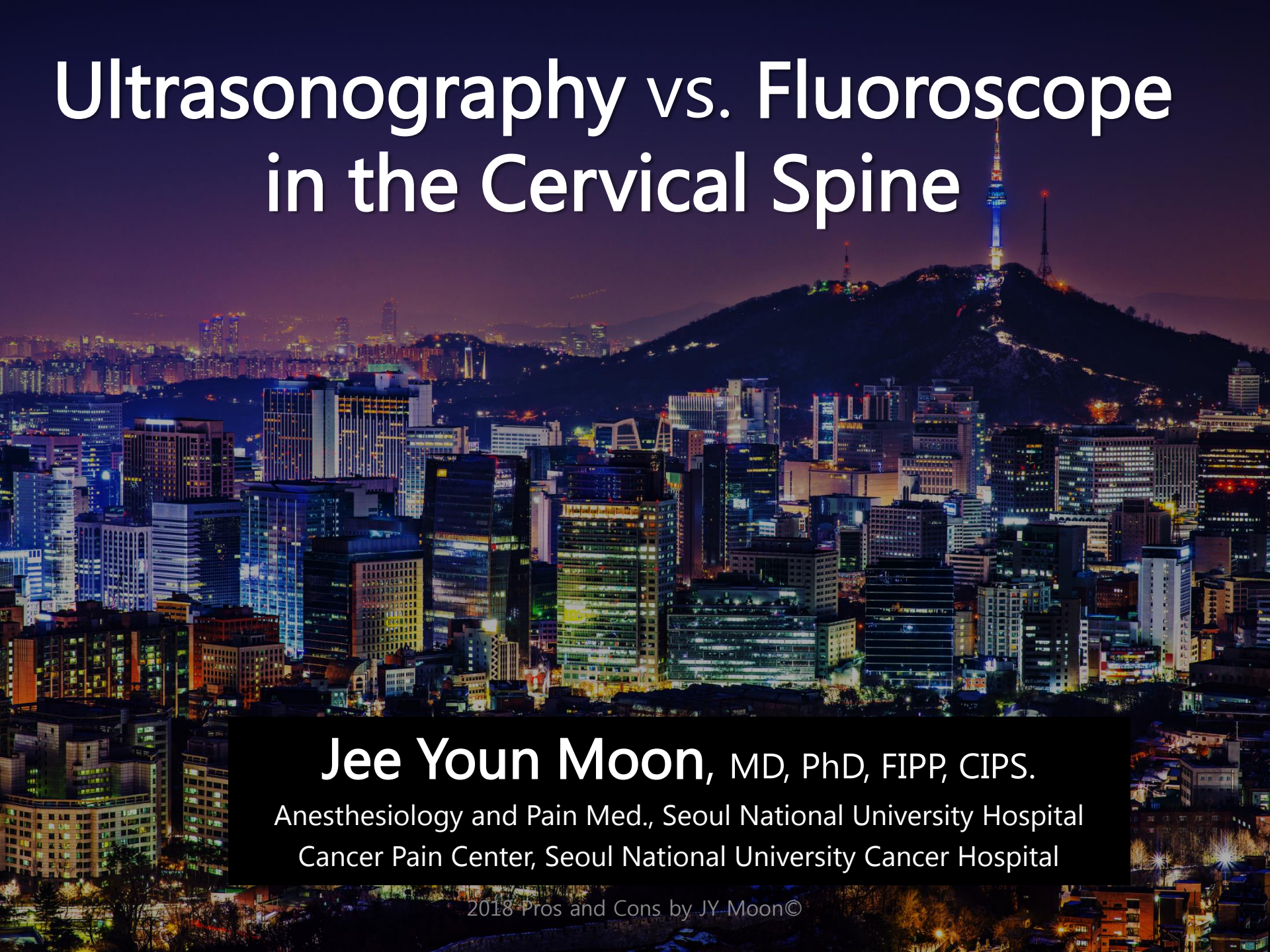
Ultrasonography vs. Fluoroscope in the Cervical Spine



Jee Youn Moon, MD, PhD, FIPP, CIPS.

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Cancer Pain Center, Seoul National University Cancer Hospital

Disclaimer

The contents presented in these slides and in the lecture are the opinions of the speaker and do not necessarily reflect the opinion of any companies or organizations.

Today's Contents

1. Advantages and Limitations of Ultrasound(US)-guided Interventions
2. Categories of US-guided Interventions
3. Pros & Cons of US for interventions in the C-spine

Advantages of US

1) Direct visualization of soft tissue structures
2) No radiation exposure –accumulation of physician exposure to radiation can be significant over time
3) Less expensive with increased portability
4) Real-time dynamic scanning

Limitations of US

1) **Poor penetration** through bone or air

2) Failure to identify **a small blood vessel & nerves**

    1) Due to the limitation of the resolution

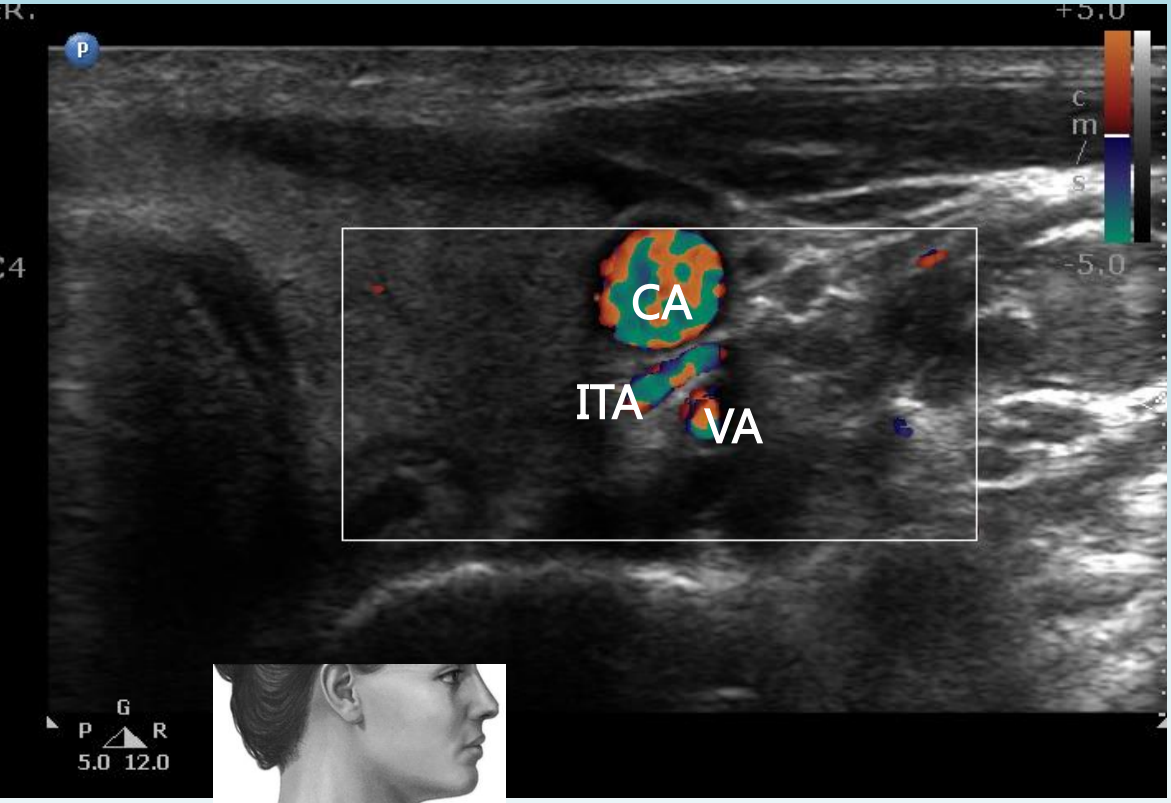
    2) Due to operator's poor skill or inexperience

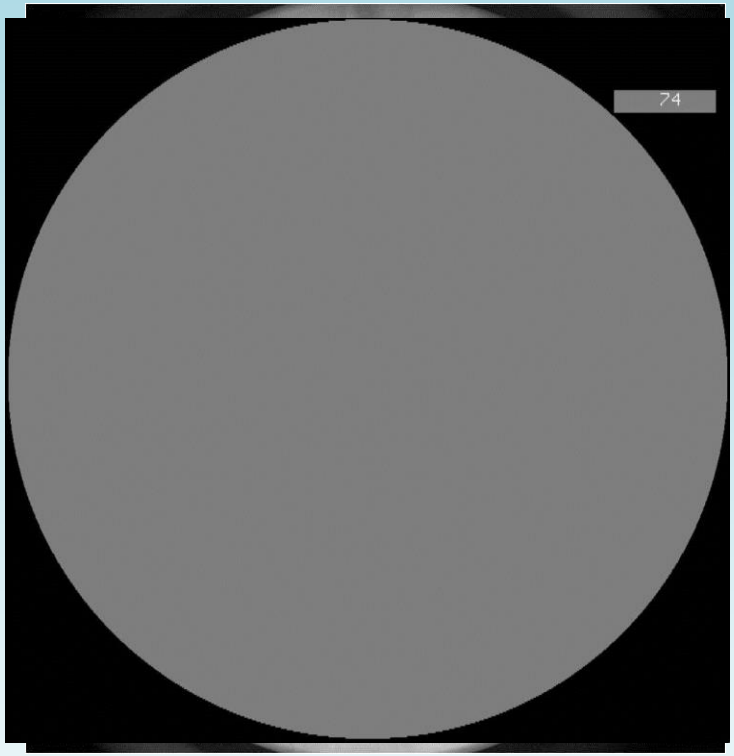
    3) Esp. in obese patients

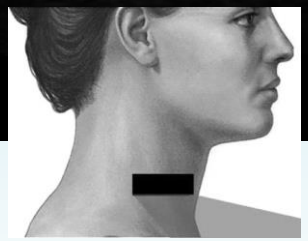
3) Failure to identify **the exact spinal level**

US vs. FL

US avoids, whereas Contrast FL detects IV injection





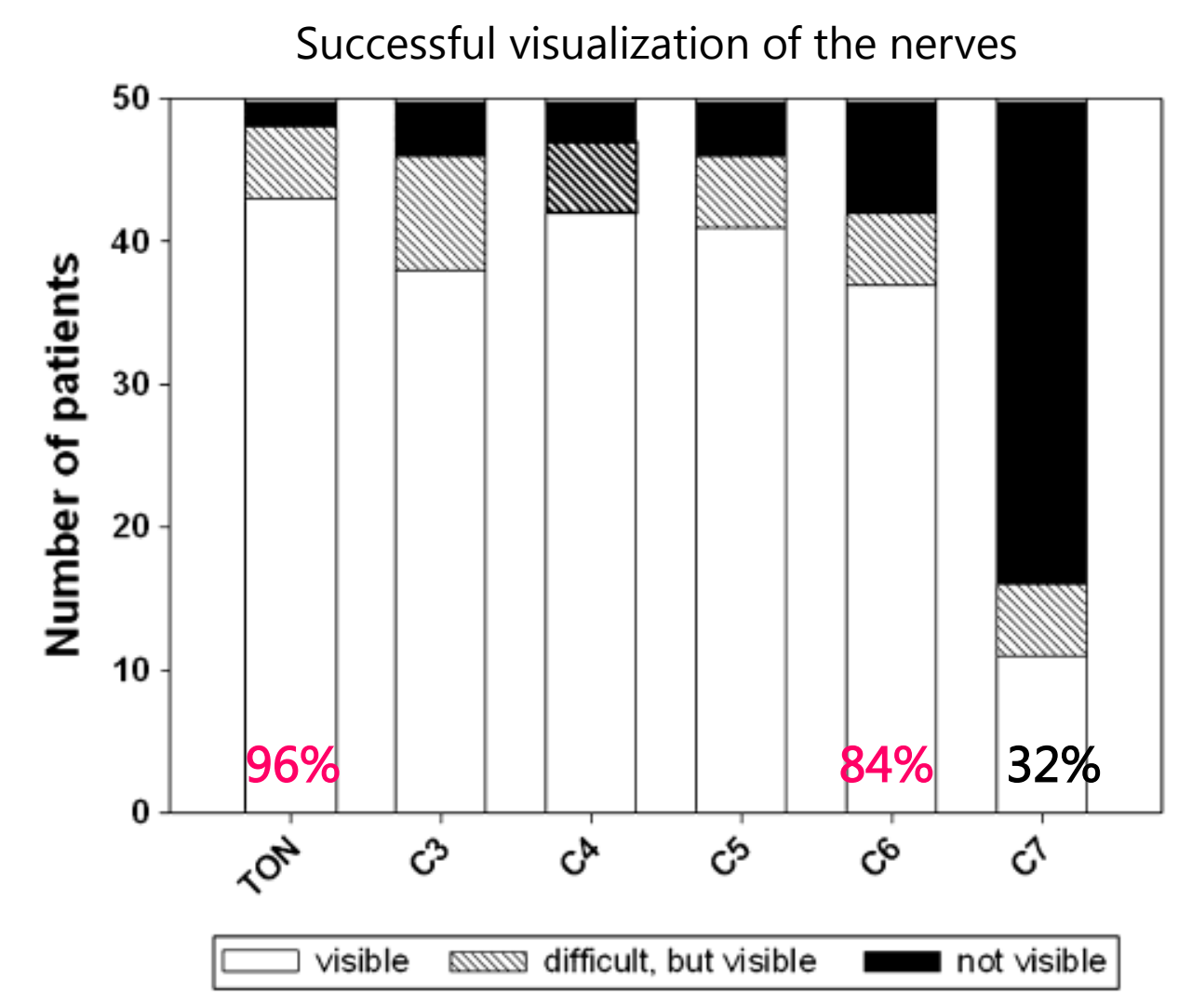


Ultrasound Anatomy of the Nerves Supplying the Cervical Zygapophyseal Joints: An Exploratory Study

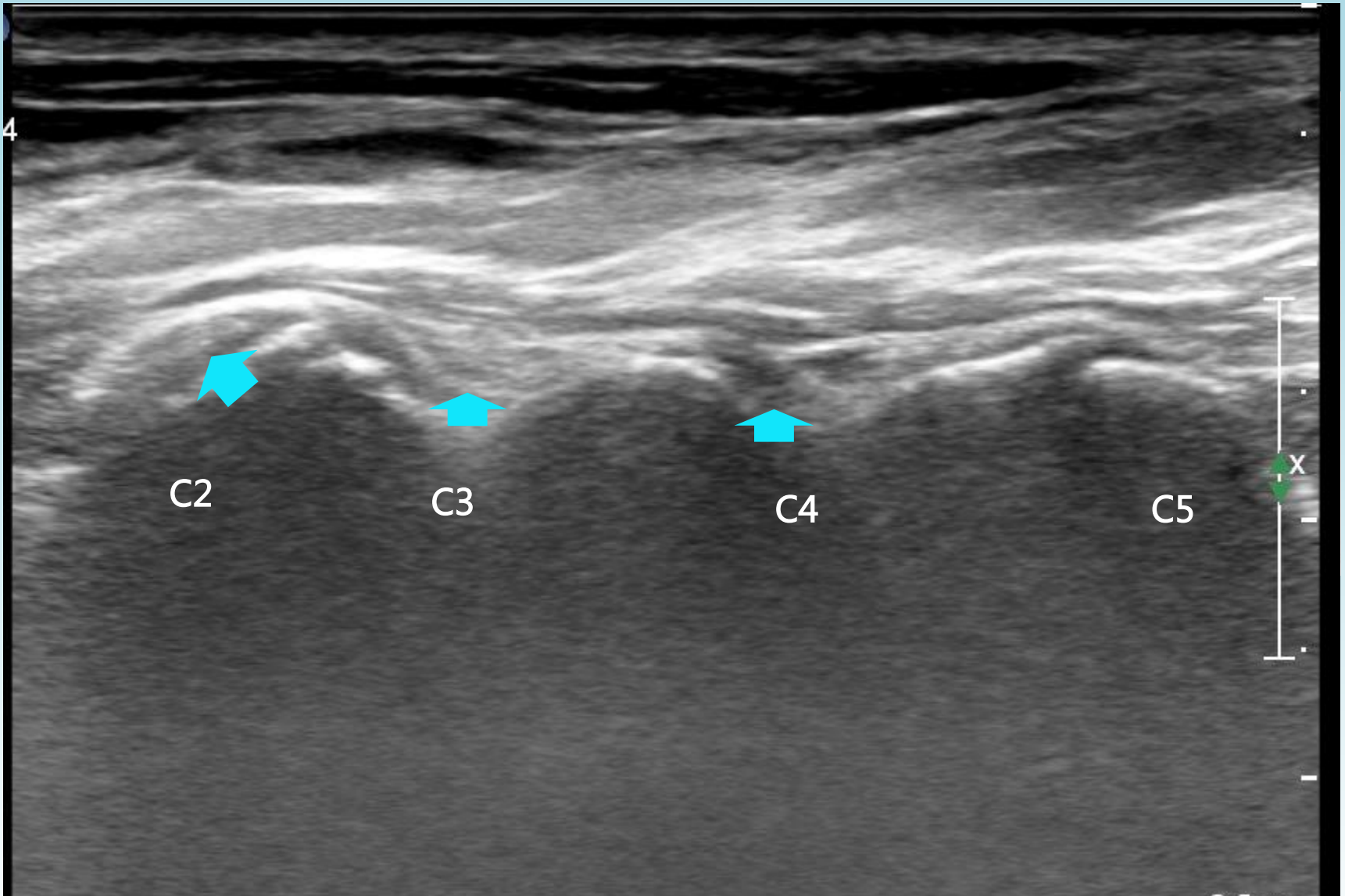
Andreas Siegenthaler, MD, Juerg Schliessbach, MD, Michele Curatolo, MD, PhD, and Urs Eichenberger, MD

N=50 with chronic neck pain

Siegenthaler, et al. Regional Anesthesia and Pain Medicine, 2011;36:606-10



Medial Branch in the upper C-spine



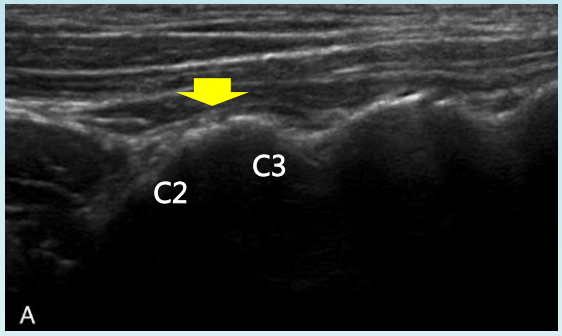
ORIGINAL ARTICLE

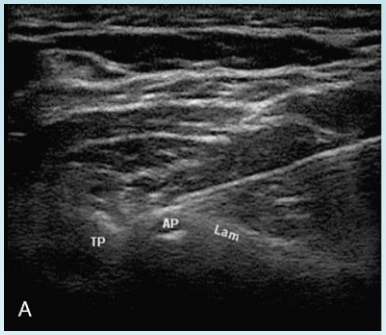
Regional Anesthesia and Pain Medicine • Volume 38, Number 3, May-June 2013

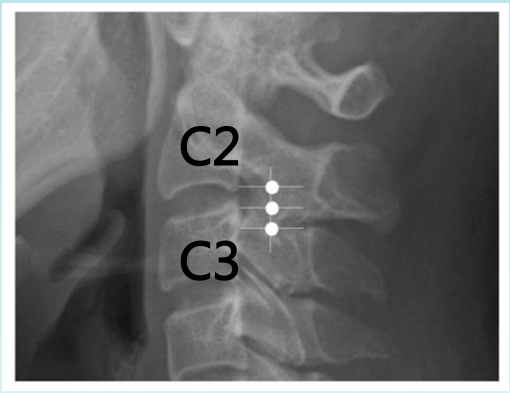
A Randomized Comparison Between Ultrasound- and Fluoroscopy-Guided Third Occipital Nerve Block

Roderick J. Finlayson, MD, FRCPC, John-Paul B. Etheridge, MD, CCFP,* Lucy Vieira, MD, FRCPC,† Gaurav Gupta, MD, FRCPC,* and De Q.H. Tran, MD, FRCPC**

- N=40 undergoing TONB
- Randomization: US *vs.* FS (injection at 3 sites) with 0.9 cc (0.75% BPV + Contrast dye)







- Primary outcome: performance time, US (212s) *vs.* FS (392s) (P < 0.001)
- Secondary outcome: success rate similar (95-100%)

Using ultrasound we need a single injection, whereas FL needs 3 injections

BRIEF TECHNICAL REPORT

(*Reg Anesth Pain Med* 2014;39: 160–163)

A Prospective Validation of Biplanar Ultrasound Imaging for C5-C6 Cervical Medial Branch Blocks

Roderick J. Finlayson, MD, FRCPC, John-Paul B. Etheridge, MD, CCFP,† Worakamol Tiyaprasertkul, MD,* Bill Nelems, MD, FRCPC,† and De Q.H. Tran, MD, FRCPC**

- In the lower C-spine, level determination can be hampered by the increased depth and the smaller contour of the C6 AP(articular pillar)
- **Biplanar US Imaging for C5-C6 MBB**
  - Advance the needle to the target AP in a transverse image
  - Rotate the transducer in a sagittal image to verify the needle position on the correct level

TABLE 2. Phase 1 and Phase 2 Results for Each Block Level

	Phase 1	Phase 2
C2–C3	NA	100%
C3	82%/18%/0	100%
C4	85%/15%/0	97.7%
C5	85%/15%/0	91.4%
C6	67%/33%/0	84.9%

Phase 1: proportion of the needle tips in each of the 3 zones: 1/2/3.
Phase 2: success rate for each level according to the blinded observer.

(*Reg Anesth Pain Med* 2012;37: 219–223)

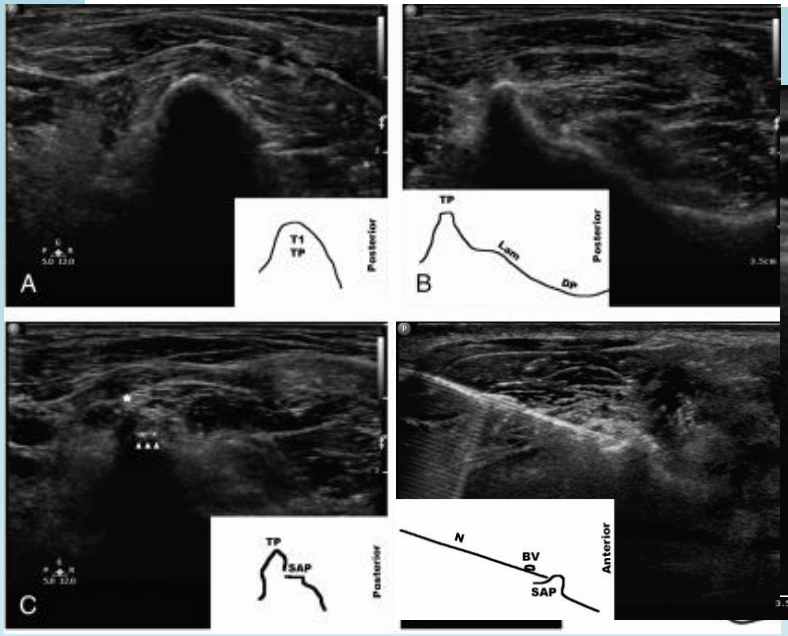
TABLE 2. Results

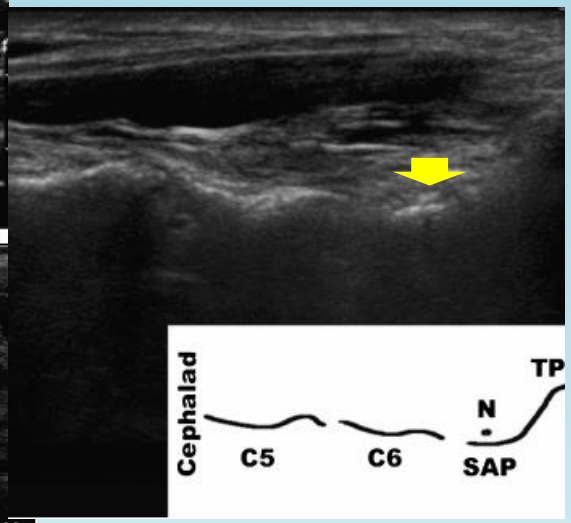
	C5	C6
Successful, %	100	97.5
No. successful blocks	40/40	39/40
No. passes, median (range)	1 (1–2)	2 (1–3)
Blood vessel, %	12.5	30
Postblock pain, median (range)	1 (0–6)	
Postblock reduction in pain (SD), %	76.9 (25.5)	
Performance time (SD), s	248.8 (82.7)	

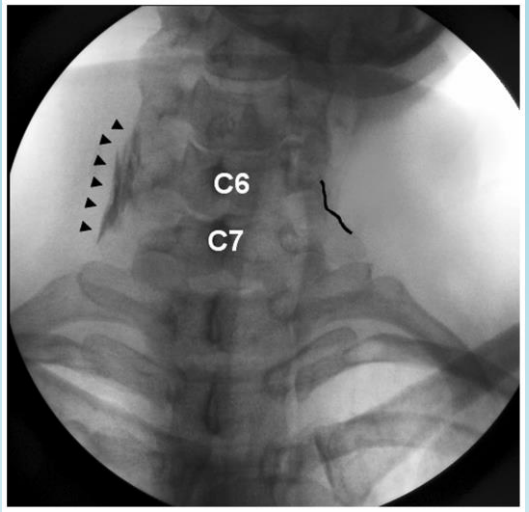
A Randomized Comparison Between Ultrasound- and Fluoroscopy-Guided C7 Medial Branch Block

Roderick J. Finlayson, MD, FRCPC, John-Paul B. Etheridge, MD, CCFP,†‡*
*Worakamol Tiyaprasertkul, MD,§ Bill Nelems, MD, FRCPC,†‡ and De Q.H. Tran, MD, FRCPC**

(*Reg Anesth Pain Med* 2015;40: 52–57)



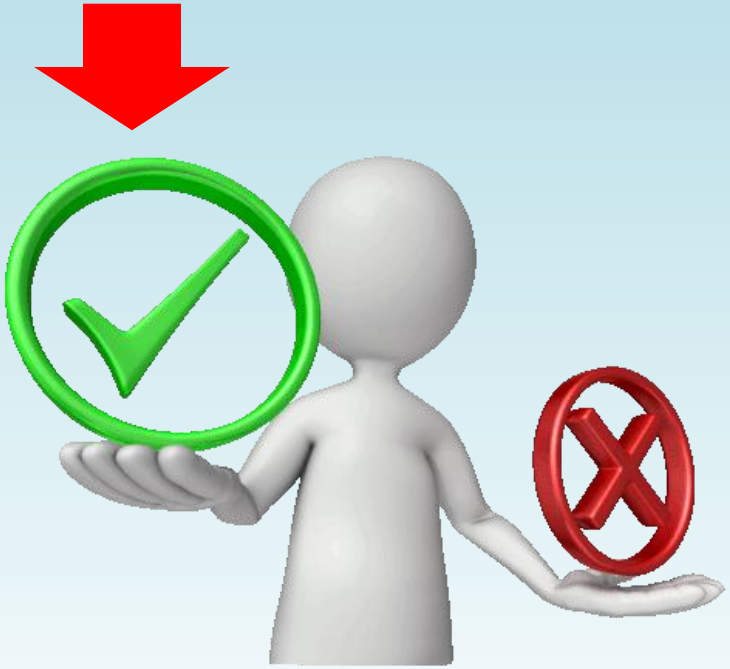




- N = 50 patients undergoing C7-MBB
- Randomization: US using a biplanar (posterolateral) approach *vs.* FS
- Primary outcome: performance time, US (233s) *vs.* FS (390s) ($P < 0.001$)
- Secondary outcome: fewer needle pass in US (2 vs. 4; $P < 0.001$)
- Success rate similar at 1 month in both groups (92-96%)

It must be true that **the cervical spine is a better place** to use US than other spines

Well visualization of target structures regardless of a BMI



Today's Contents

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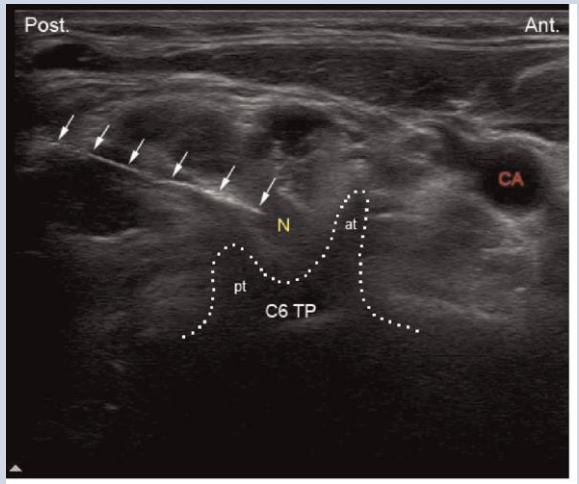
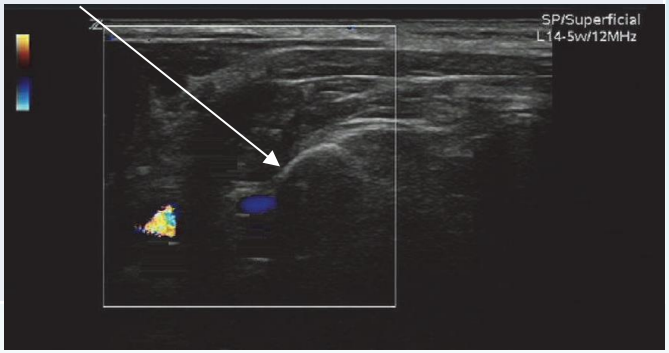
RCTs: FL- *vs.* US-guided Blocks in Pain Medicine.

- *Category 1*: Procedures with the superiority of US-guidance to FL –guidance.
- *Category 2*: Procedures with the non-inferiority of US -guidance over FL –guidance.
- *Category 3*: Procedures showing a feasibility of US with a conjunction of FL.

Category 1: Superiority of US to FL

	Intervention	Results
Finlayson, et al. (2013)	TONB (N = 40)	US with a shorter performance time and fewer needle passes than FS (each P < 0.001). A similar success rate (95-100%). No differences in pre- and post-block pain scores in both groups.
Finlayson, et al. (2015)	C7 MBB (N = 50)	US with a shorter performance time and fewer needle passes than FS guidance (each P < 0.001). A similar success rate (92-96%). No differences in pre- and post-block pain scores in both groups.

Category 2: Non-inferiority of US over FL

	Intervention	Results
Jee, et al. (2013)	C5, C6, C7 Nerve Root block (N = 110)	Using US- or FS-guided ESIs for cervical RP, HIVD or FS, Significant improvements in function and pain <u>in both groups</u> 
Wan, et al. (2017)	Deep Cervical Plexus Block (N = 56)	<u>A similar reduction</u> of the NRS pain score for 24w (< 0.05 in both groups) without differences between U & F groups.  

Category 2: Non-inferiority of US over FL

	Intervention	Results
Ha, et al. (2010)	**Lumbar FJB from L2/L3 to L5/S1** (N = 26)	No difference in performance time. The VAS score and ODI was improved for 6 months in both groups.
Yun, et al. (2012)	**Lumbar FJB at L4/5 and L5/S1** (N = 57)	Significant improvement in pain and functional disability in both groups for 3 months. A preparatory time was longer in the US group (P = 0.023).
Bellingham, et al. (2012)	**Pudendal nerve block (N = 23)**	**differences in the degree of sensory block between US- or FS groups. *Performance time* was longer using US (P < 0.0001).**
Fowler, et al. (2014)	**Piriformis injection (N = 28)**	No differences in NRS pain scores, patient satisfaction, procedure time, a number of needling, and most functional outcomes between US-guided and FS-guided blocks.
Soneji, et al. (2016)	**SI Joint Injection (N = 40)**	No significant differences in NRS pain scores at 1 month, procedure-related variables, physical functioning, discomfort, opioid utilization, and patient satisfaction between US and FS groups. *Performance time* was longer using US (p < 0.01).

Category 3: feasibility (+) of US with FL

	Intervention	Results
Park, et al. (2013)	Caudal ESI (N = 120; verified by FS)	Using the color Doppler US, 97% successful rate with US. The needle repositioning in 13.3% in FS and 15% in US. The NRS and ODI improved 2 and 12 weeks in both groups.
Evansa, et al. (2015)	Lumbar ESI (N = 112; verified by FS)	No significant differences between US and FS in procedure time, number of needle insertion attempts or passes, and NRS pain scores and disability scores for 3-months.
Yang, et al. (2016)	Lumbar TFESI at L3/4 and L4/5 levels (N = 80; verified by FS)	Success rate with US: 85%. The operation time in the US group was shorter ($P < 0.05$) and the radiation dosage (2640 μGym^2) in US. No differences in pain relief or complication

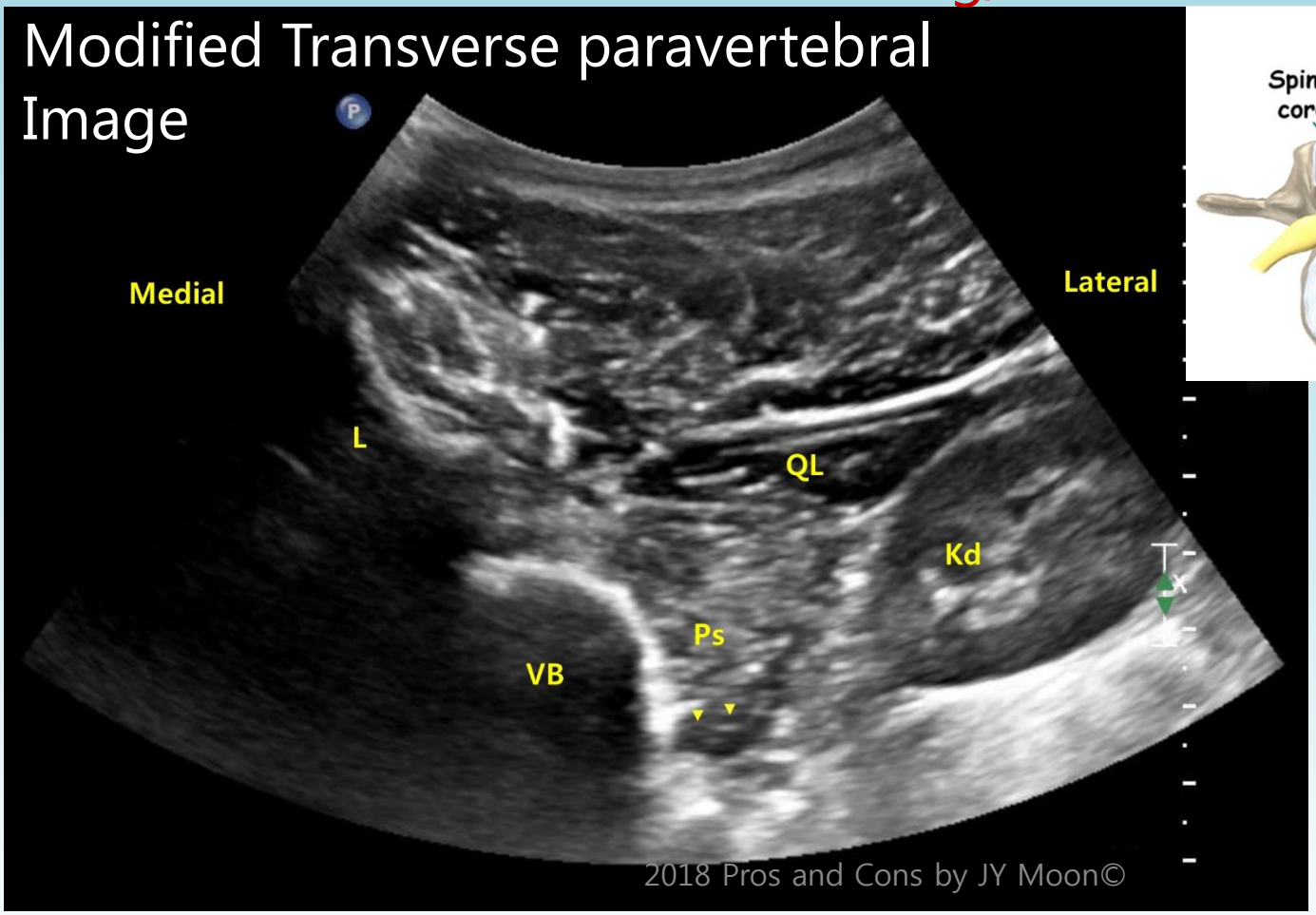
Ultrasound-Assisted Versus Fluoroscopic-Guided Lumbar Sympathetic Ganglion Block: A Prospective and Randomized Study

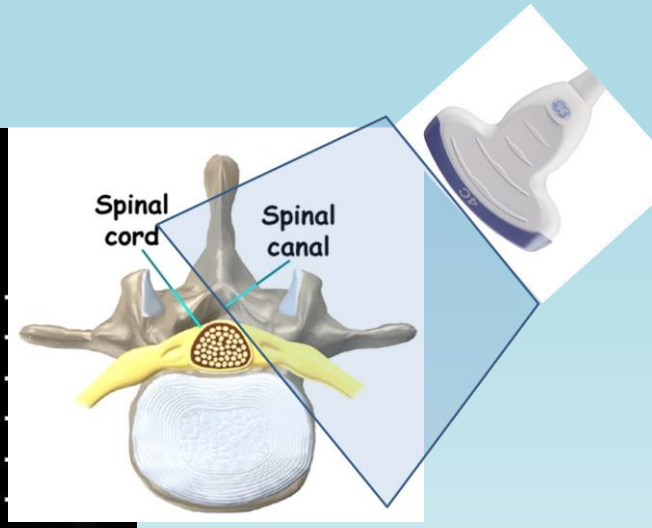
Jung-Hee Ryu, MD, PhD,*† Chang Soon Lee, MD,‡ Yong-Chul Kim, MD, PhD,*‡
Sang Chul Lee, MD, PhD,*‡ Hariharan Shankar, MD, PhD,§ and Jee Youn Moon, MD, PhD‡||

Anesthesia & Analgesia
Accepted for publication September 13, 20

Exclusion: Patients with BMI ≥ 30 kg/m^2

Modified Transverse paravertebral Image





In our study

- Total procedure time and success rate were not different.
- Imaging time of US group was longer (P=0.012).
- Bone-touching during the procedure was less frequent in US group (P=0.001).
- Radiation exposure was significantly lower in the US group (P < 0.001).

- US-assisted LSGB appears to be a feasible method with the added benefit of lower radiation exposure.
- However, we did not find an advantage of US-assisted LSGB over FL-guided LSGB in terms of performance time.

Pain Management Center at SNUH

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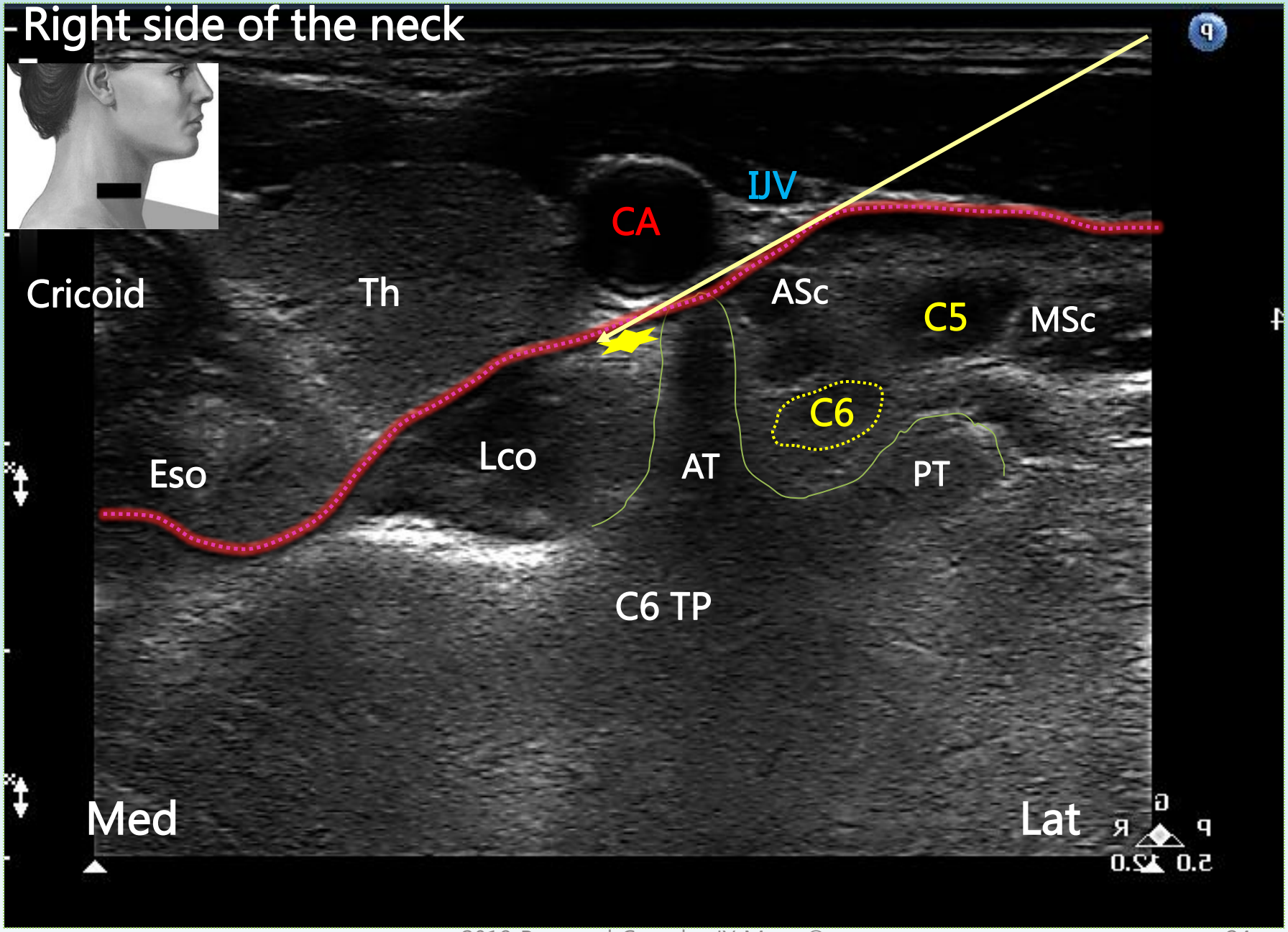
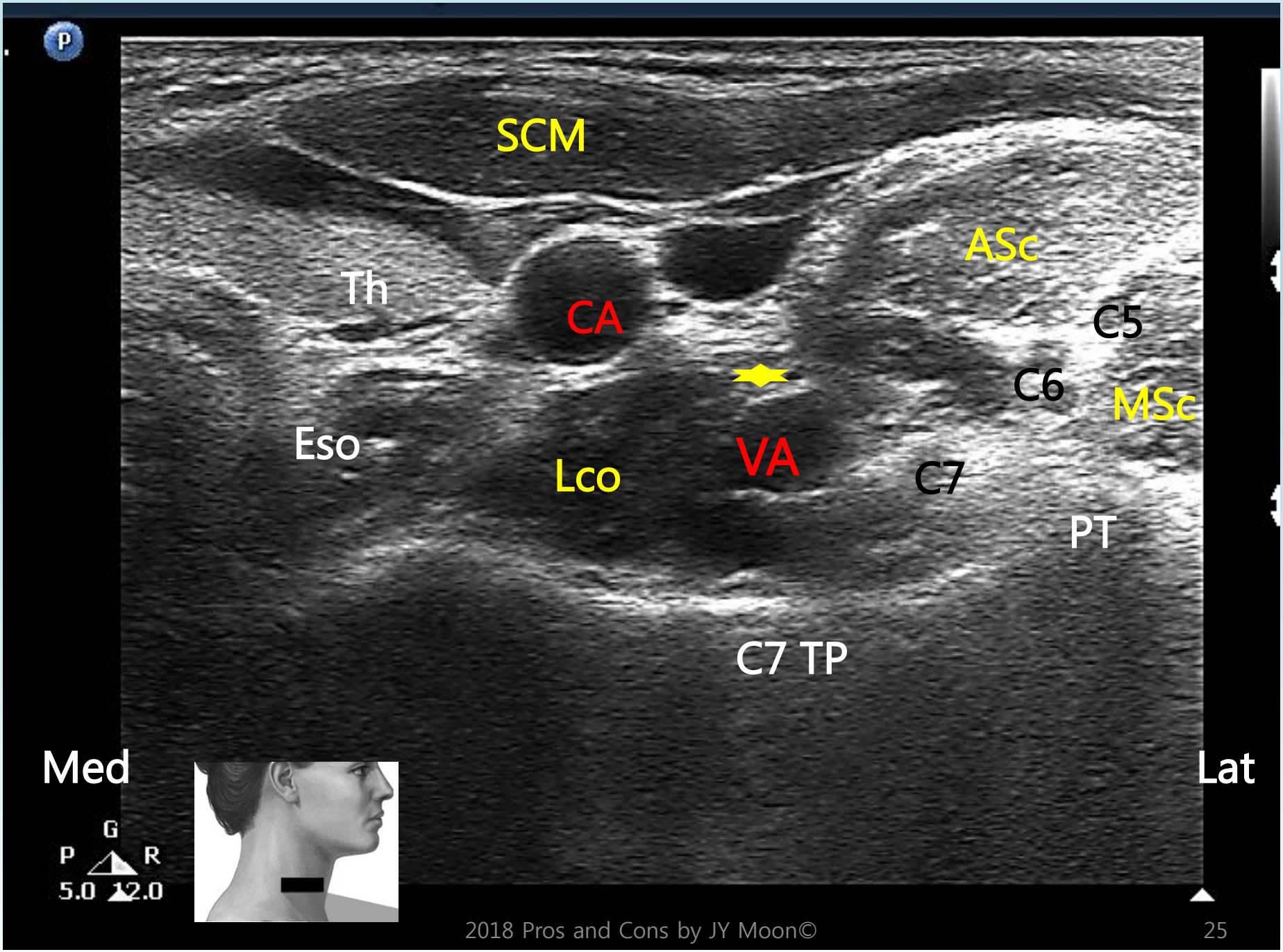
Stellate Ganglion Block (SGB) & Atlantoaxial (AA) Joint Block

Right side of the neck

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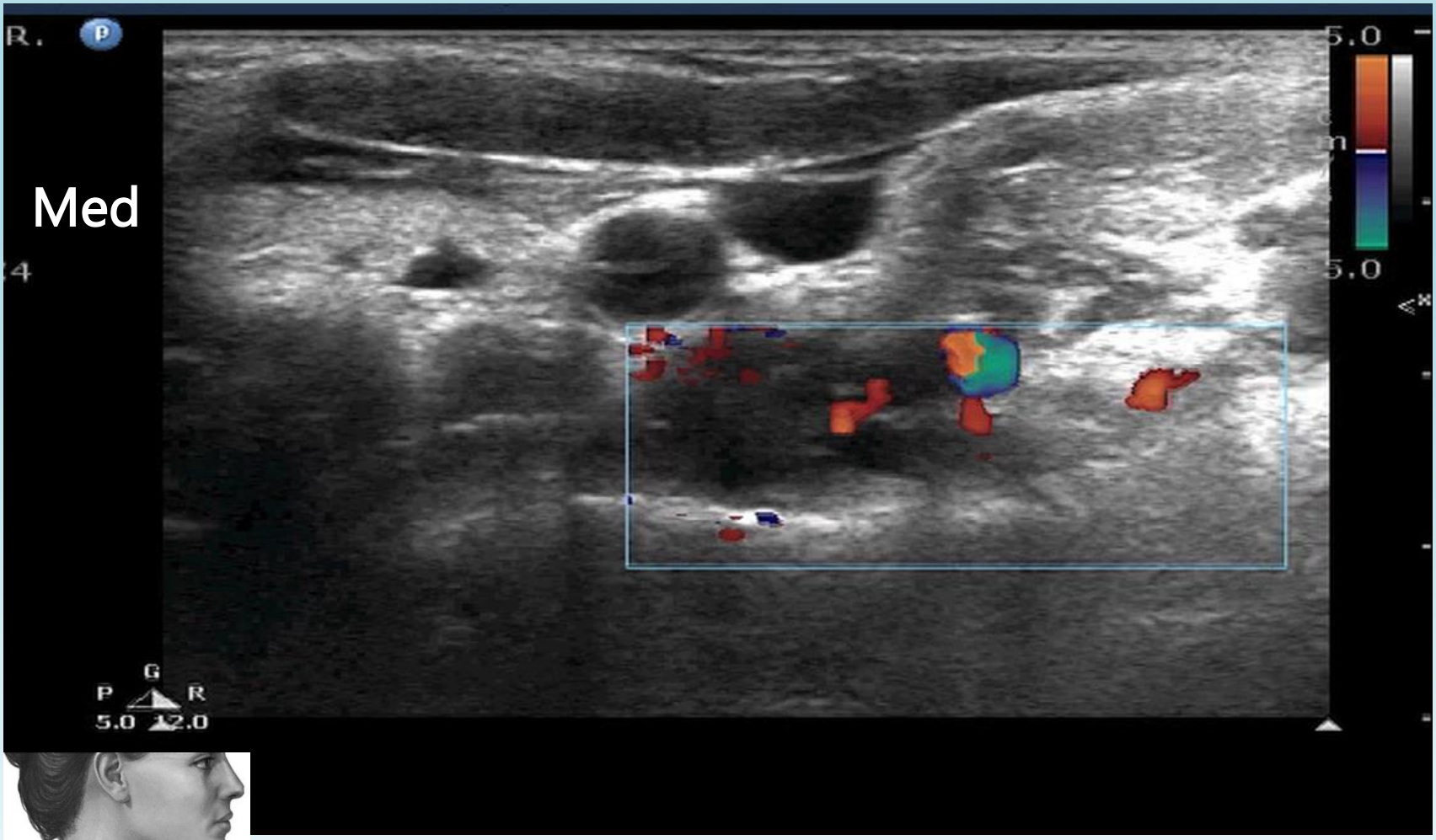
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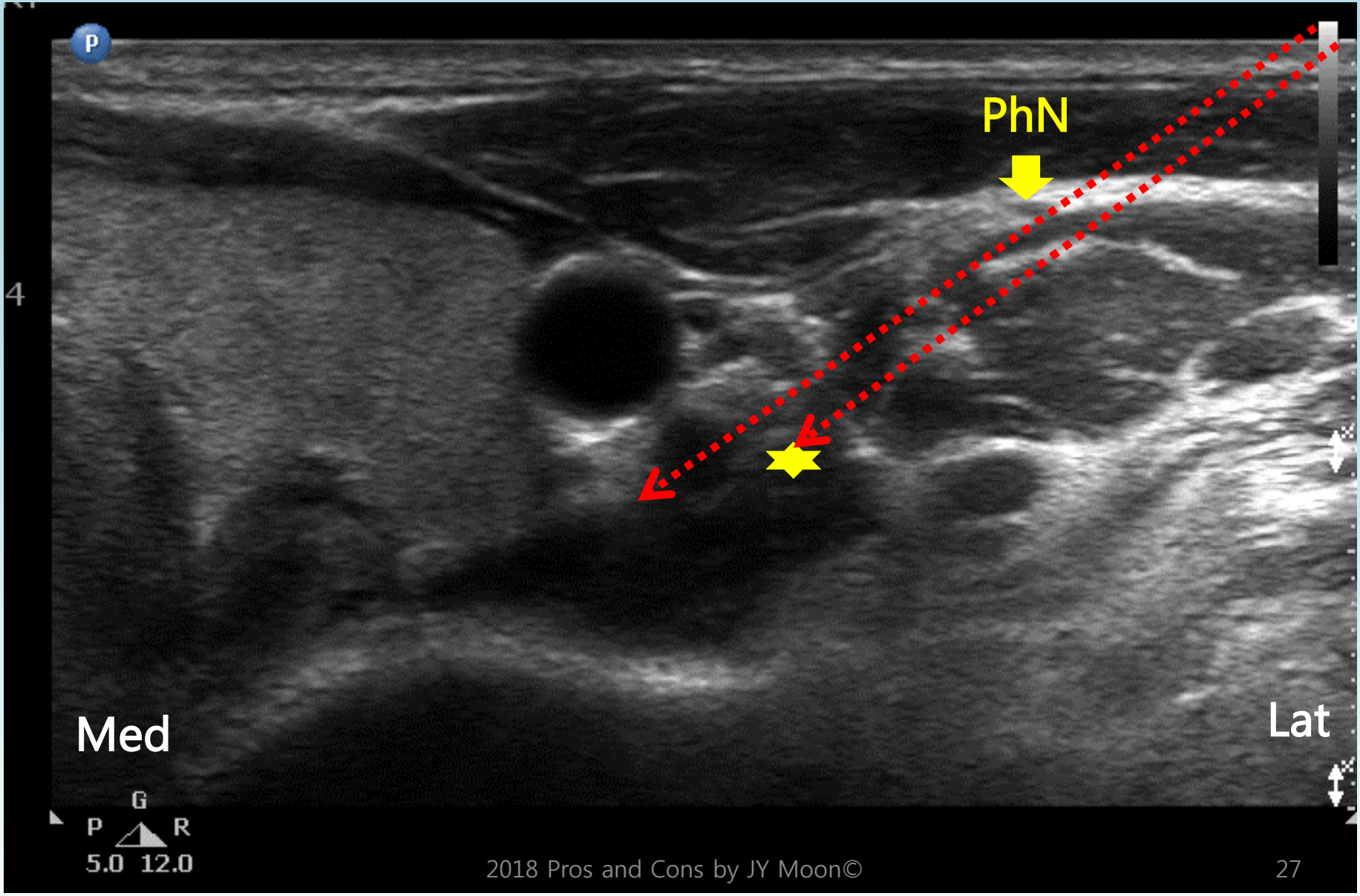
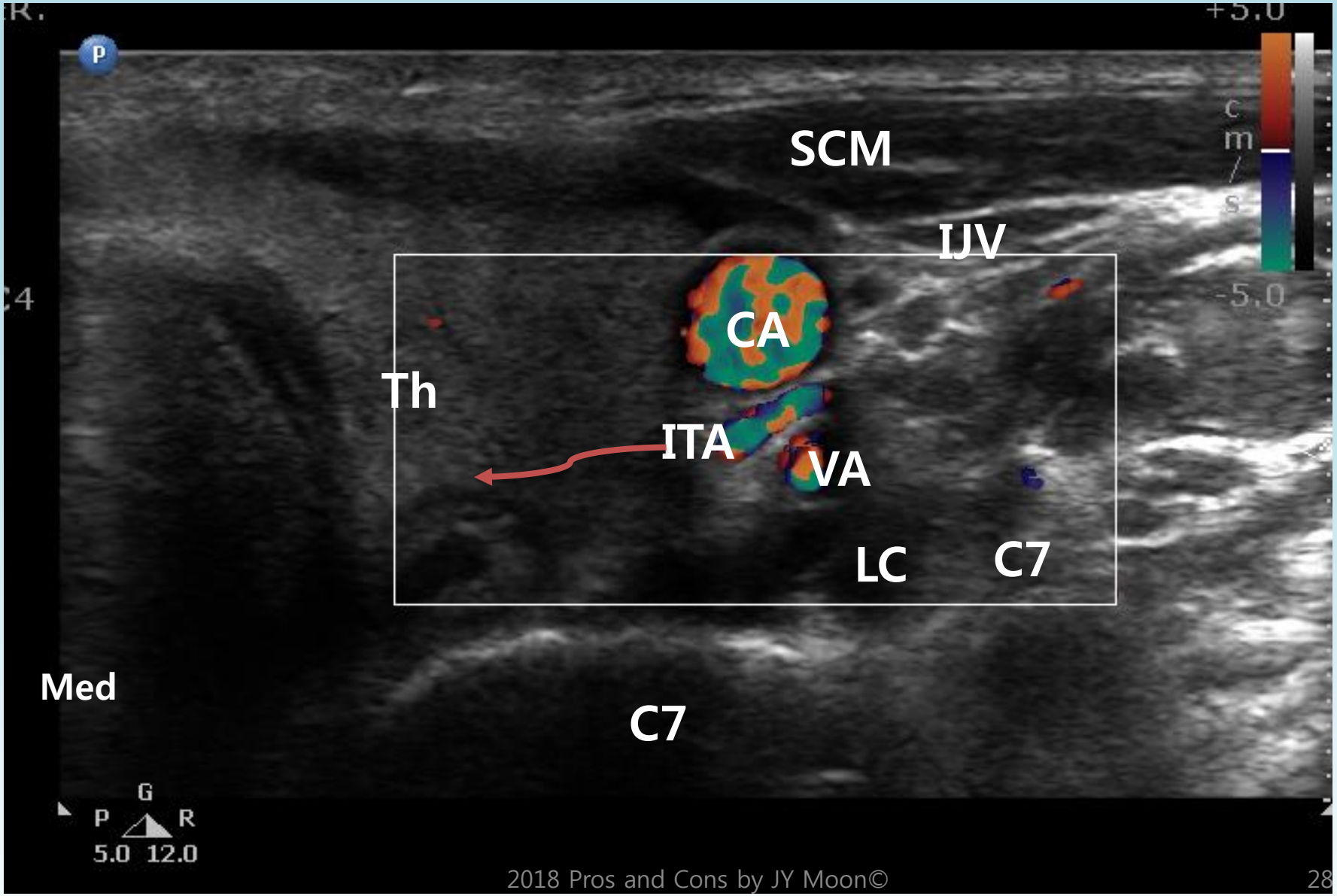
Where is the Phrenic Nerve?

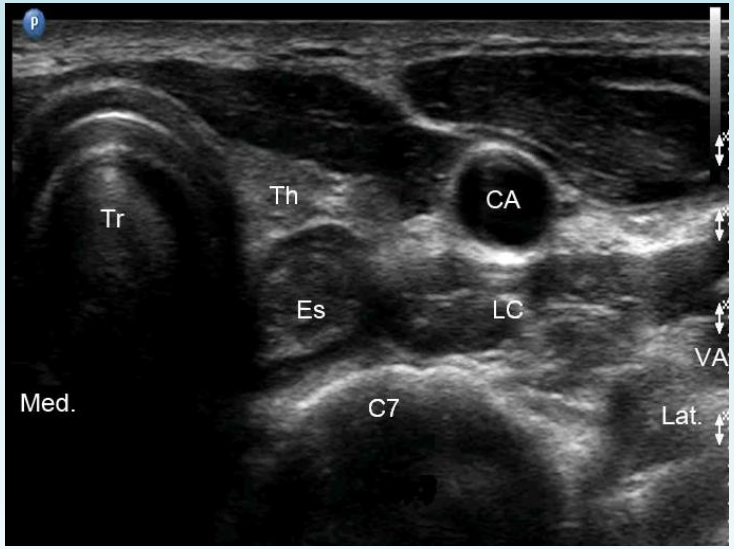


Inferior Thyroidal Artery



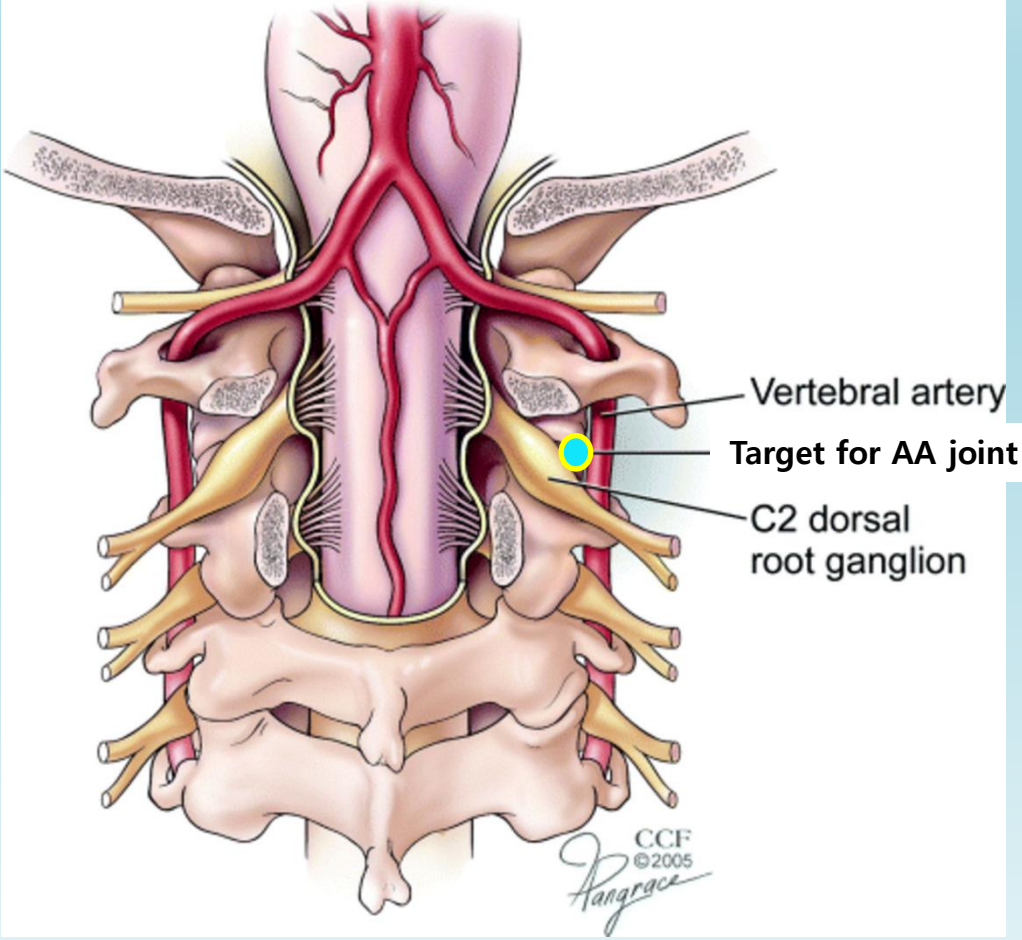
Fluoroscope vs. Ultrasound

1. **Vertebral artery** is exposed at the level of C6 in 6-10% of the population.
2. **The inferior thyroid vessels** may be a major source of a retropharyngeal hematoma.
3. Ultrasound imaging can also identify **the esophagus**, especially on the left side.
4. Others



Ultrasound !!!

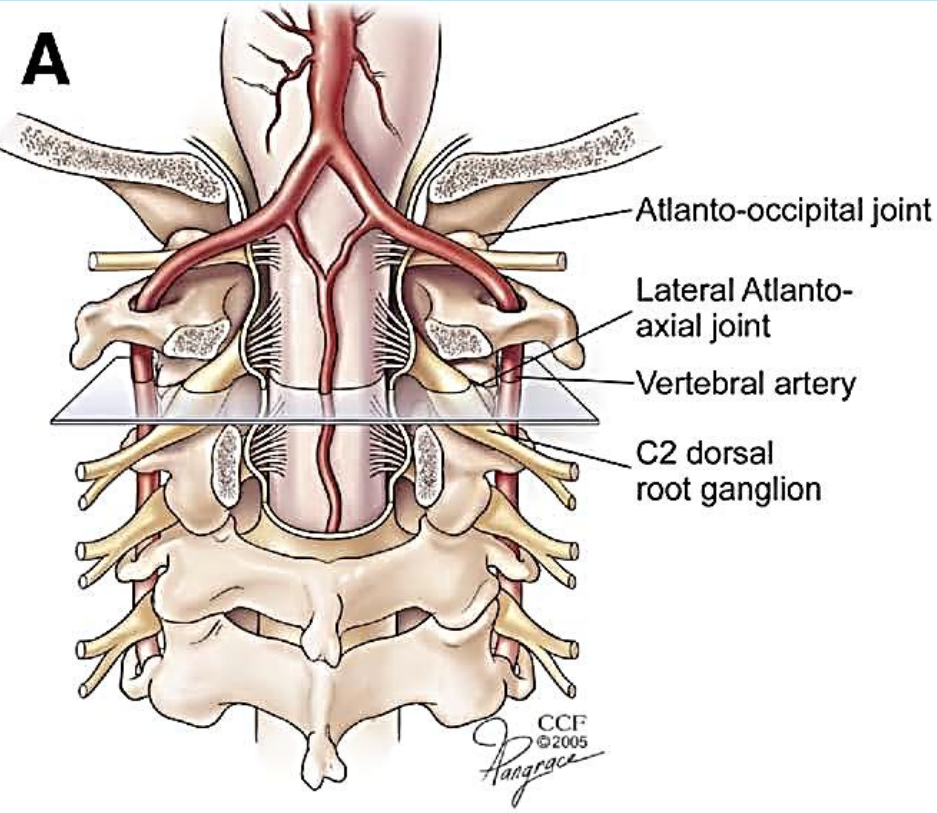
Lateral Atlantoaxial Joint Block

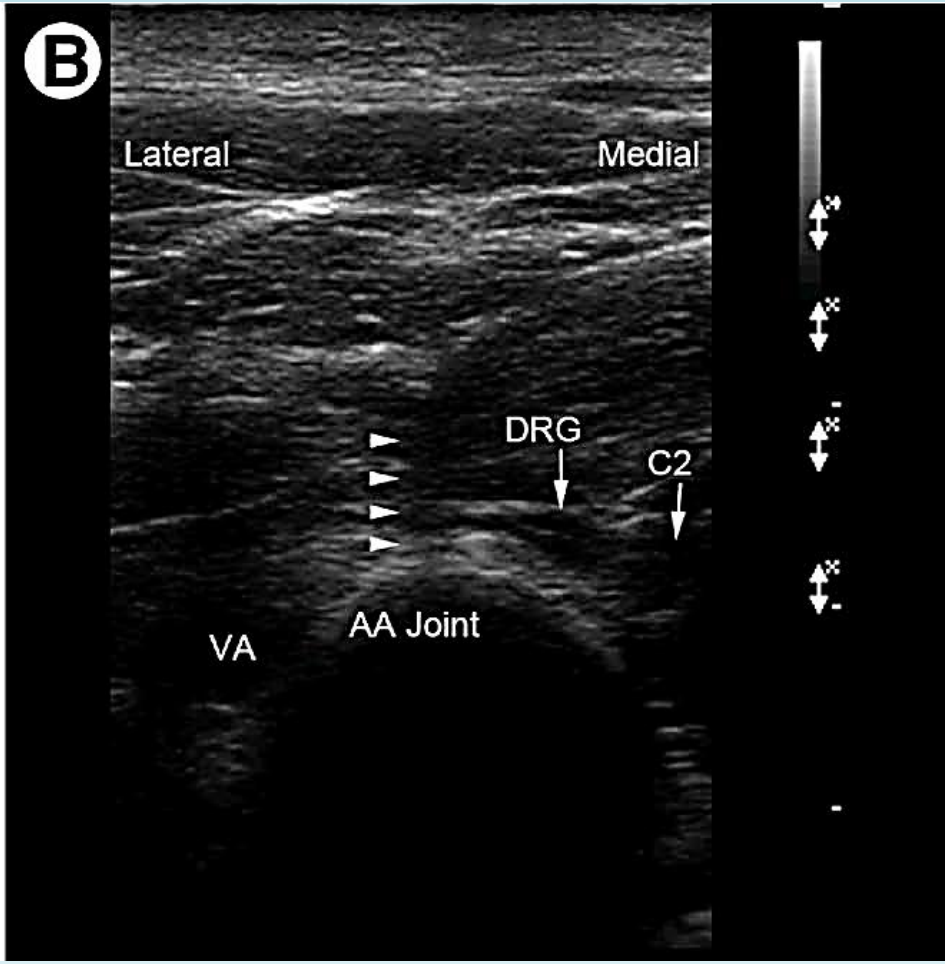


The Longitudinal Effectiveness of Lateral Atlantoaxial Intra-articular Steroid Injection in the Treatment of Cervicogenic Headache

Pain Med. 2007;8(2):184-188.

Samer N. Narouze, MD, MSc,* Jose Casanova, MD, PhD,† and Nagy Mekhail, MD, PhD*

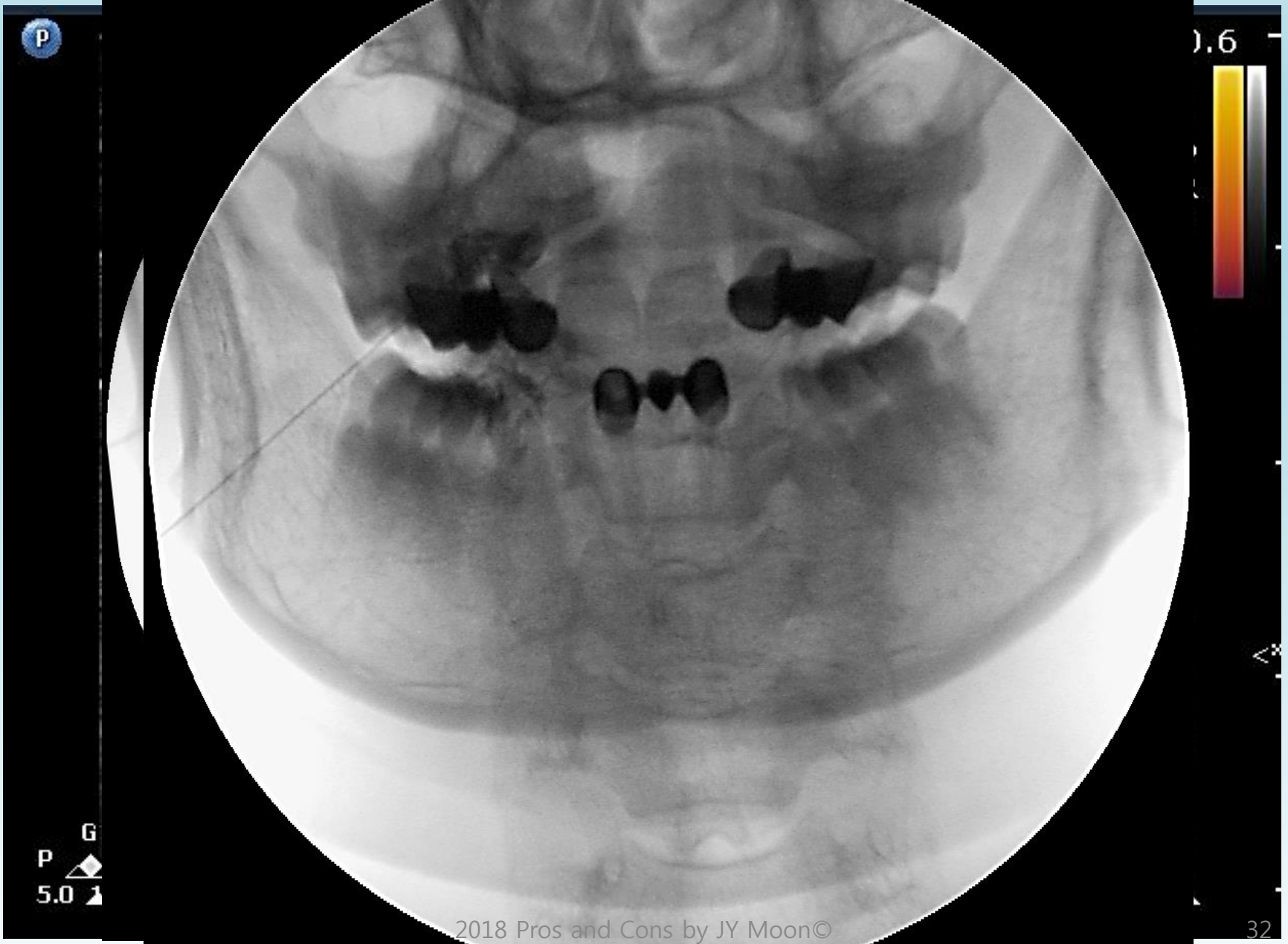




- VA: lateral to the AAJ
- C2 DRG & Root: the posterior aspect of the middle of the joint
- Advancing a 22-gauge blunt-tip needle using an **out-of-plane approach**

Ultrasonography in pain medicine: Future directions

Samer Narouze, MD, MSc RAPM (2009) 13, 198-202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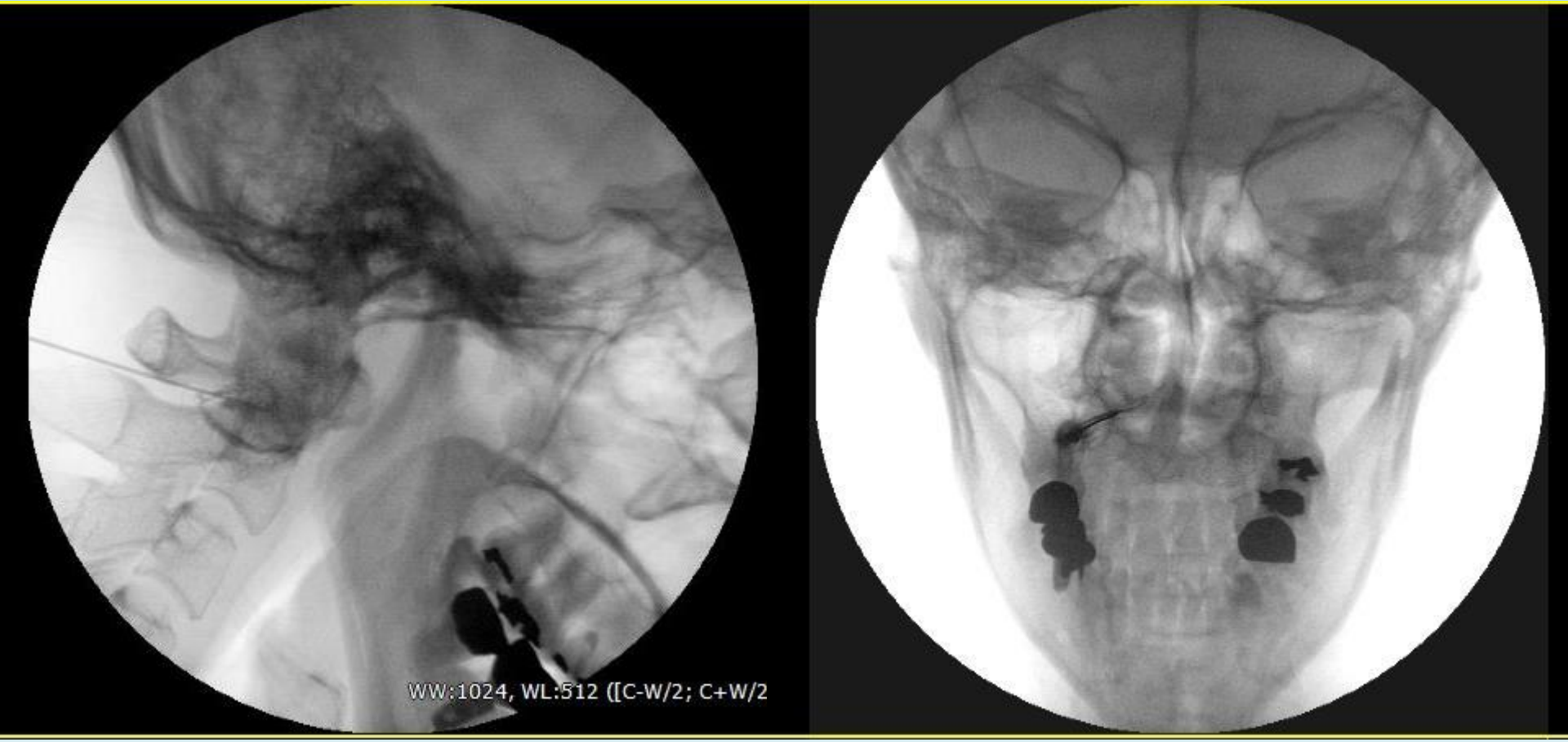
Fluoroscope-guided AA Joint Block



	FL-guided AA block	US-guided AA block
Procedure time	< 5 min	> 10 min
Intraarticular injection	Yes	No

Conclusion

- US guidance may match or improve performance- and safety-related outcomes in the cervical spine.

PROS	CONS
Stellate Ganglion Block	Atlantoaxial Joint Block
Third Occipital Nerve Block	Cervical Interlaminar Injection?
Cervical Medial Branch Block	Discography?
Cervical Facet joint block	
Cervical Nerve Root Block	

- However, US neither detects nor prevents IV injection. If our target structures are located deeply or beneath bony shadow, we still need FL guidance.

Thank you

Is there anything worse than being blind?

Yes, a man with sight and no vision

- Helen Keller