

# Central Venous Access for Neurosurgery: PRO Subclavian Vein (SCV), CON Internal Jugular Vein (IJV)



Ashley Fejleh, DO  
Assistant Professor  
Division of Neuroanesthesiology  
UC San Diego Health  
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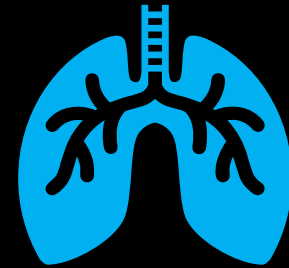
# Obvious Pros of Subclavian Vein (SCV) Central Line



- Low CLABSI risk<sup>1</sup>
- CDC preferred site<sup>3</sup>
- Best for pt requiring line >5 days, ie. aSAH



- Lower CRT risk<sup>1</sup>
- Easier cannulation in hypovolemic patients (clavipectoral fascia)
- Fewer arterial punctures<sup>12</sup>



- No sig diff in mechanical complications compared to IJ <sup>1,6</sup>
- PTX risk drops with US use and experience<sup>5,6</sup>

[Review](#) > [Crit Care Med.](#) 2017 Apr;45(4):e437-e448. doi: 10.1097/CCM.0000000000002092.

## Cumulative Evidence of Randomized Controlled and Observational Studies on Catheter-Related Infection Risk of Central Venous Catheter Insertion Site in ICU Patients: A Pairwise and Network Meta-Analysis

Koustoula Arvaniti <sup>1</sup>, Dimitrios Lathyris, Stijn Blot, Fani Apostolidou-Kiouti, Despoina Koulenti, Anna-Bettina Haidich

Affiliations + expand

PMID: 27632678 DOI: [10.1097/CCM.0000000000002092](#)

[Randomized Controlled Trial](#) > [N Engl J Med.](#) 2015 Sep 24;373(13):1220-9.

doi: [10.1056/NEJMoa1500964](#).

## Intravascular Complications of Central Venous Catheterization by Insertion Site

Jean-Jacques Parienti <sup>1</sup>, Nicolas Mongardon, Bruno Mégarbane, Jean-Paul Mira, Pierre Kalfon, Antoine Gros, Sophie Marqué, Marie Thuong, Véronique Pottier, Michel Ramakers, Benoît Savary, Amélie Seguin, Xavier Valette, Nicolas Terzi, Bertrand Sauneuf, Vincent Cattoir, Leonard A Mermel, Damien du Cheyron; 3SITES Study Group

Collaborators, Affiliations + expand

PMID: 26398070 DOI: [10.1056/NEJMoa1500964](#)

[Meta-Analysis](#) > [Crit Care Med.](#) 2012 May;40(5):1627-34.

doi: [10.1097/CCM.0b013e31823e99cb](#).

## Meta-analysis of subclavian insertion and nontunneled central venous catheter-associated infection risk reduction in critically ill adults

Jean-Jacques Parienti <sup>1</sup>, Damien du Cheyron, Jean-François Timsit, Ousmane Traoré, Pierre Kalfon, Olivier Mimoz, Leonard A Mermel

Affiliations + expand

PMID: 22511140 DOI: [10.1097/CCM.0b013e31823e99cb](#)

## Infection Control

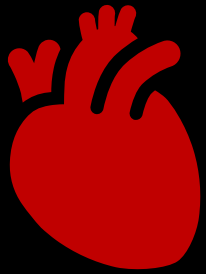
# Summary of Recommendations

Guidelines for the Prevention of Intravascular Catheter-Related Infections (2011)

### \* 2.2. Central venous catheters

1. Weigh the risks and benefits of placing a central venous device at a recommended site to reduce infectious complications against the risk for mechanical complications (e.g., pneumothorax, subclavian artery puncture, subclavian vein laceration, subclavian vein stenosis, hemothorax, thrombosis, air embolism, and catheter misplacement) [37–53]. **Category IA**
2. Avoid using the femoral vein for central venous access in adult patients [38, 50, 51, 54].  
**Category IA**
3. Use a subclavian site, rather than a jugular or a femoral site, in adult patients to minimize infection risk for nontunneled CVC placement [50–52]. **Category IB**
4. No recommendation can be made for a preferred site of insertion to minimize infection risk for a tunneled CVC. **Unresolved issue**

# Obvious Pros of Subclavian Vein (SCV) Central Line



- Anatomically favorable for cardiac access
- I.e. Multi orifice air aspiration catheters
- Low catheter malposition rate with experienced operators



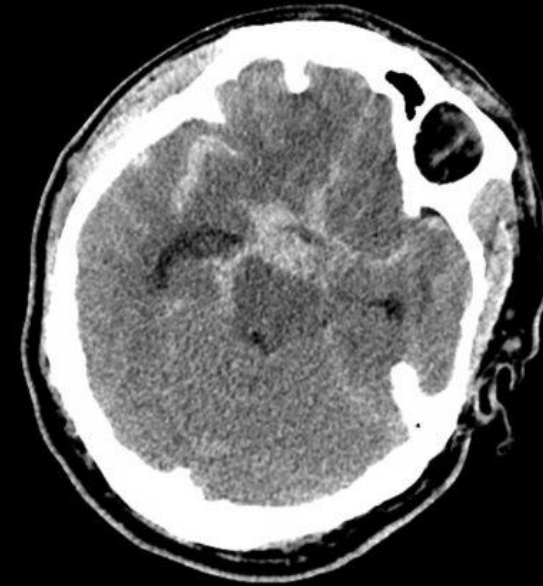
- Patient comfort and tolerance



- No impairment of cerebral venous drainage

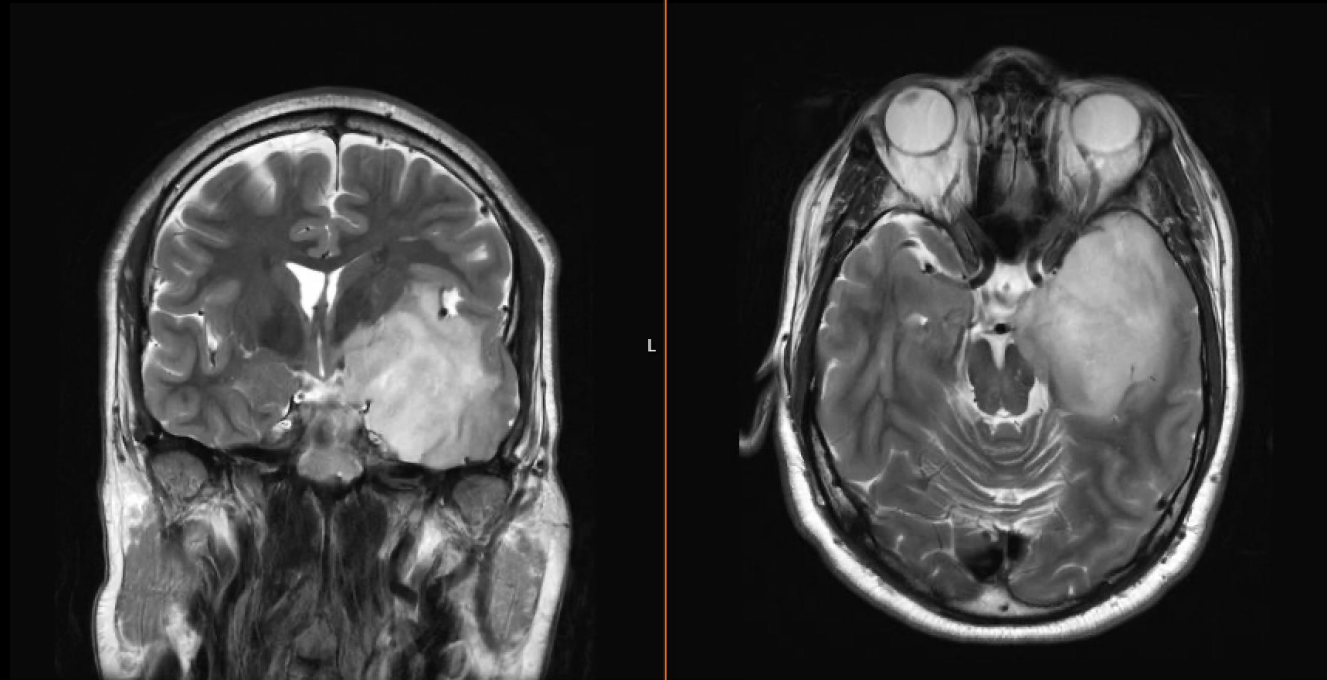
# Neurosurgical procedures requiring CVC

- Cerebrovascular
  - iAVM
  - Open aneurysm clipping
  - Direct/indirect bypass
- Suboccipital craniectomy in sitting position for VAE aspiration
- Vascular tumor
  - Non embolized meningioma
  - Glomus tumor
- TBI (intracranial hematomas)



# Neurosurgical procedures requiring CVC

- Large intracerebral tumors
- Complex spine surgeries
- Patients requiring long term vasoactive infusions or hypertonic saline
- Difficult peripheral iv access



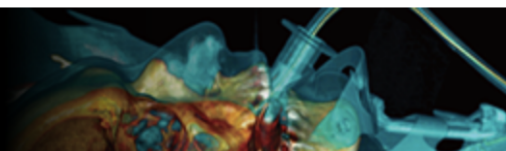


# An important theoretical CON for IJV

- Little and weak data support showing no significant impairment in venous drainage from IJ catheterization
- No studies looking at patients in final surgical position
- *However*, neck rotation and flexion in mayfield still *may* cause elevations in ICP, esp significant for someone with already elevated ICP



Schulman, et al., NEJM 2018



[Crit Care Res Pract.](#) 2012; 2012: 685481.

Published online 2012 May 17. doi: [10.1155/2012/685481](https://doi.org/10.1155/2012/685481)

PMCID: PMC3363165

PMID: [22675621](https://pubmed.ncbi.nlm.nih.gov/22675621/)

## An Ultrasound Study of Cerebral Venous Drainage after Internal Jugular Vein Catheterization

[Davide Vailati](#), \* [Massimo Lamperti](#), [Matteo Subert](#), and [Alberto Sommariva](#)

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- Vailati, et al., 2012
- Observational prospective study
- IJV US diameter pre and post cannulation
- N=50
- Elective neurosurgery
- Supine and head tilt 30 degrees
- Concludes IJV line does not sig impair jugular venous flow and indirectly cerebral venous return

- Woda, et al., 1996
- Prospective
- N=11
- NSICU pts requiring ICP monitor
- No sig diff in ICP with IJV CVC

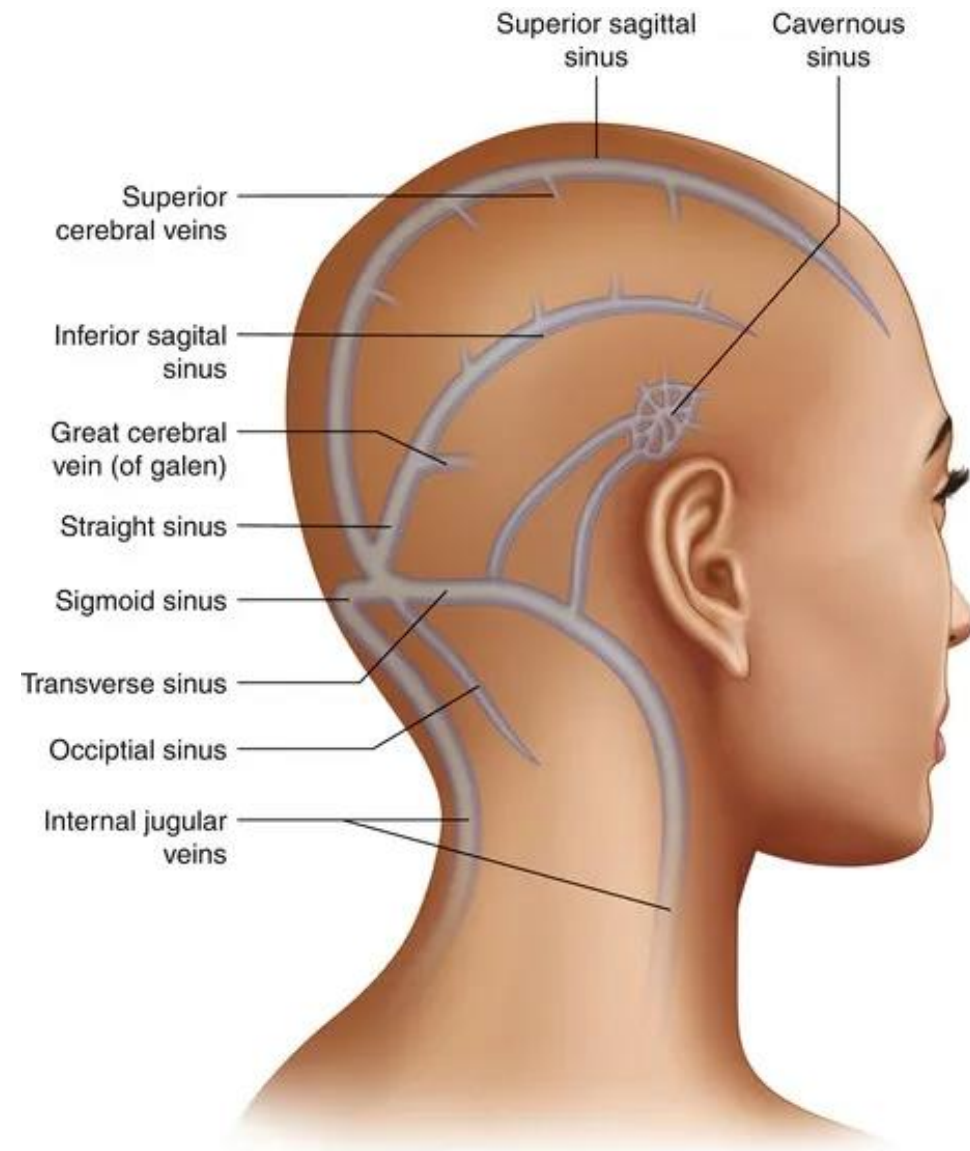
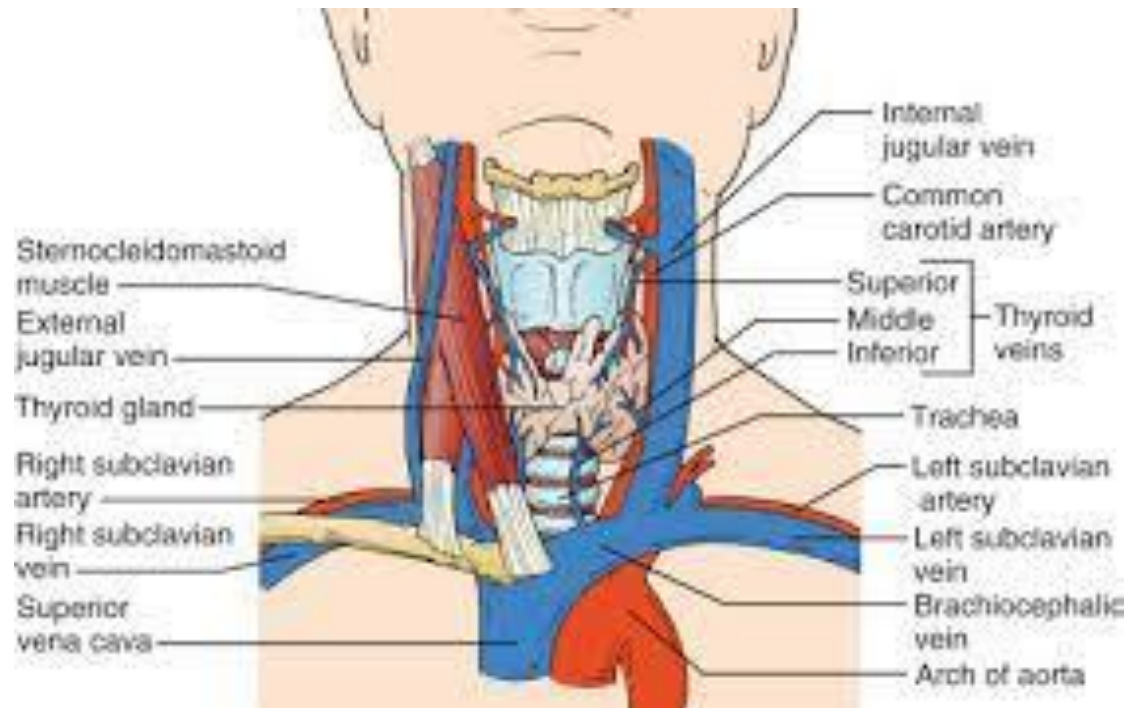
► [J Neurosurg Anesthesiol.](#) 1996 Oct;8(4):286-92. doi: [10.1097/00008506-199610000-00005](https://doi.org/10.1097/00008506-199610000-00005).

## The effect of right internal jugular vein cannulation on intracranial pressure

[R P Woda](#) <sup>1</sup>, [M E Miner](#), [C McCandless](#), [T D McSweeney](#)

Affiliations + expand

PMID: 8884625 DOI: [10.1097/00008506-199610000-00005](https://doi.org/10.1097/00008506-199610000-00005)

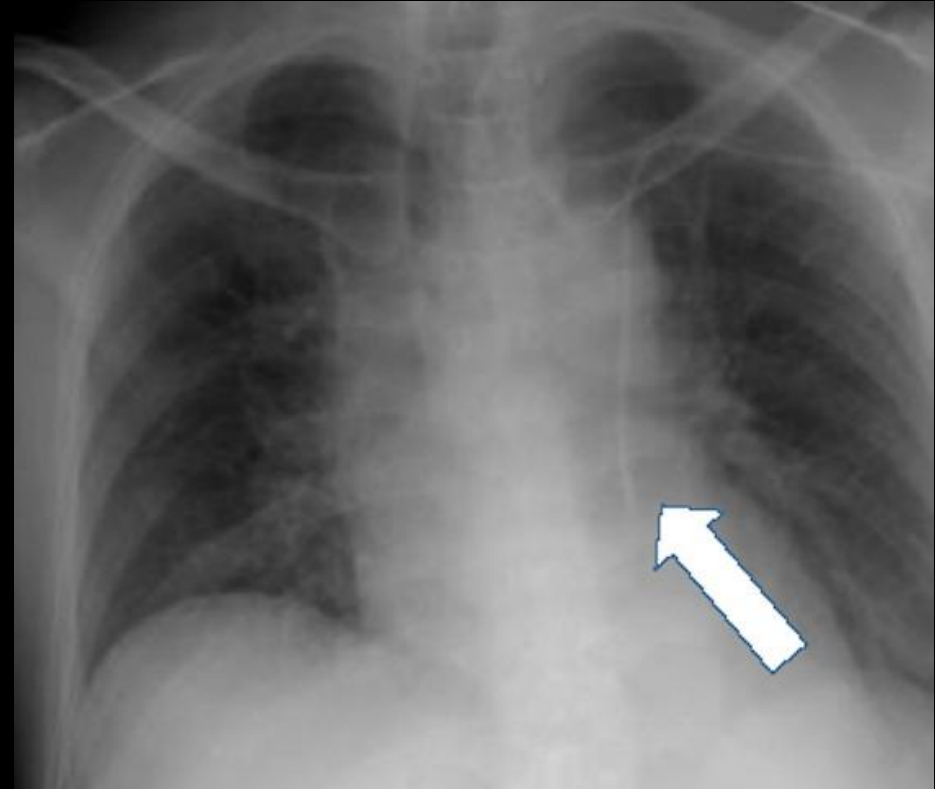
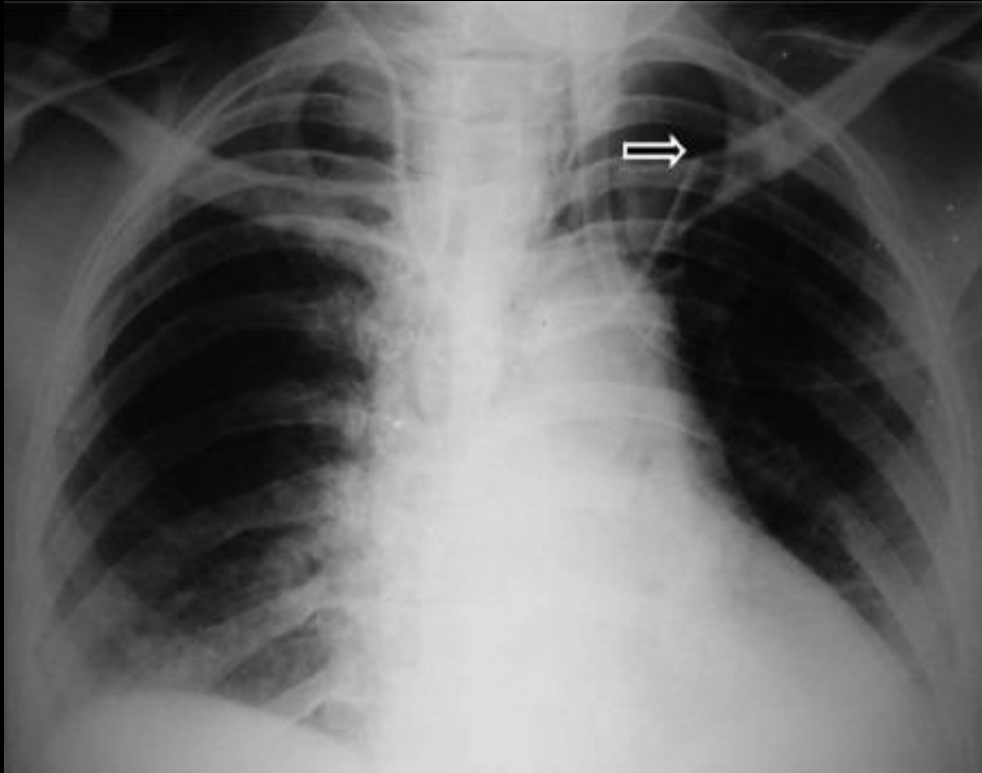




# Theoretical Pros of IJ CVC access

- Quicker cannulation than subclavian
- Less mechanical complications
- Less catheter misplacement
- No effect on cerebral venous drainage
- Ability to monitor S<sub>ijv</sub>O<sub>2</sub>
- Safer for coagulopathic patients
  - Compressible vascular structures
- Practitioners place more and are more comfortable

# Catheter malposition



# Not SCV vs IJ, but *HOW* to catheterize SCV

- Laterality; L > R
- Landmark vs Ultrasound guided in modern era
- Supraclavicular or infraclavicular approach
- Short axis vs Long axis needle position
  - Short axis out of plane needle position (SAX-OOP)
    - Ensures needle is precisely centered on the vessel
  - Long axis in plane needle position (LAX-IP)
    - Requires alignment of needle, beam and target

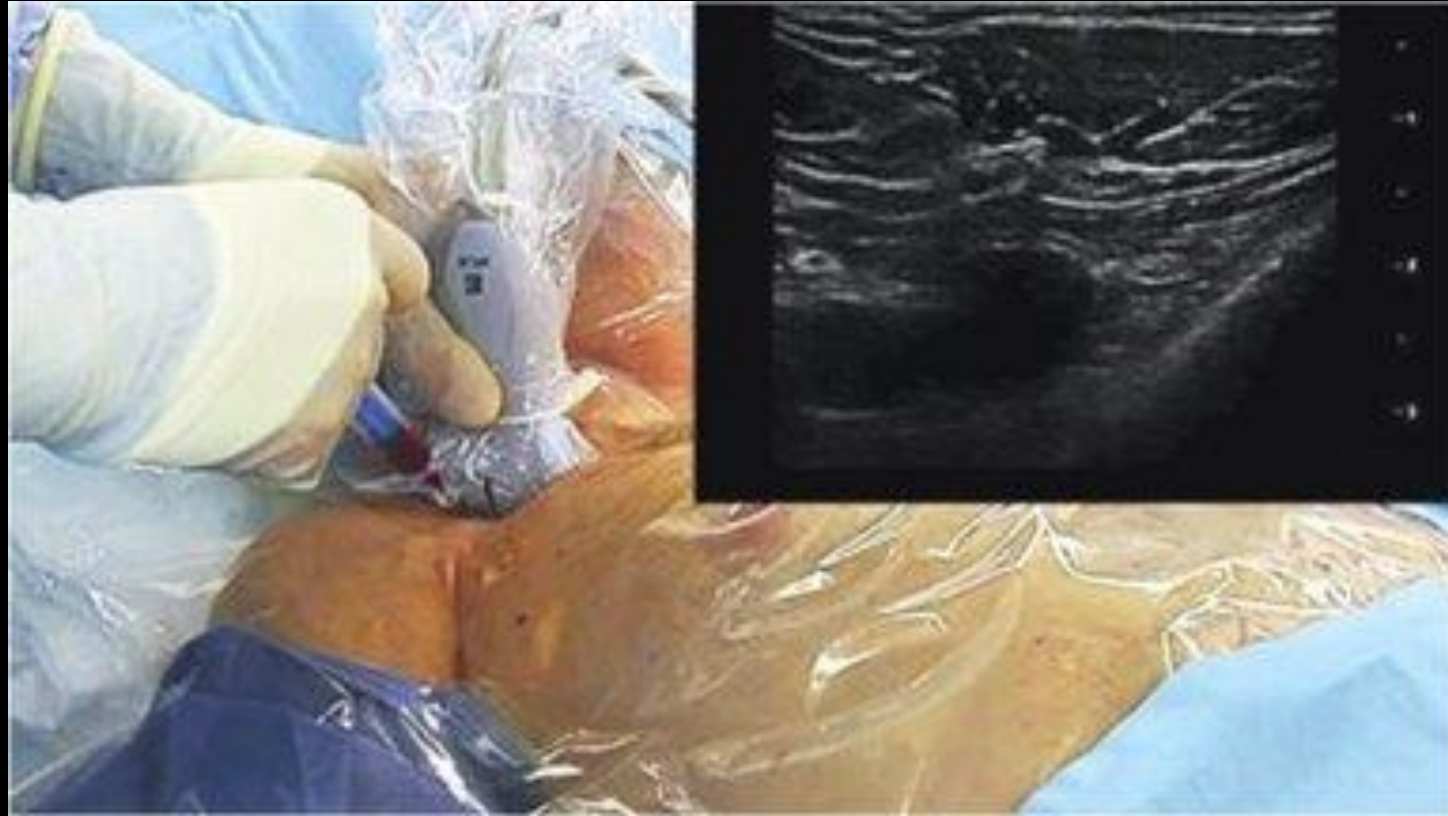


**Table.** Studies evaluating direct ultrasound-guided subclavian vein cannulation in comparison to landmark approach.

Authors/ publication	Type of study	Participants	Enrollment	Operators	Outcomes
Fragou et al. <sup>10</sup>	Prospective randomized single center	Mechanically ventilated and sedated patients in the medical ICU	LM group: N=201, US group: N=200	Multiple, with more than 6 years of experience in placement of central venous catheters	Increased success rate for experienced operators (100% vs 87.5%) Significantly decreased mechanical complication rate
Alic, Y et al. <sup>28</sup>	Prospective randomized single center	ICU patients (type of ICU not specified)	LM group: N=35, US group: N=35	One physician experienced in both techniques	No significant difference between success at 1 <sup>st</sup> attempt, overall success, or complication rate between LM and US group.
Palepu et al. <sup>29</sup>	Prospective randomized single center	Combined medical and surgical ICU Patients	LM group: N=28, US group: N=17	Multiple operators with varying levels of experience	No significant difference between overall success (p=0.52), number of attempts (p=0.23) or complication rate (p>0.99)
Gualtieri et al. <sup>30</sup>	Prospective randomized single center	Combined trauma, surgical and medical ICU Patients	LM group: N=27, US group: N=25	More than one operator with varying levels of experience	Increased success rate for inexperienced operators (92% vs 44%) using direct US guidance Reduced minor complications (4% vs 41%)

ICU, intensive care unit; LM, landmark; US, ultrasound

# Infraclavicular SAX-OOP



# Infraclavicular LAX-IP





# Take Home Points

- Subclavian venous central line has decreased infection and catheter related thrombus risk with similar mechanical complication risk to internal jugular making it a favorable central line site for most patients.
- Speed of subclavian line placement, mechanical complications, and catheter malpositioning decrease with operator experience and ultrasound guided placement.
- In neurosurgical cases, subclavian central lines are favorable for cerebral venous drainage, correct positioning of air aspiration catheters, administration of hypertonic saline, measuring cerebral and spinal cord perfusion as well as postop patient comfort.
- Like the IJ, there is no increased risk for venous drainage impairment with subclavian cannulation making it ideal for patients with elevated ICP going for neurosurgery.
- It is important to gain experience and teach trainees proper subclavian central line placement, landmark and US guided, to offer patients most benefit with fewest complications.

# Resources

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# Resources

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Thank you!