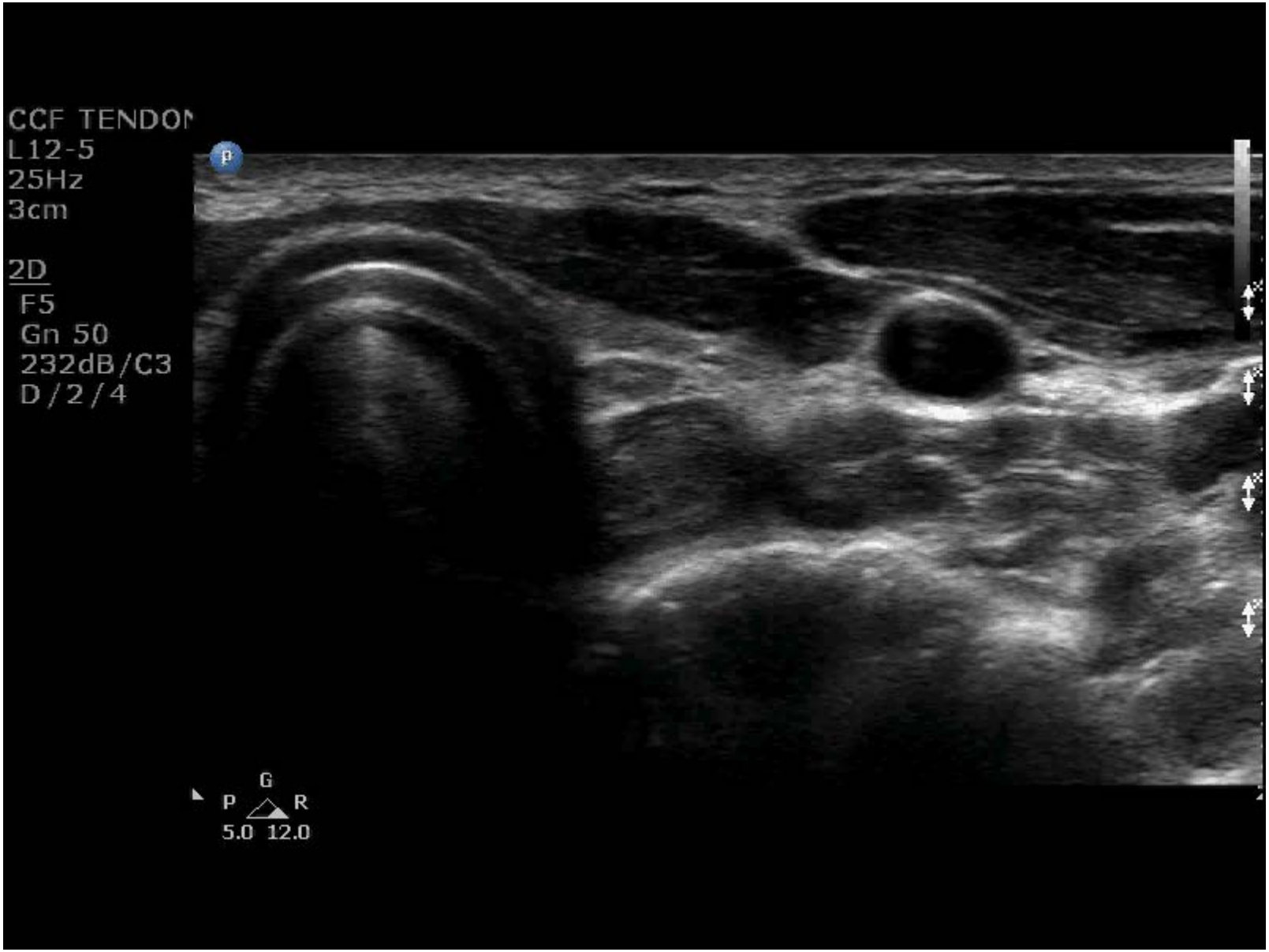
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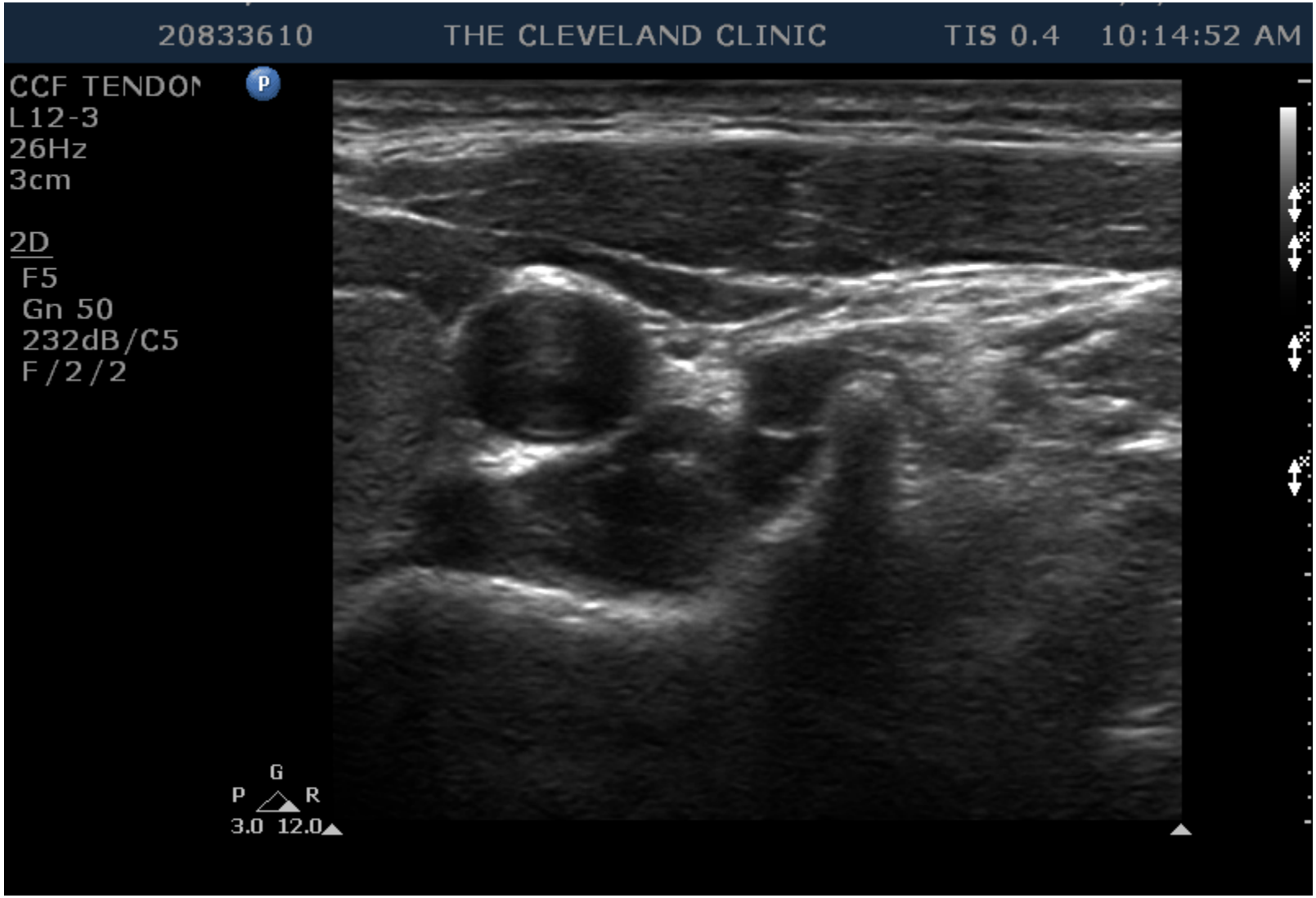
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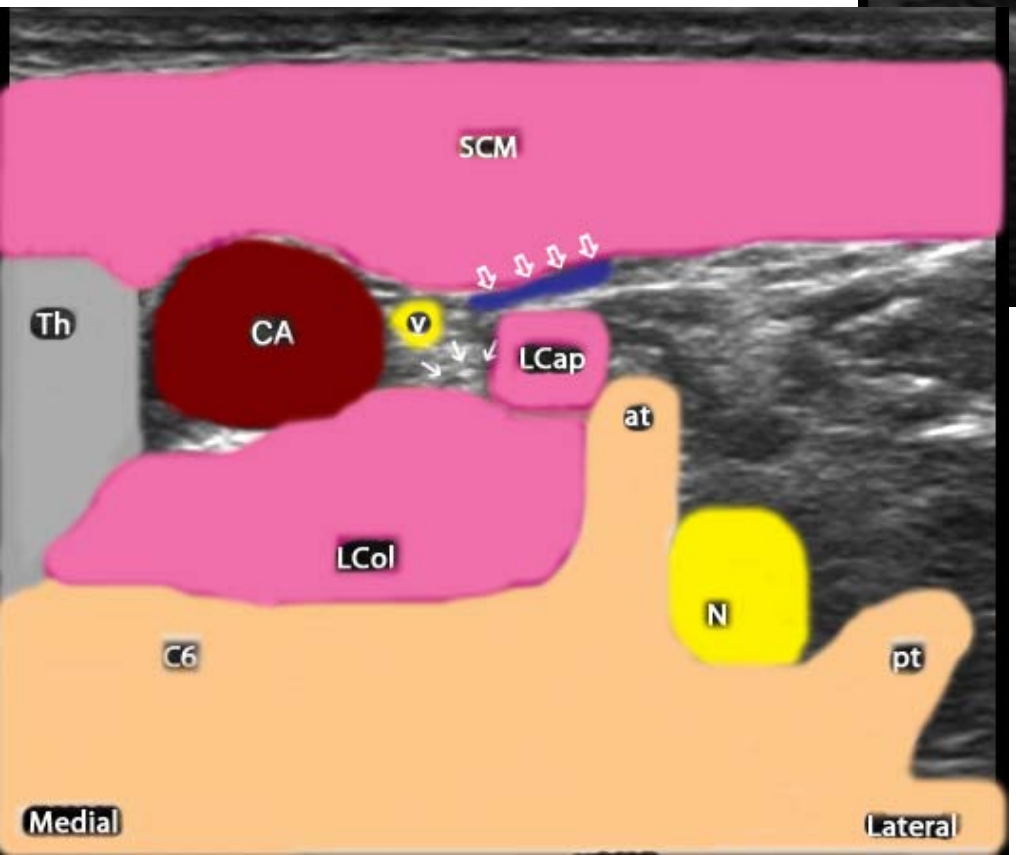
SGB – C6 level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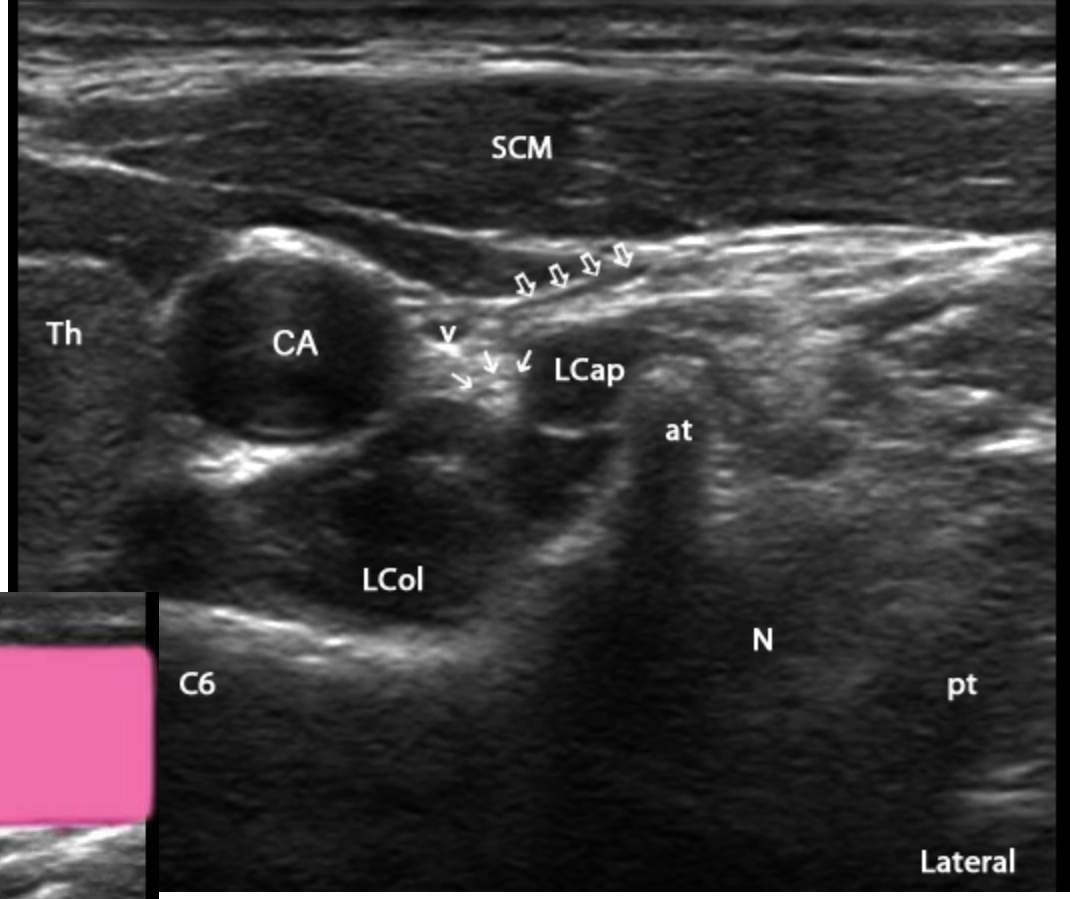
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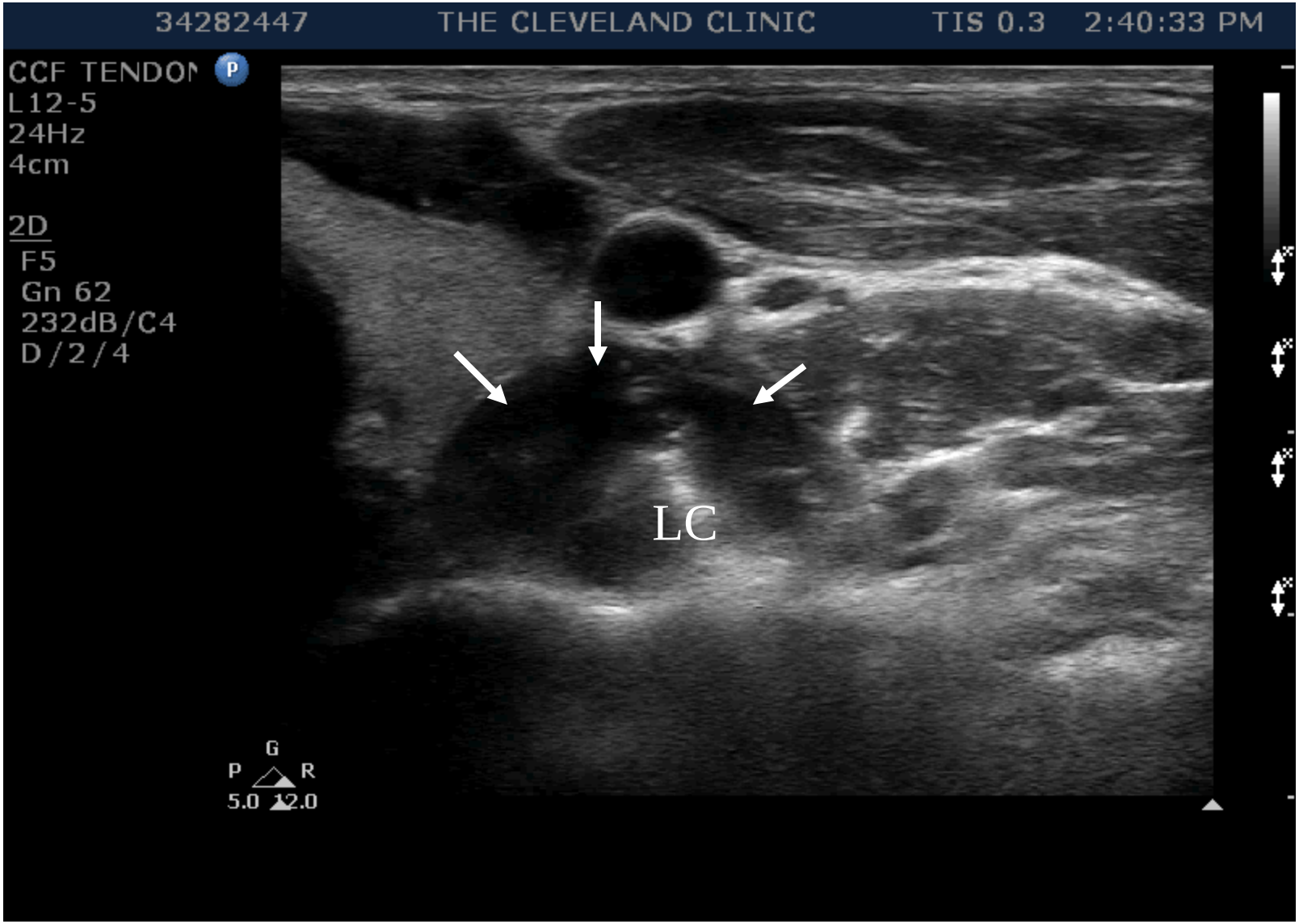
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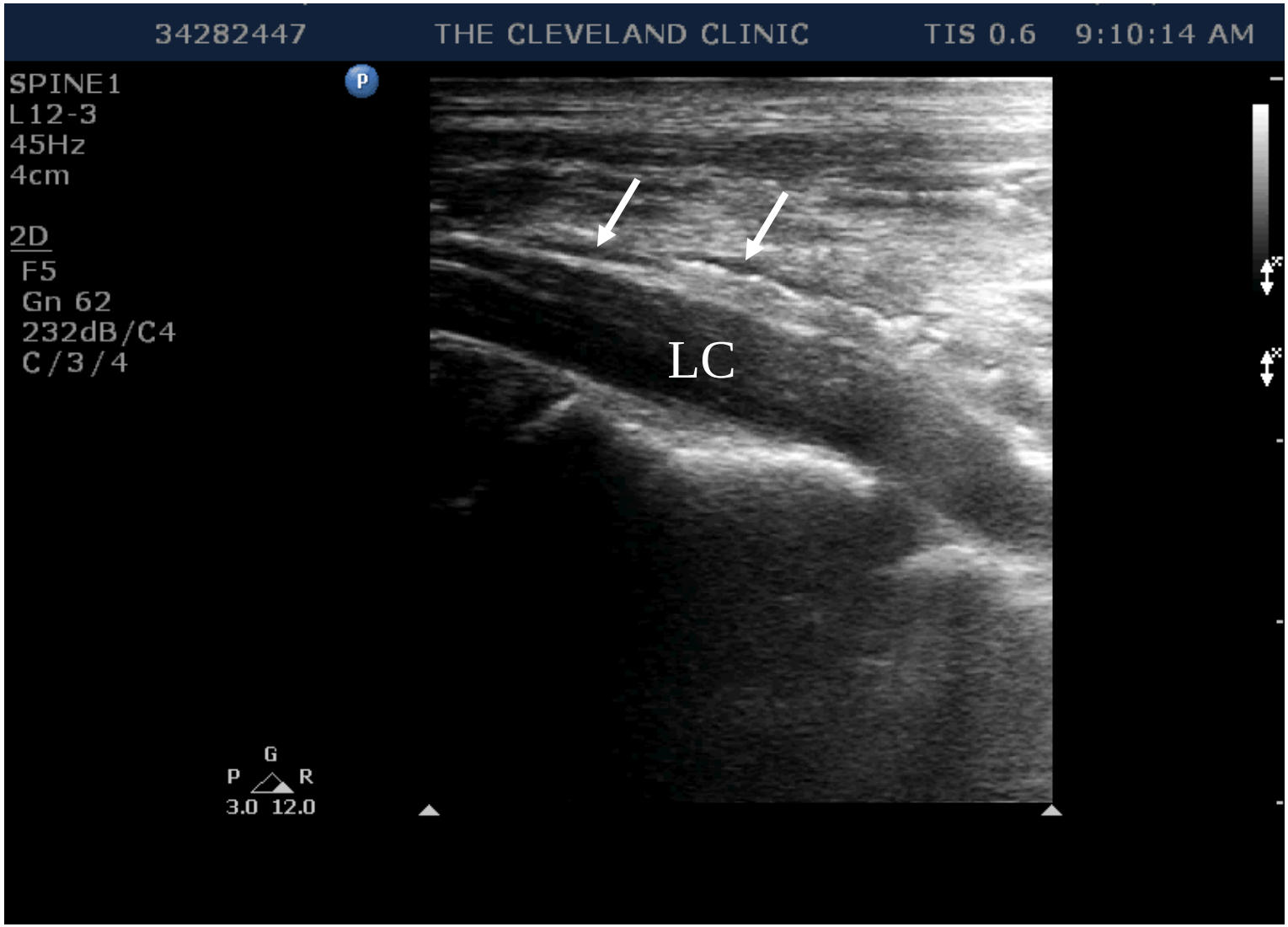
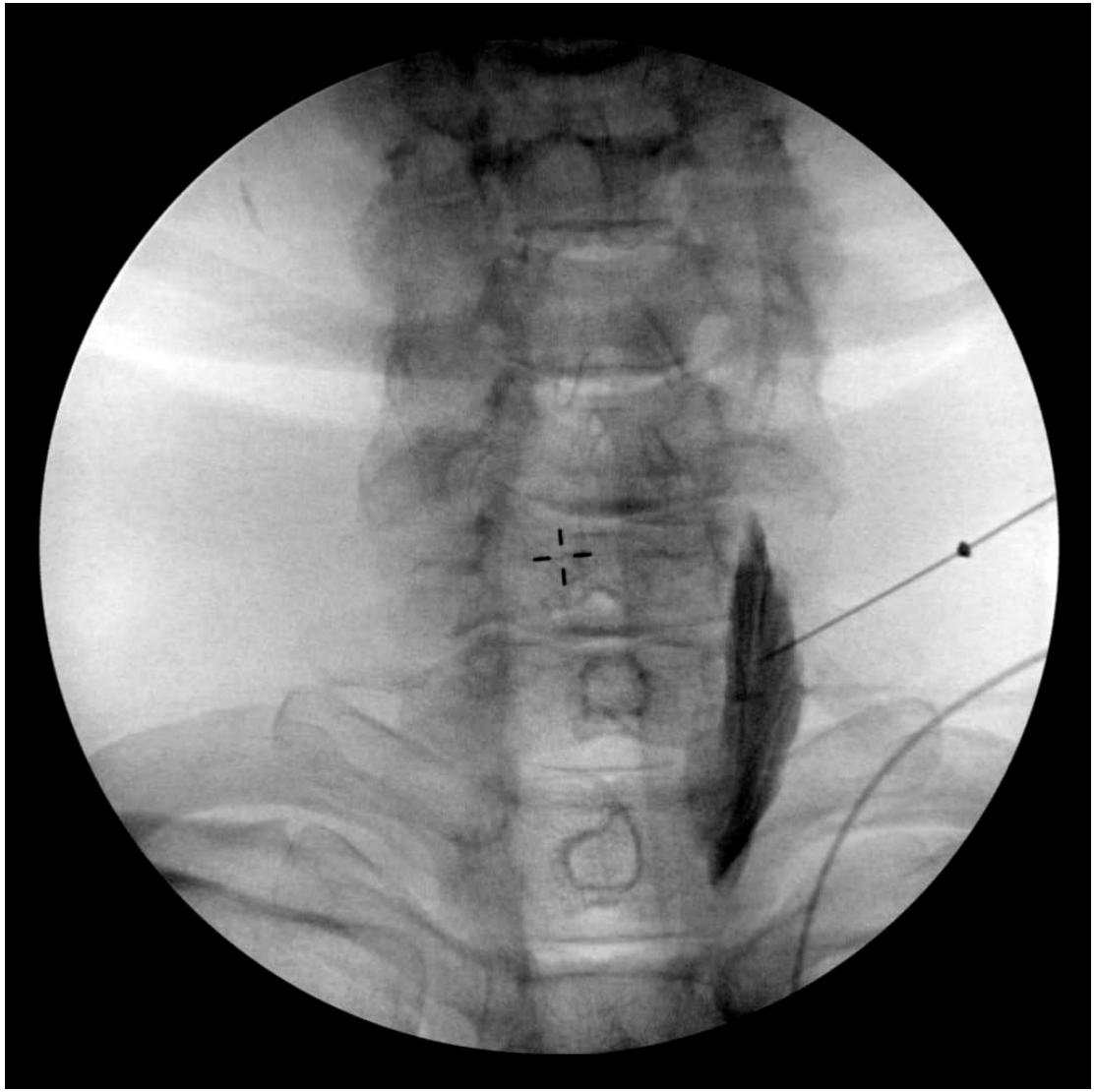
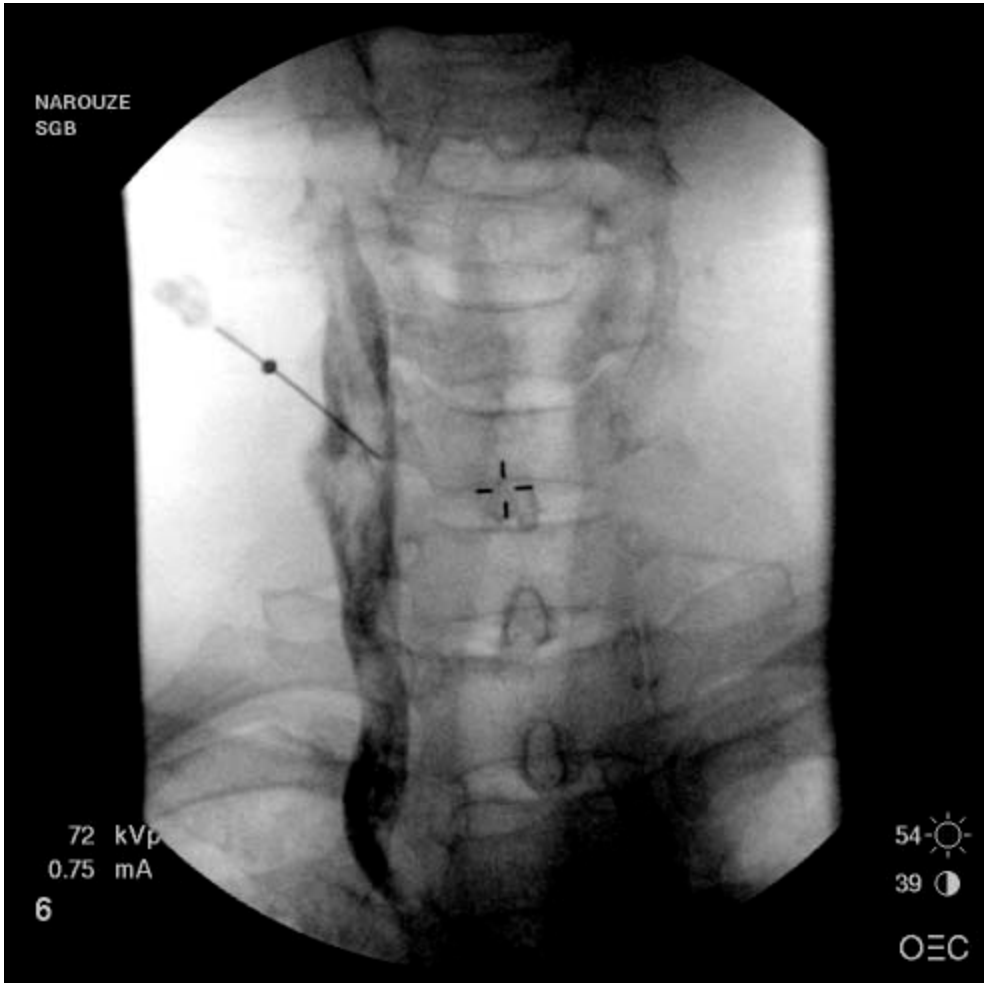


Longitudinal Scan

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Ultrasound-Guided SGB

Out of Plane Approach

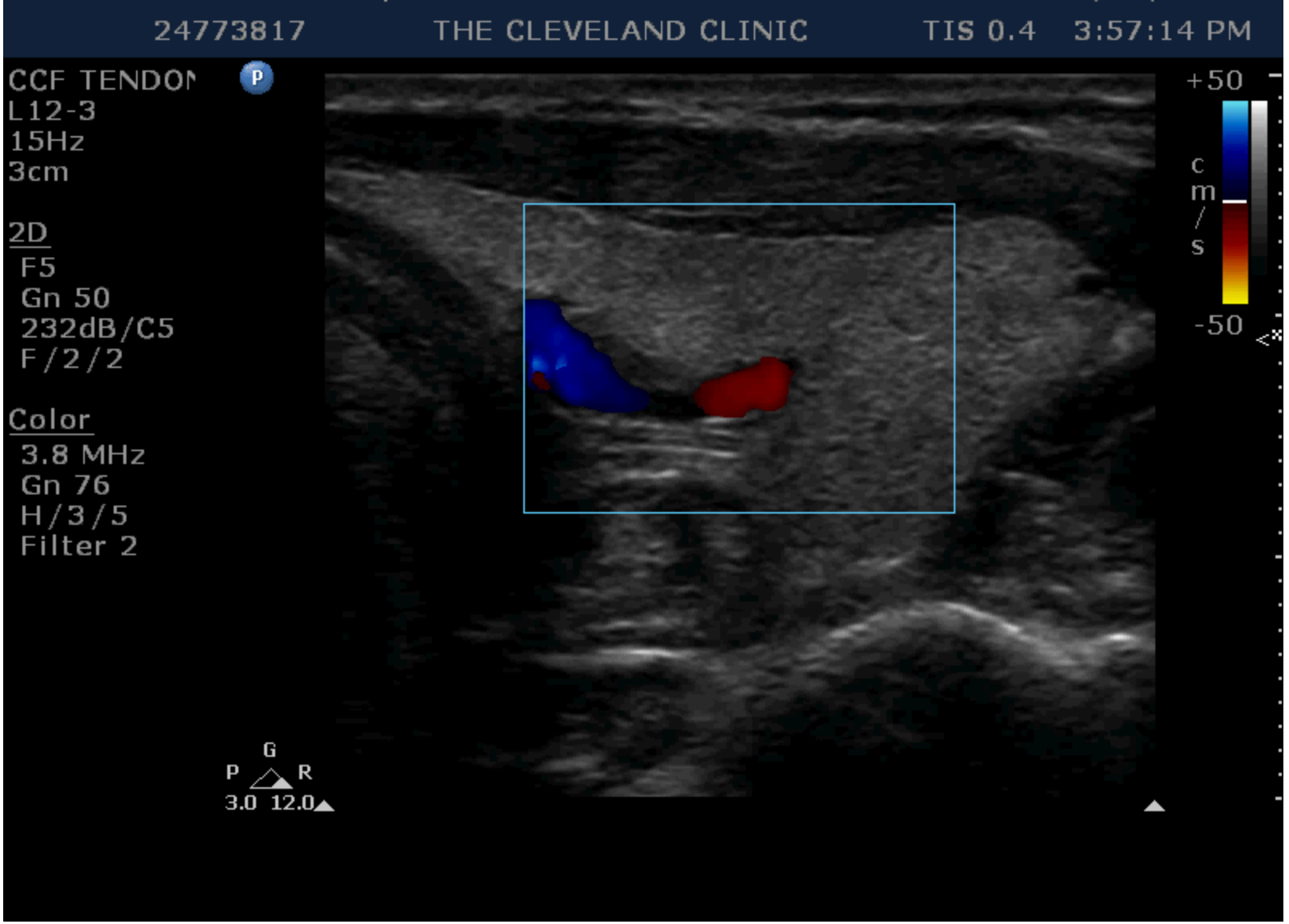
In-plane Approach

Avoid Blood Vessels

Hematoma after SGB

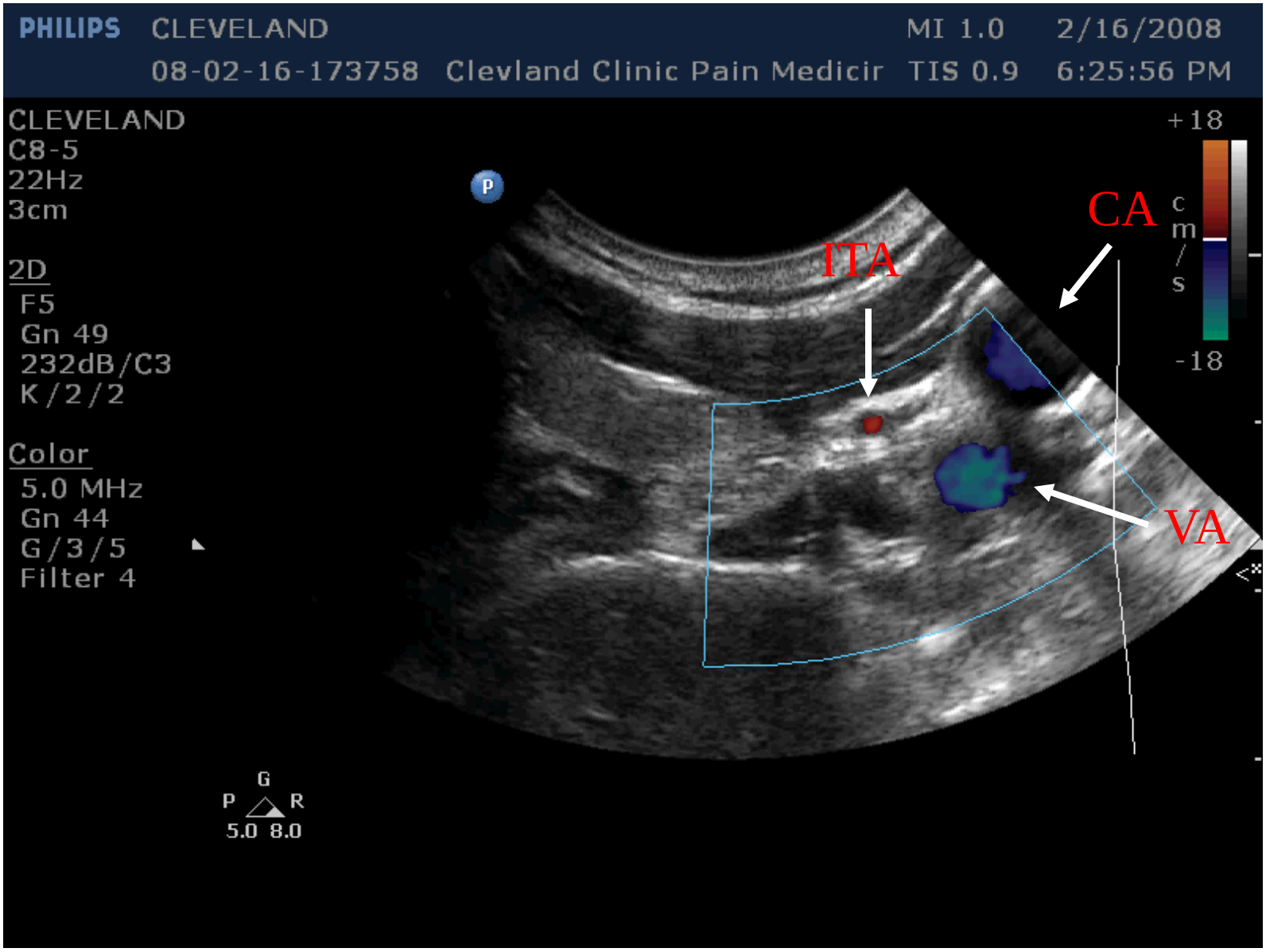
- The frequency of retropharyngeal hematoma after SGB was reported to be 1 in 100,000 cases with resulting airway compromise and obstruction.
- However Kapral et al. reported a much higher incidence of asymptomatic hematoma with the blind technique.
  3 out of 12 patients (asymptomatic), with no hematoma occurring during US technique. They attributed this to injury to the thyroid gland or the vertebral artery

Kapral S et al. Ultra-sound imaging for stellate ganglion block: Direct visualization of puncture site and local anesthetic spread. Reg Anesth 1995; 20:323-8
Higa K et al.Retropharyngeal hematoma after stellate ganglion block. Anesthesiology 2006; 105: 1238-45

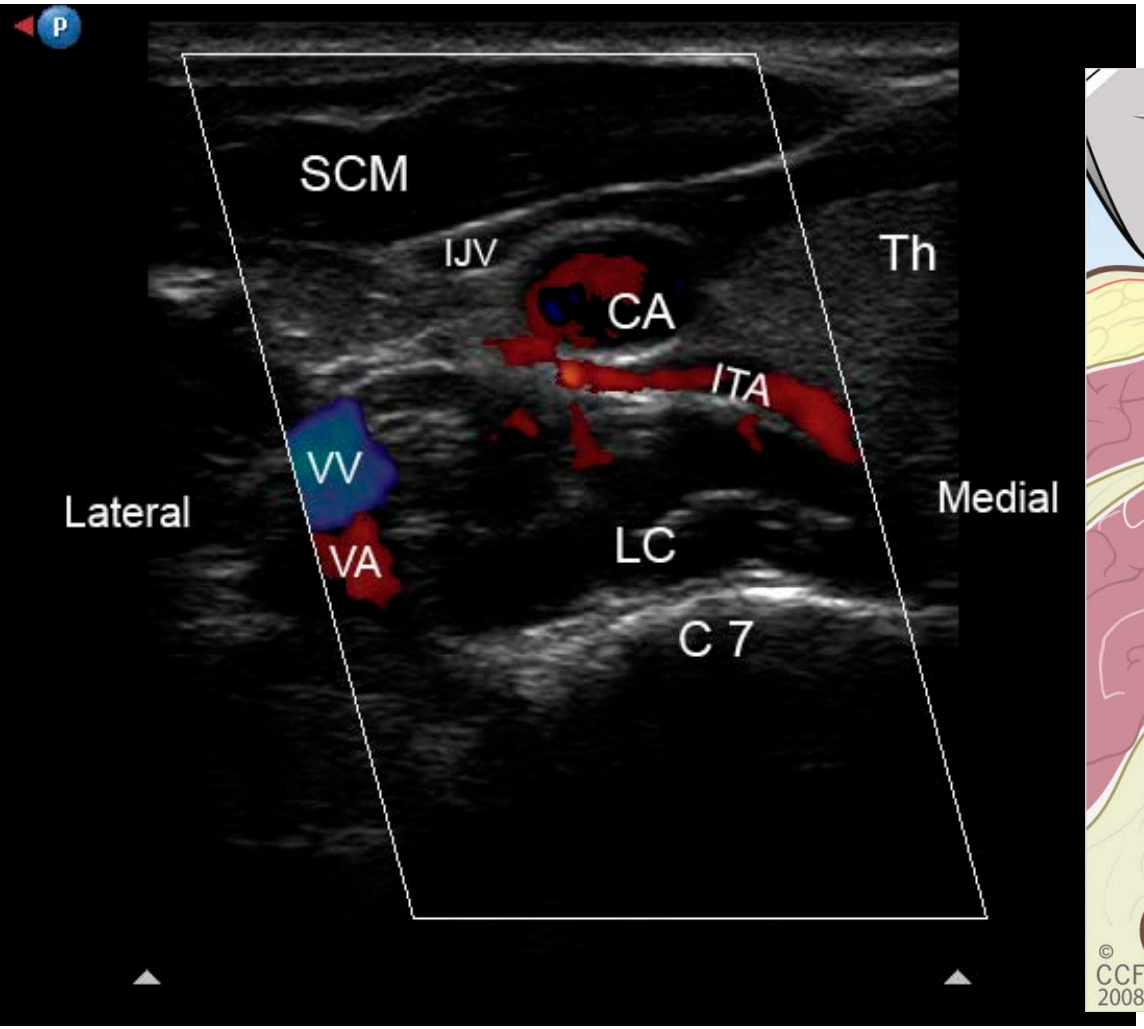


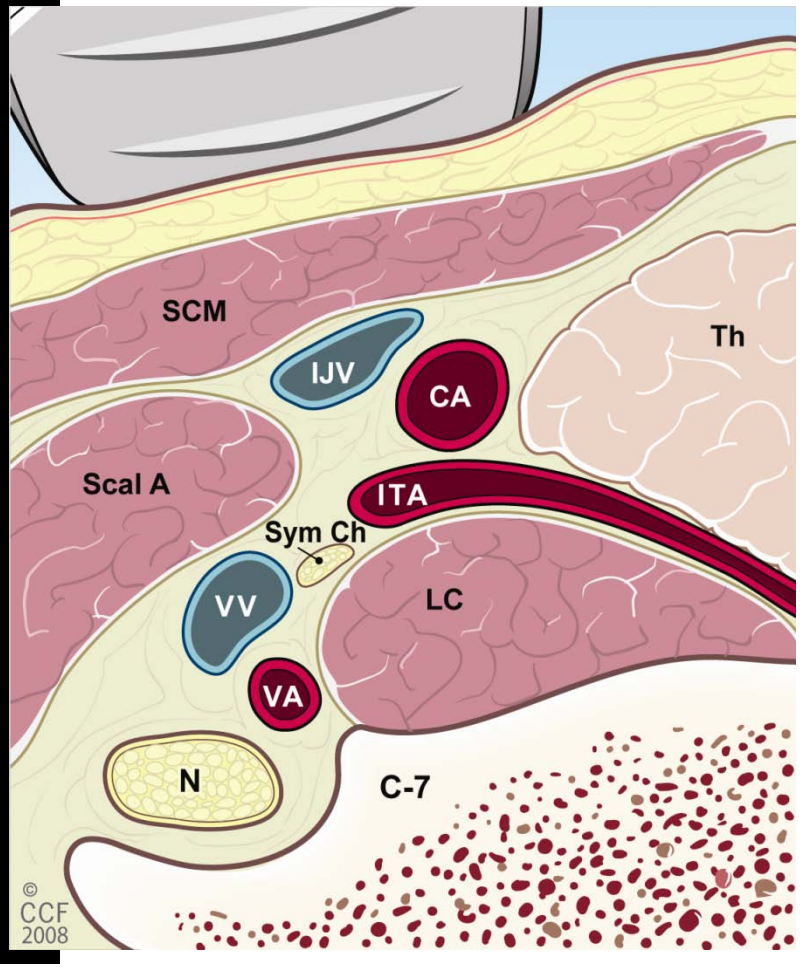
US can prevent hematoma formation from injury to the thyroid vessels

US can prevent hematoma formation from injury to the ITA

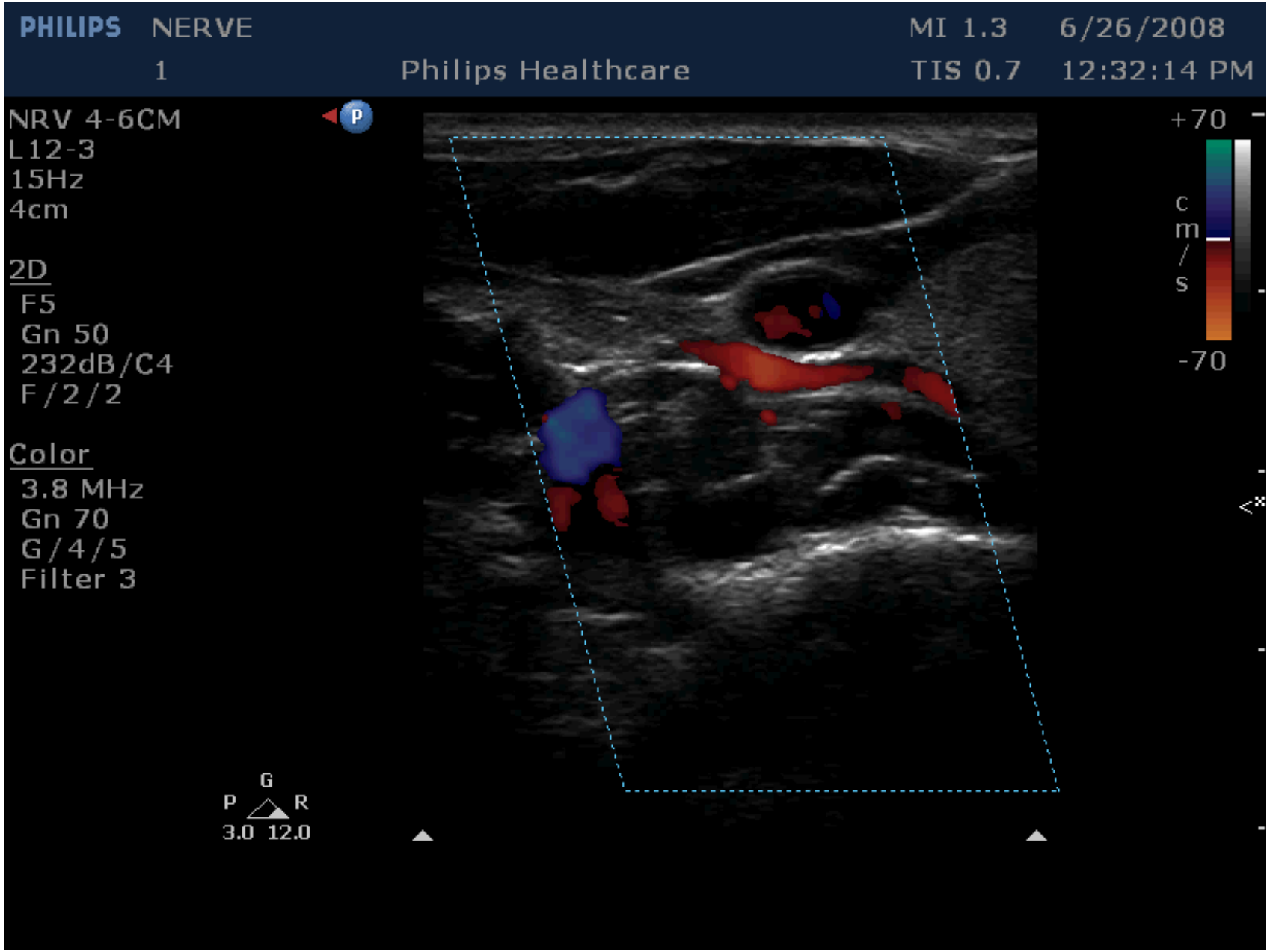


US can prevent hematoma formation from injury to the ITA





Be aware of the SERPENTINE ITA, Narouze. Anesth Analg 2009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REVIEW ARTICLE

Ultrasound-Guided Interventional Procedures in Pain Management

Evidence-Based Medicine

Samer N. Narouze, MD, MS

(*Reg Anesth Pain Med* 2010;35: 386–396)

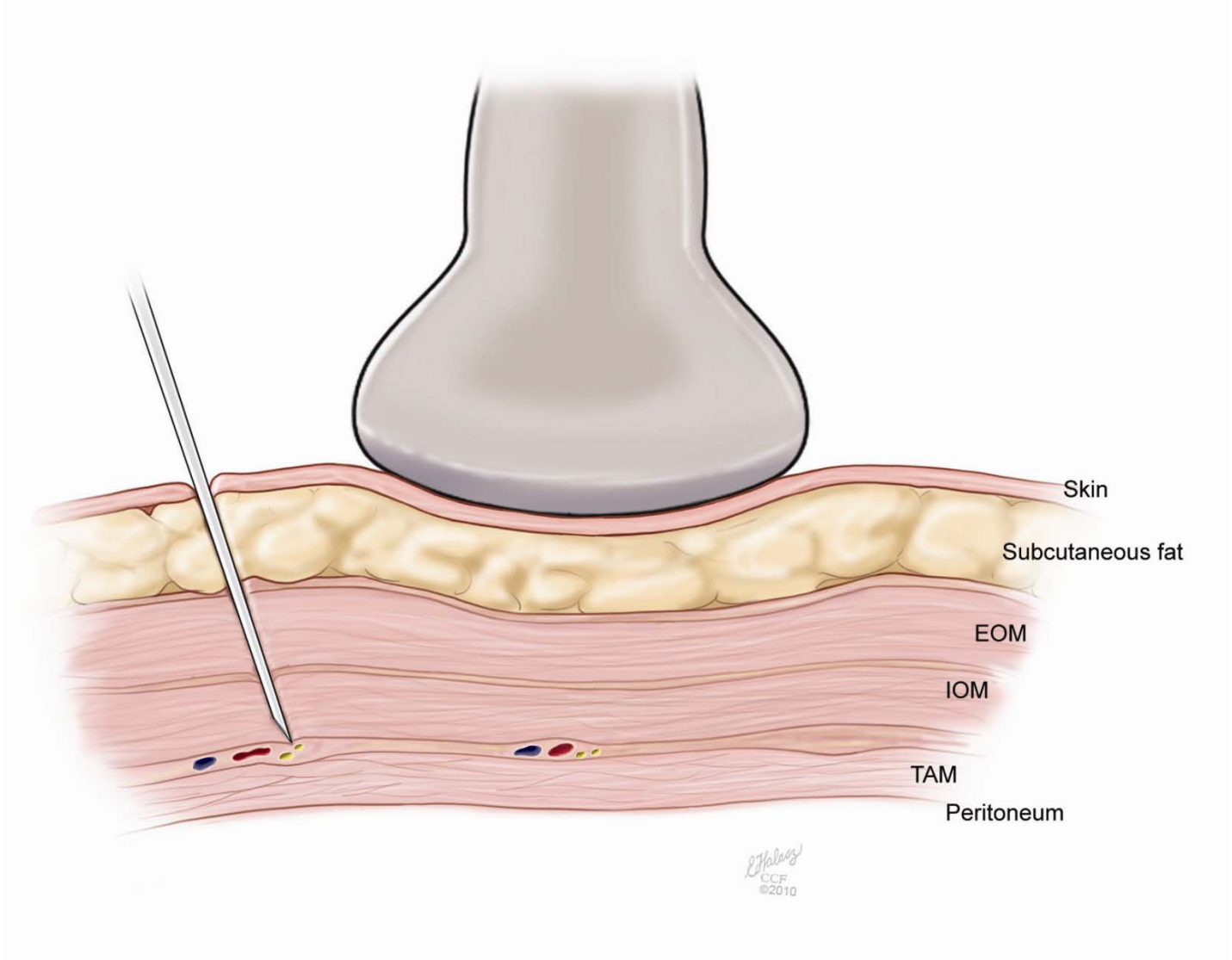
TABLE 2. Summary of the Evidence for Ultrasound in Cervical Spine Injections

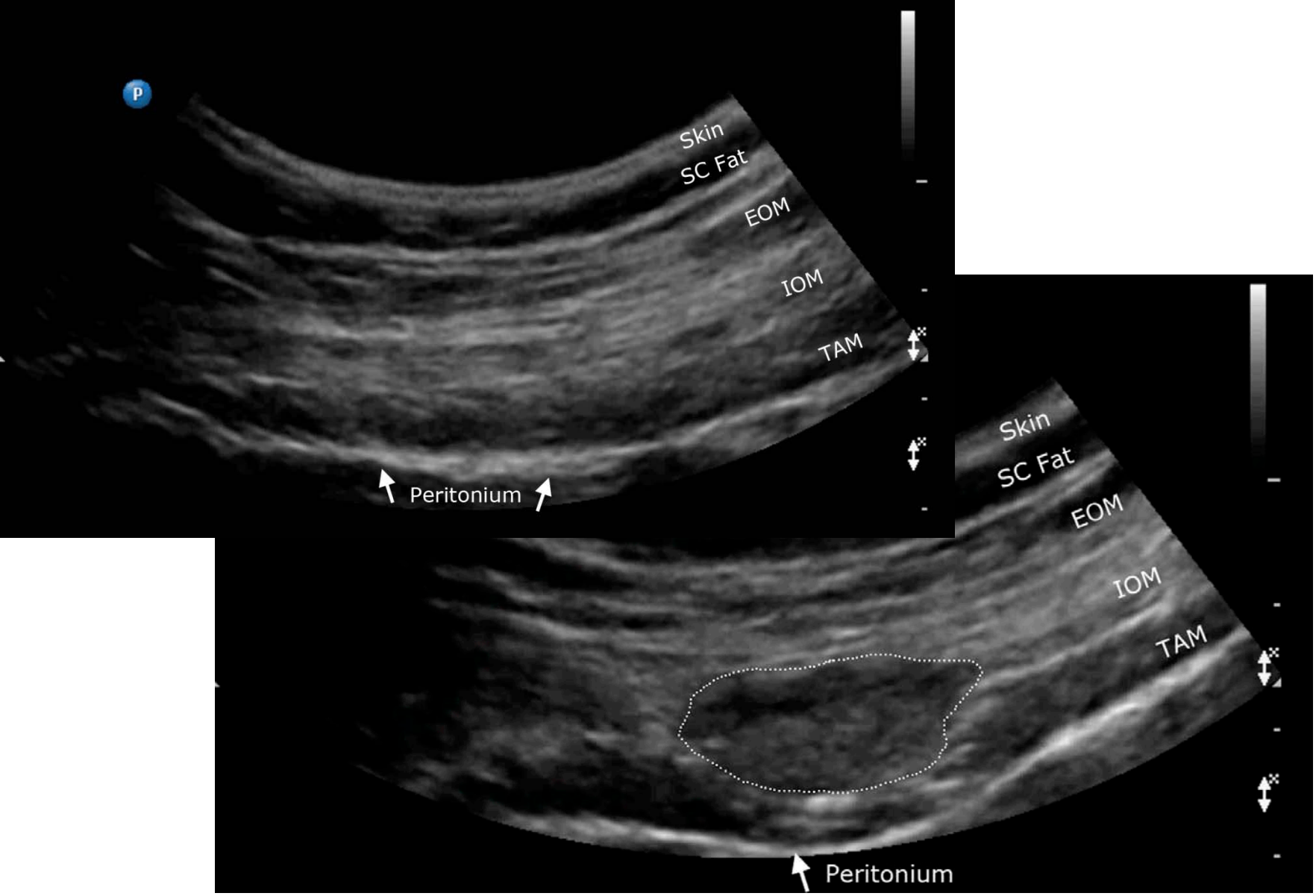
Study/Year	Block Type	No. Subjects	Study Design	Comparative Technique	Outcome
Eichenberger et al[12] (2006)	Third occipital block	14 Volunteers/ 28 injections	Prospective observational cohort trial	Fluoroscopy	82% Success
Narouze et al[11] (2009)	Cervical nerve root	10 Patients	Prospective observational cohort trial	Fluoroscopy	100% Success
Kapral et al[14] (1995)	Stellate ganglion block	12 Patients	Nonrandomized crossover trial	N/A	100% Success
Gofeld et al[18] (2009)	Stellate ganglion block	7 Patients	Observational study	Fluoroscopy	100% Success

Ultrasound-guided Peripheral Non-axial Blocks

- **TAP block and Rectus Sheath block**
- **Ilioinguinal, Iliohypogastric nerves**
- **LFCN**
- **Intercostal nerve blocks**
- **Suprascapular nerve**
- **Piriformis muscle**
- **Pudendal nerve**
- **Celiac plexus**

TAP

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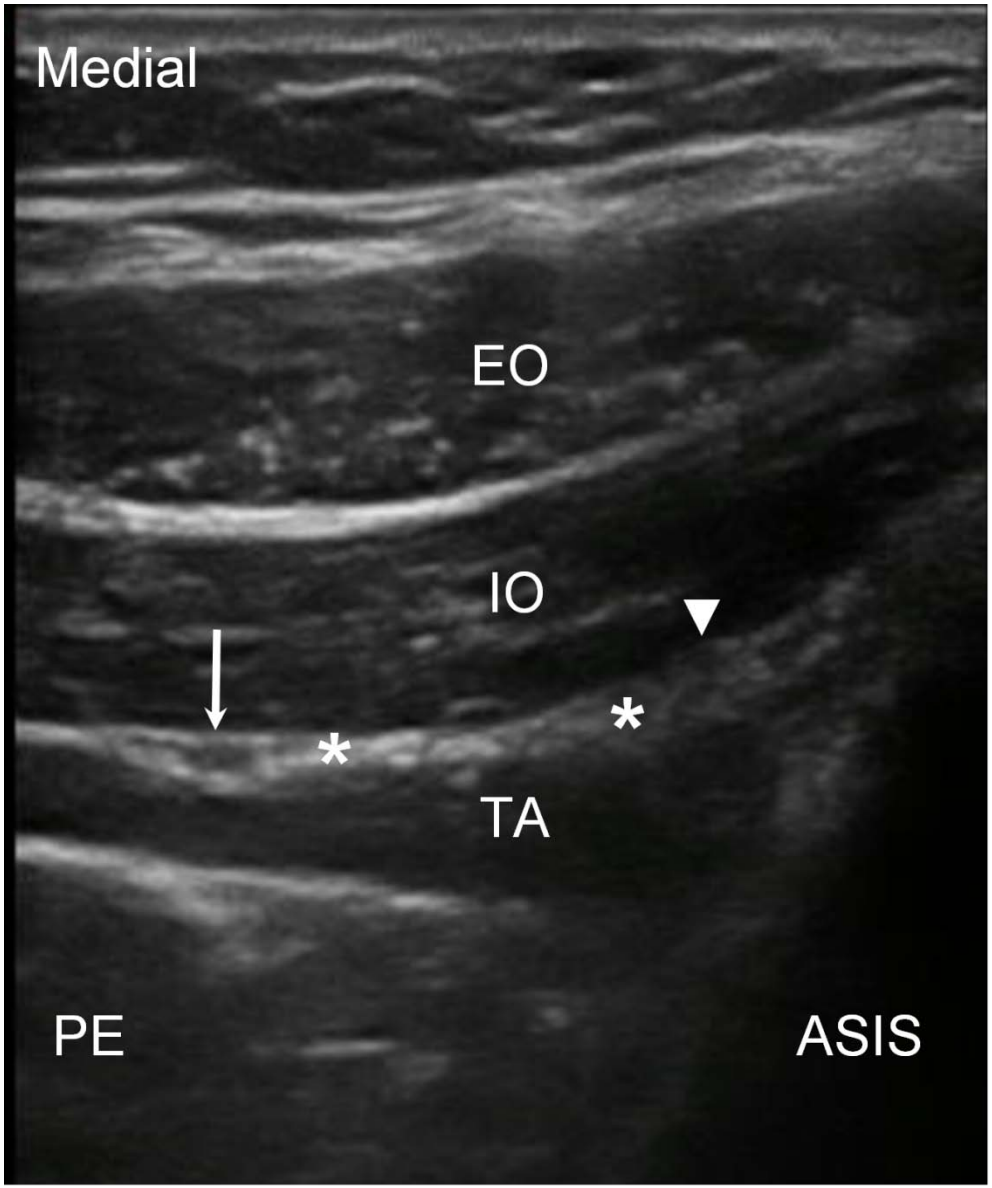
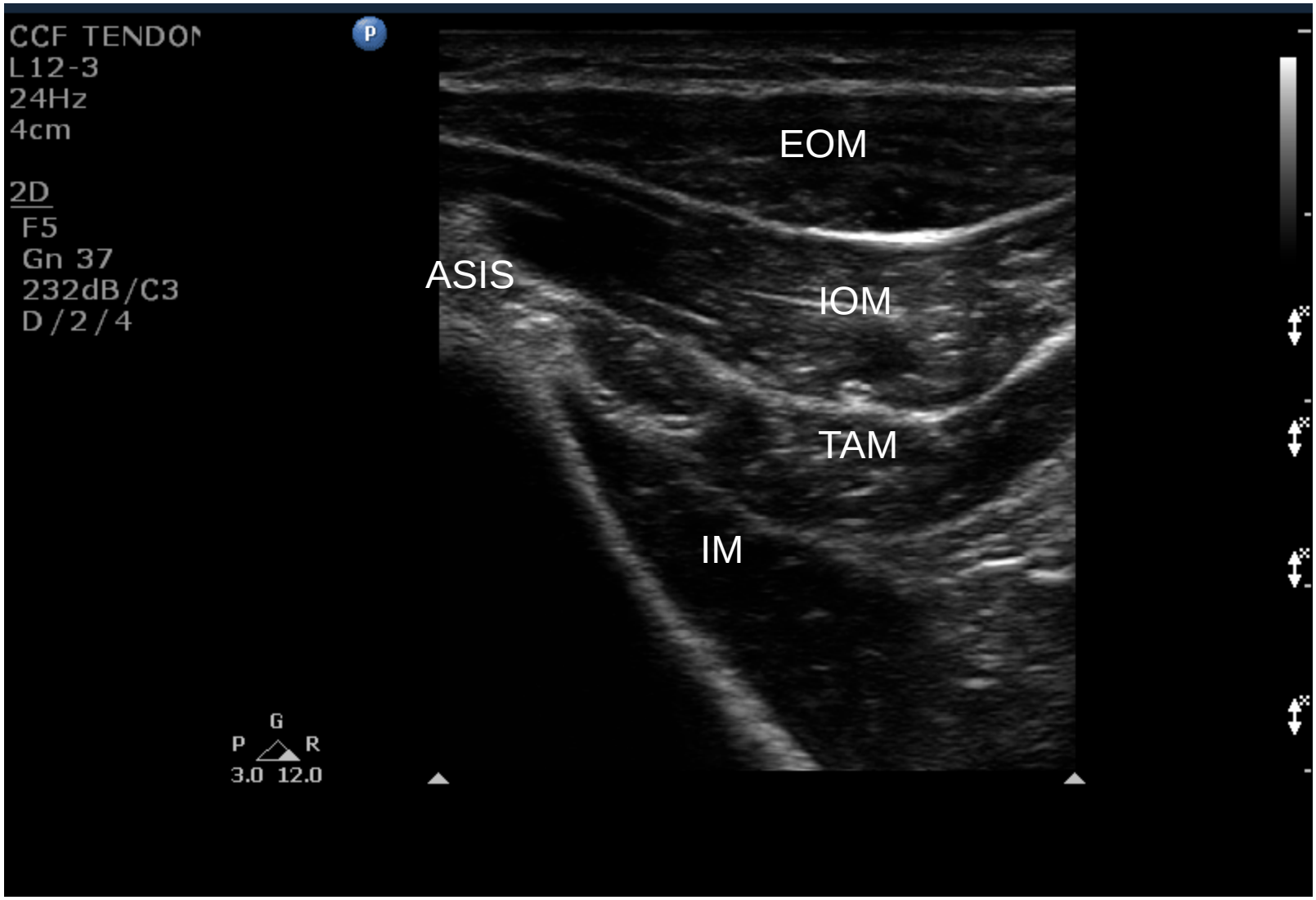
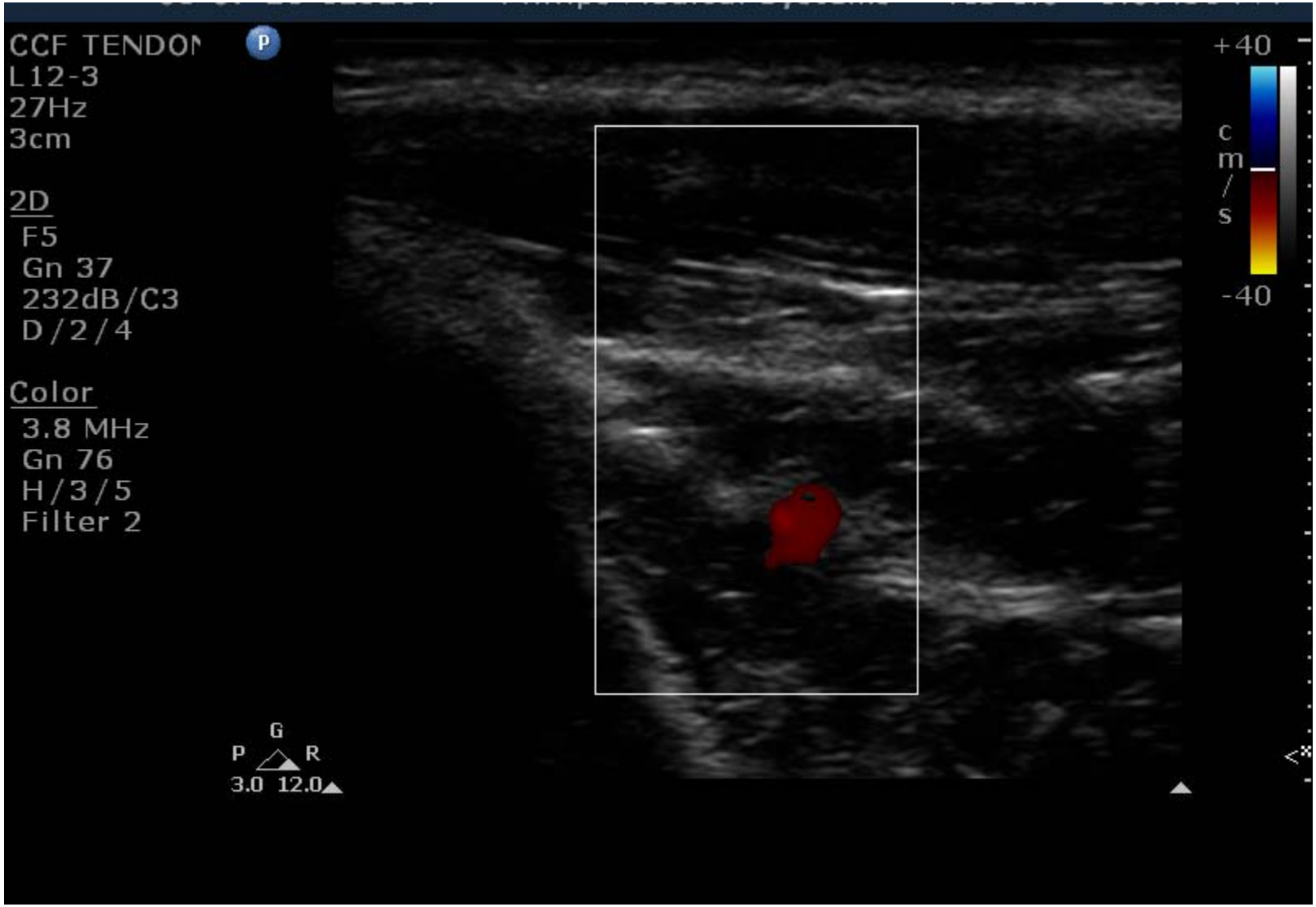
Groin Blocks



Groin Blocks

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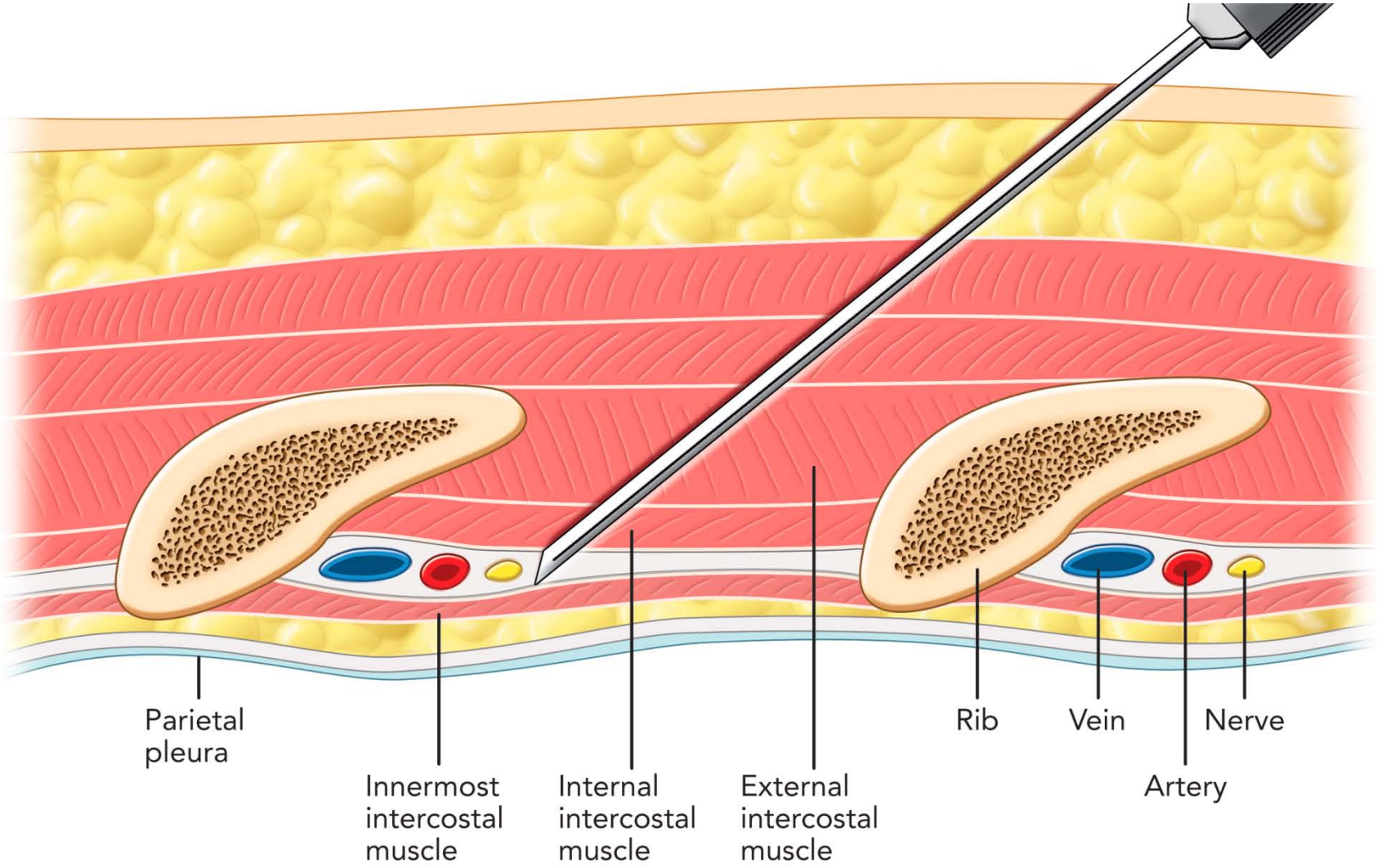
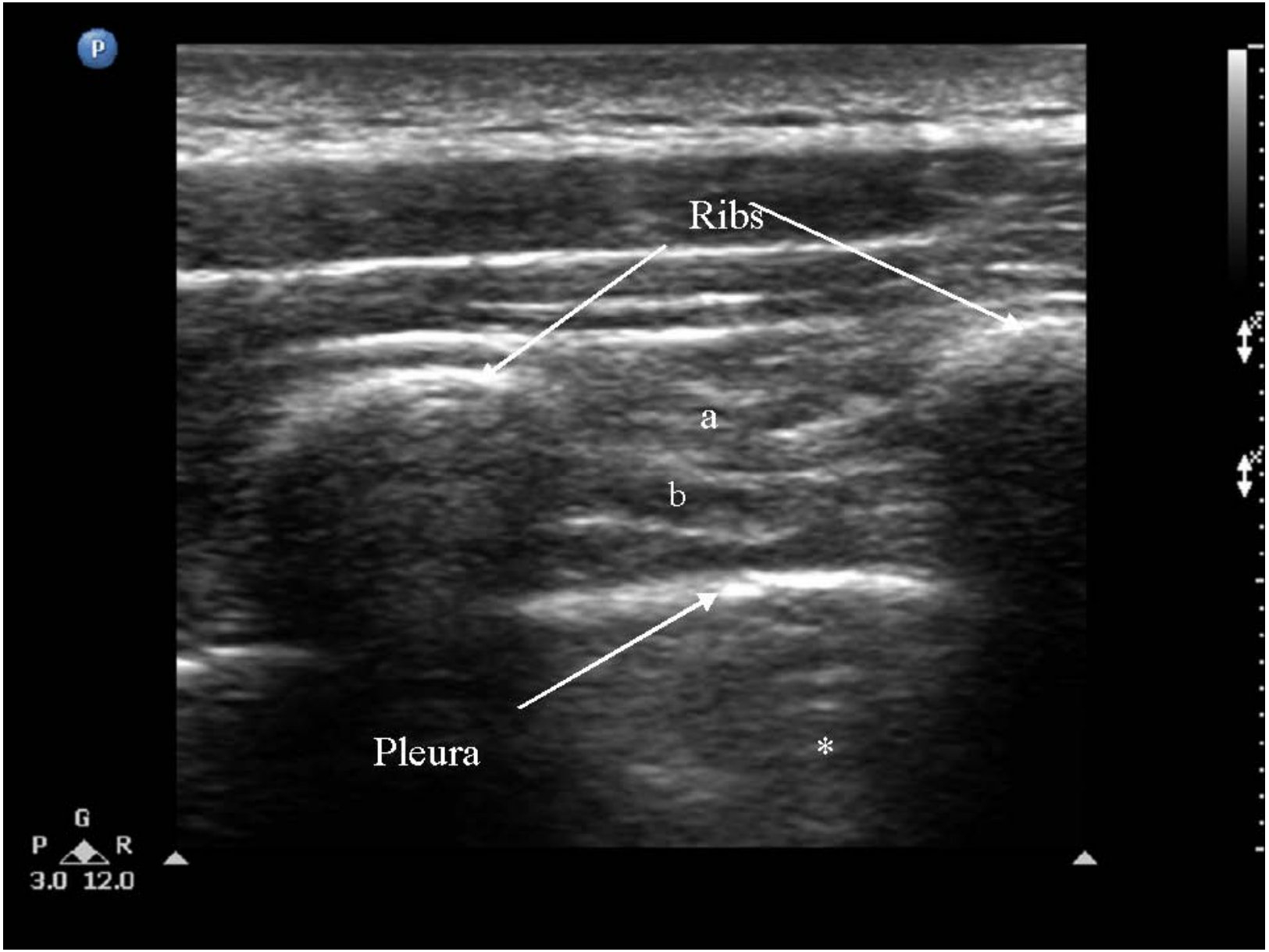
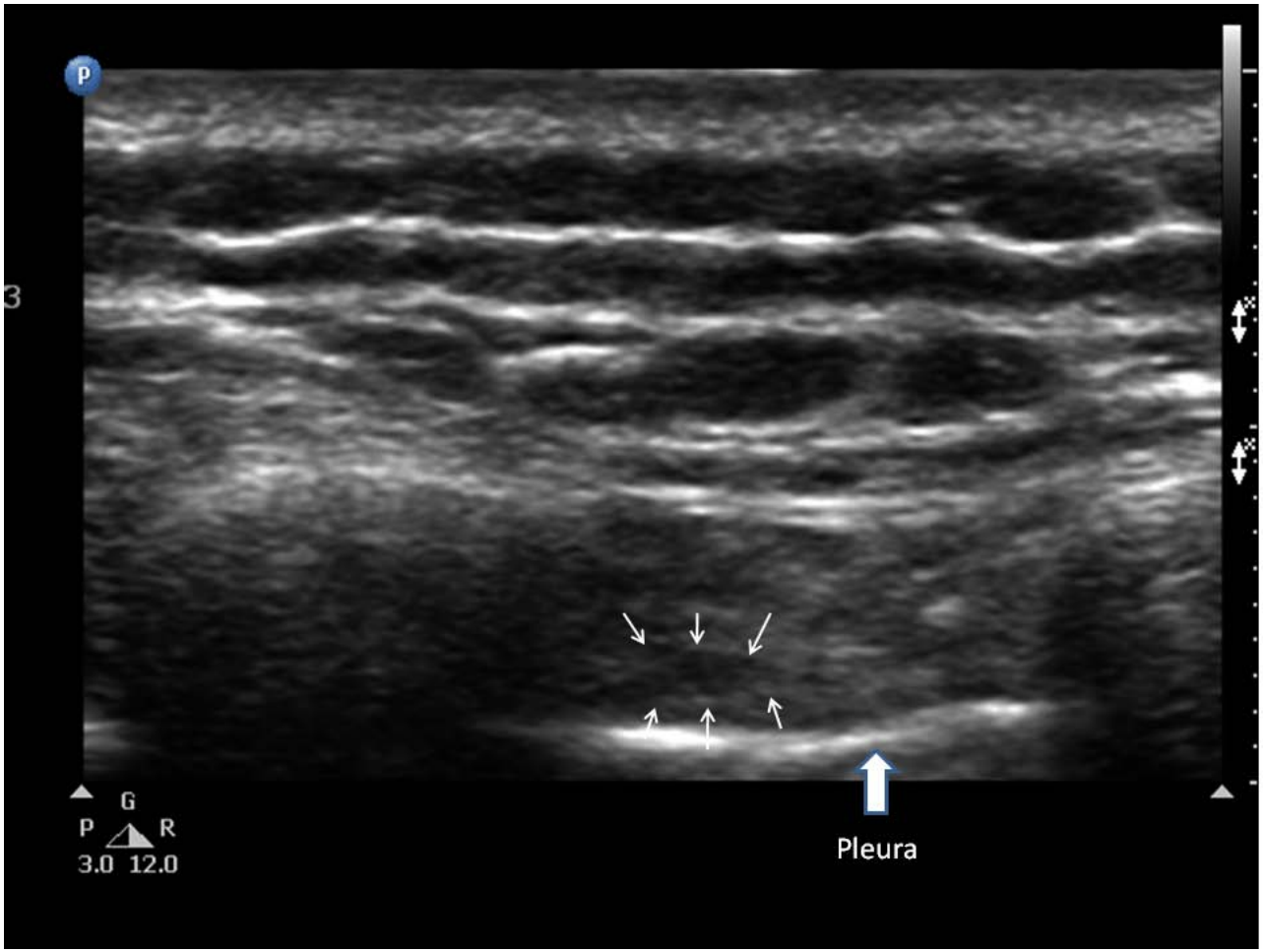
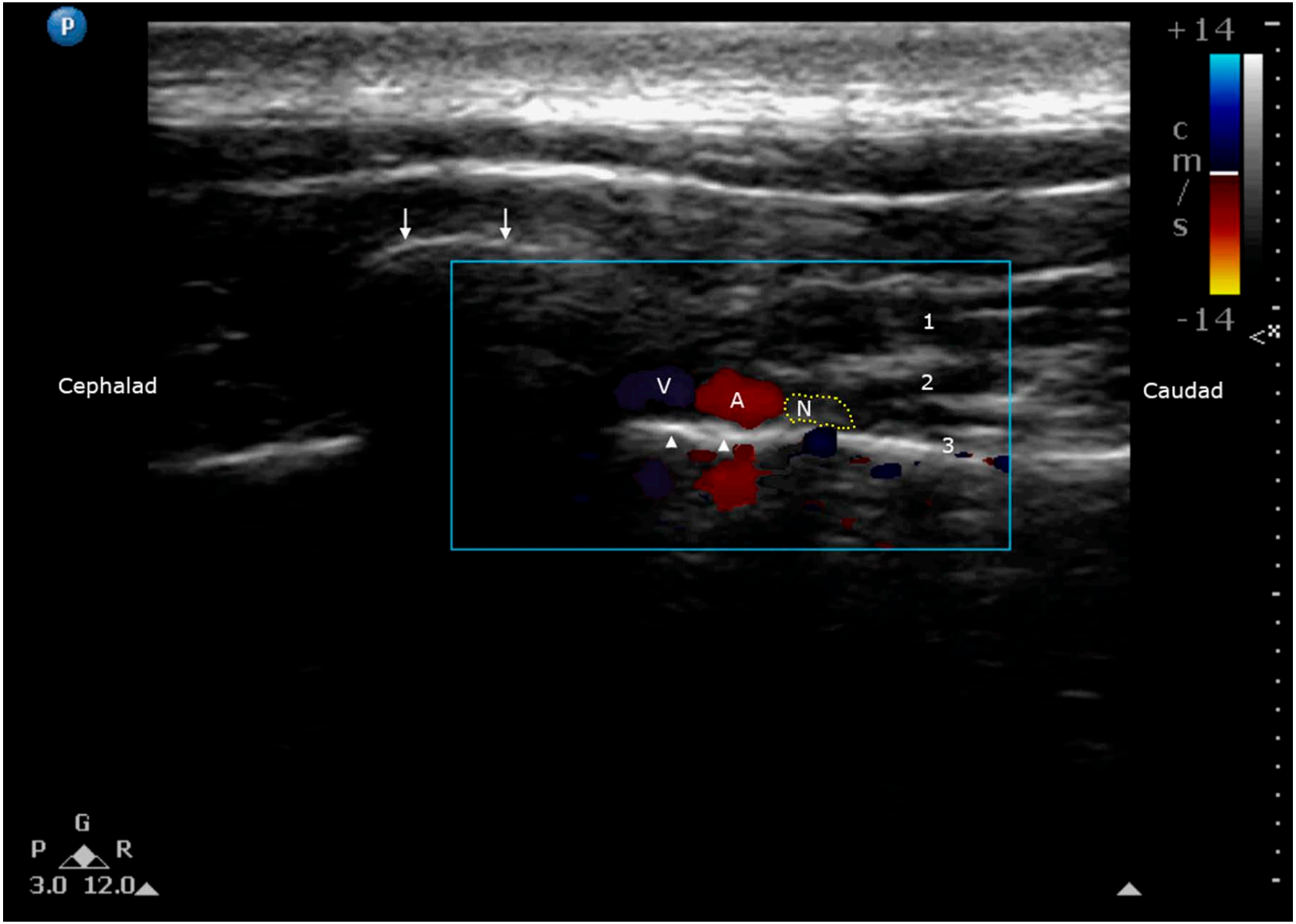
3.0 12.0

Intercostal Nerve Block

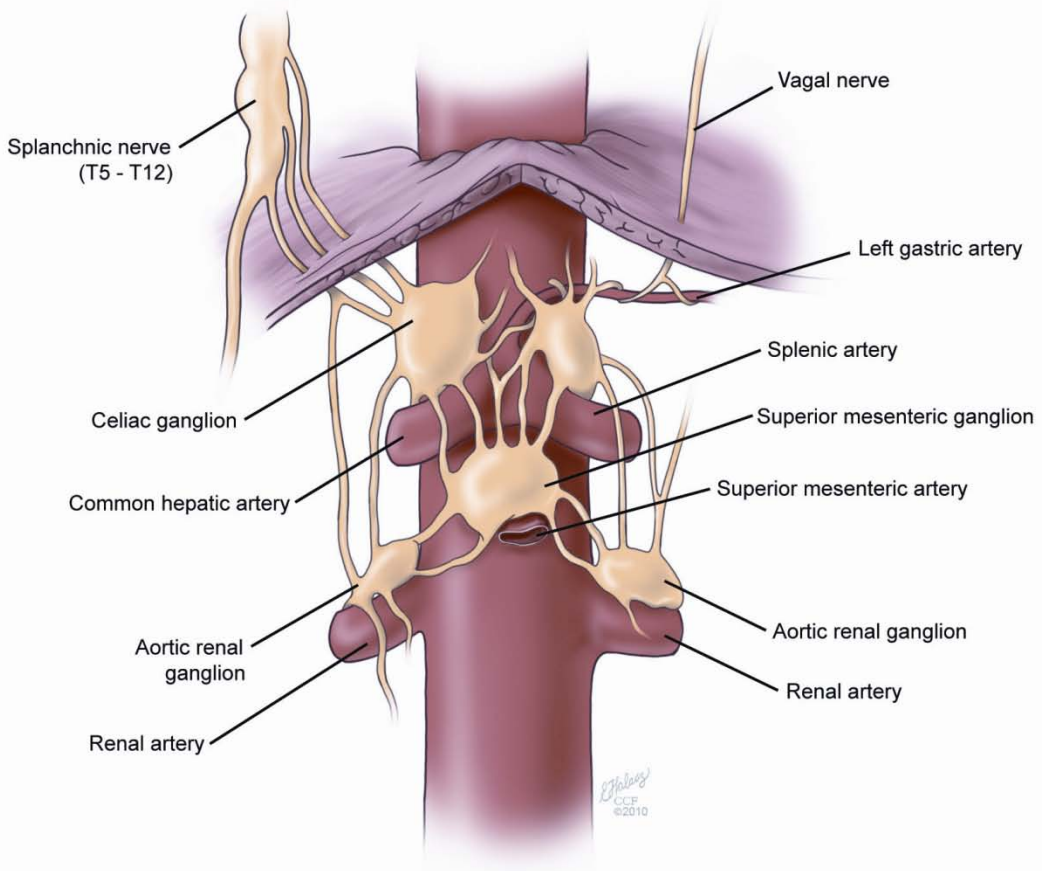



Ribs
a
b
Pleura
*
G
P
R
3.0 12.0

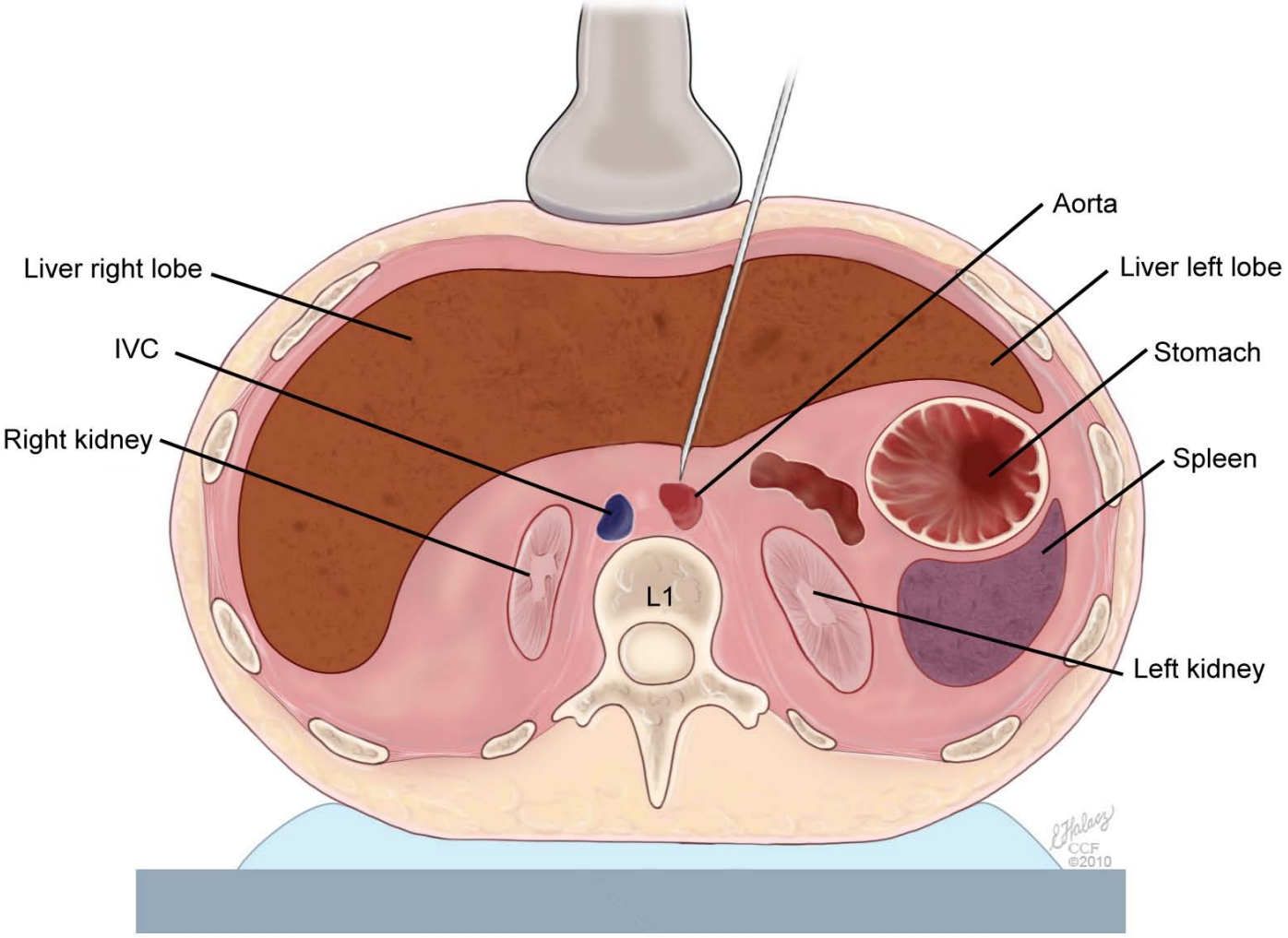

P
3
G
P
R
3.0 12.0
Pleura

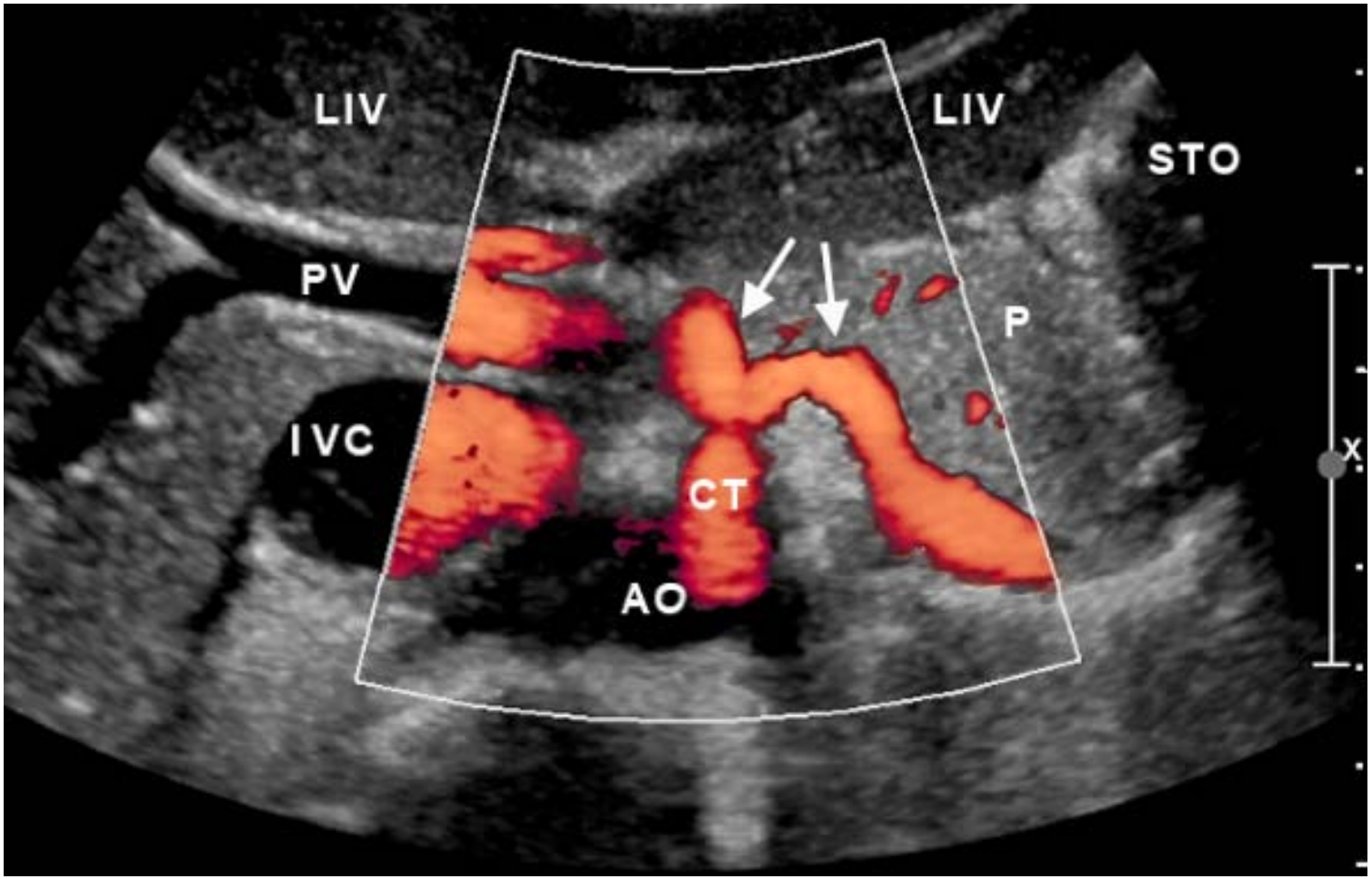

P
+14
cm/s
-14
Cephalad
Caudad
V
A
N
1
2
3
G
P
R
3.0
12.0

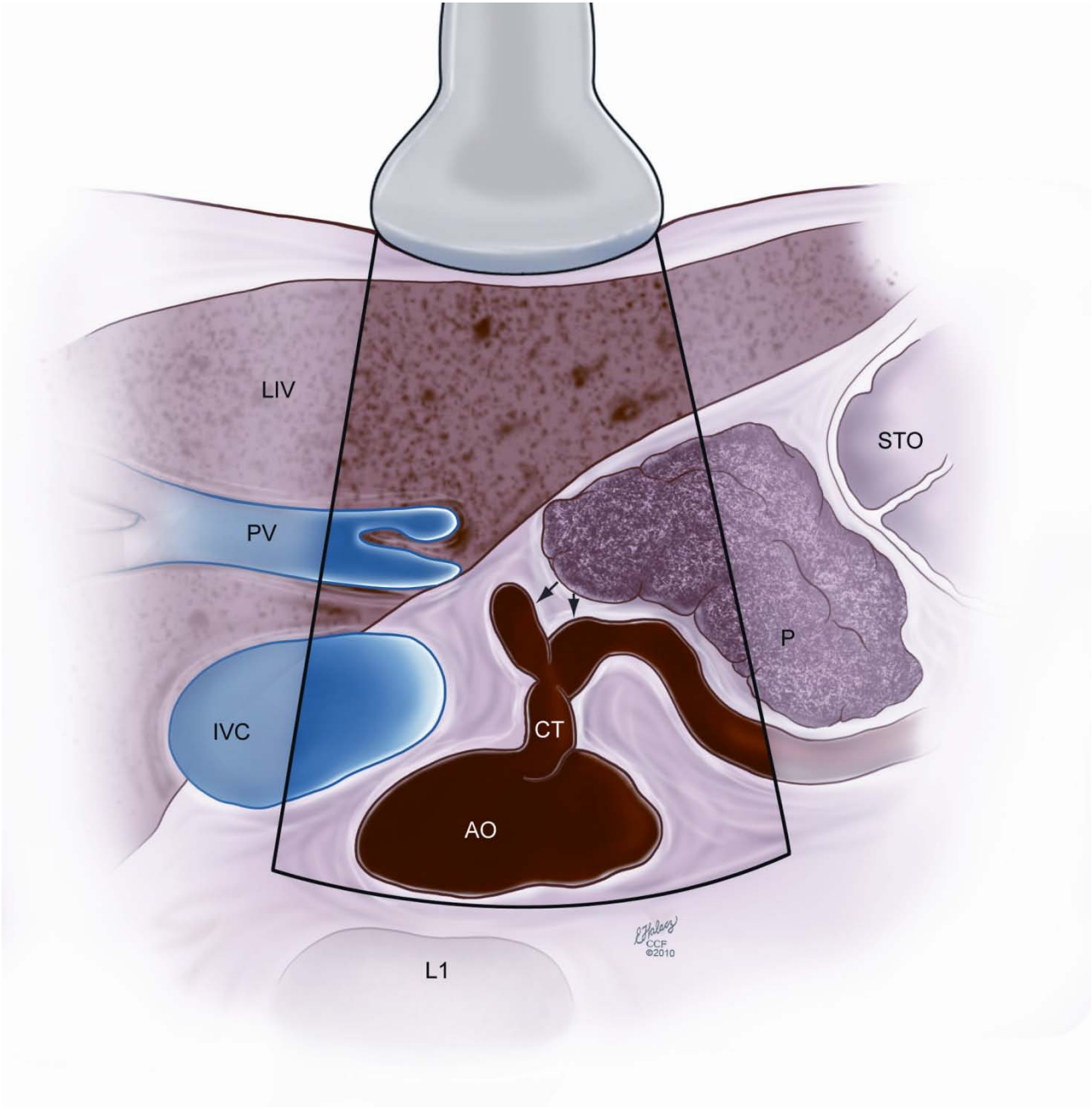
Celiac plexus

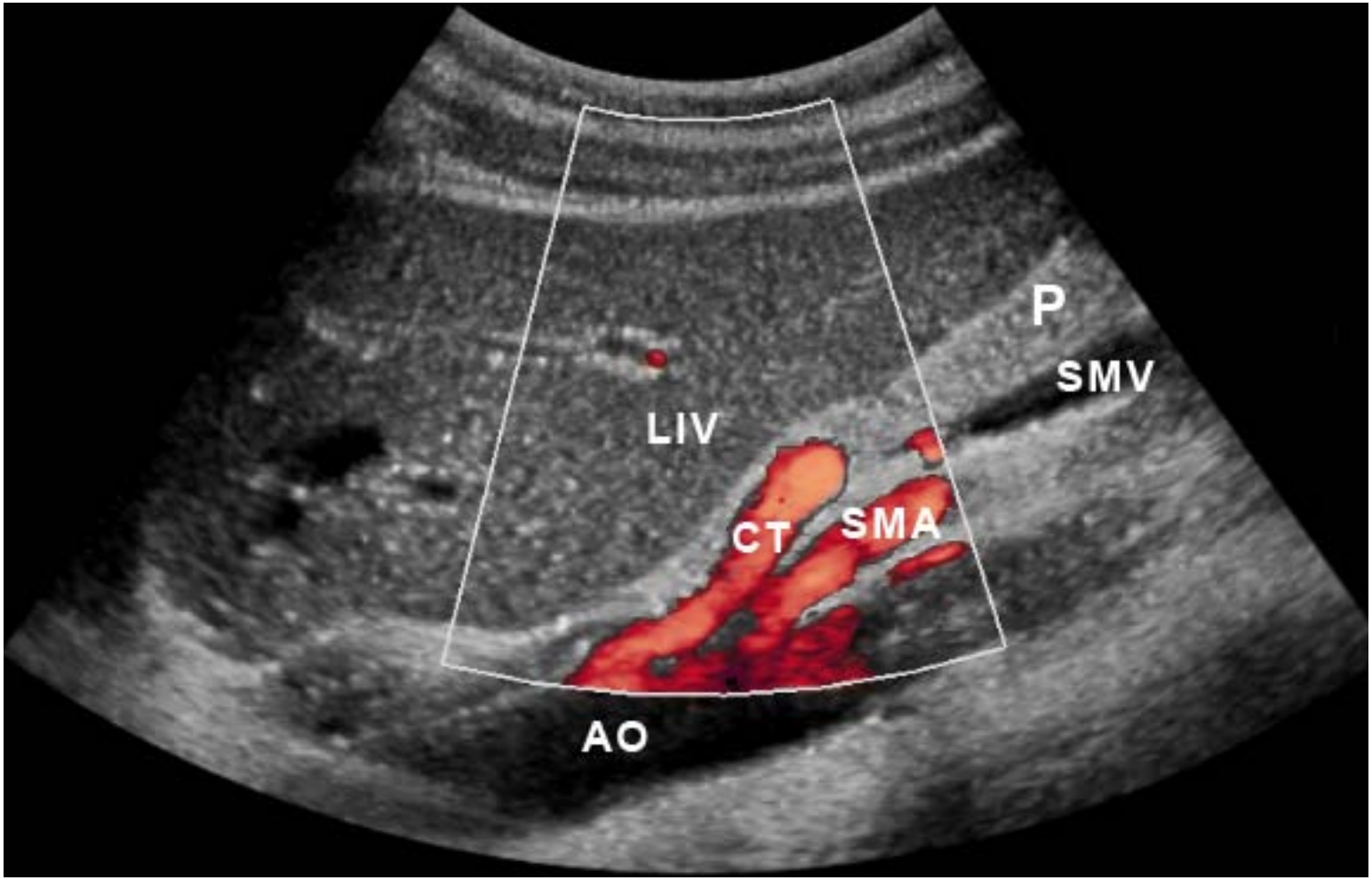


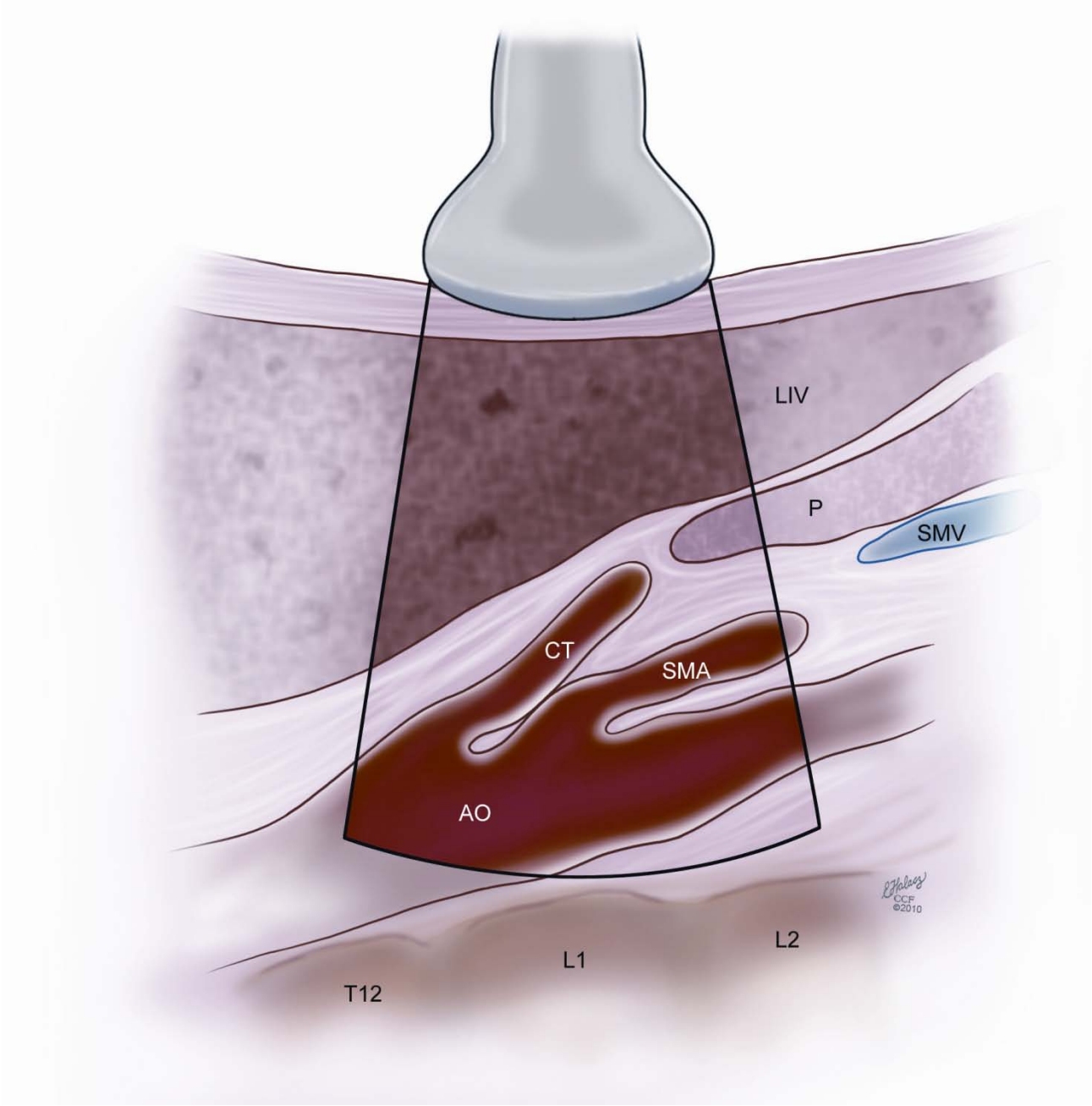
Celiac plexus




LIV
LIV
STO
PV
P
IVC
CT
AO
X


LIV
STO
PV
P
IVC
CT
AO
L1
CCF
©2010


P
SMV
LIV
CT
SMA
AO


LIV
P
SMV
CT
SMA
AO
L2
L1
T12
CCF
©2010

Thank You