



# Stellate Ganglion Block Under Ultrasound and Fluoroscopy

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## Abstract

The stellate ganglion is a fusion of the inferior cervical and first thoracic ganglions. It lies along the anterior surface of the longus colli muscle anterior to the transverse process of C7, anteromedial to the vertebral artery, and medial to the common carotid artery and jugular vein. Sympathetic fibers from the first thoracic segments ascend through the sympathetic chain, synapse with the superior, middle, and inferior cervical ganglions, and provide sympathetic innervation to the head, neck, heart, and upper extremities.

The stellate ganglion can be blocked to treat vascular, neuropathic, or visceral pain related to the head, neck, upper extremities, and thorax and is thought to work by improving perfusion and inhibiting sympathetic impulses. Examples of conditions treated with stellate ganglion blockade include complex regional pain syndrome, peripheral vascular disease, hyperhidrosis, phantom pain, atypical chest pain, cluster headache, post-herpetic neuralgia, post-traumatic stress disorder, cardiac arrhythmias, and even long COVID (Lee et al., *Cleve Clin J Med* 89(3):147–153, 2022; Wen et al, *Neurol Sci* 42(8):3121–3133, 2021).

An image guided approach is highly suggested due to risk of complications including Horner syndrome, tracheal/esophageal injury, thyroid injury, pneumothorax, vascular puncture, and recurrent laryngeal nerve injury. Contraindications include recent myocardial infarction, glaucoma, certain nerve palsies, severe emphysema, and cardiac conduction blocks (Goel et al., *Reg Anesth Pain Med* rapm-2018-100127, 2019).

Both ultrasound and fluoroscopic guidance can be used. With ultrasound color Doppler should be used to visualize vascular structures. The block is

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performed at the C6 level because the vertebral artery is unprotected at C7 risking vascular puncture (Wang, Curr Pain Headache Rep 22(1):6, 2018).

### Keys to Procedure

- Understand the relevant anatomy surrounding the stellate ganglion.
- Understand how to optimize imaging utilizing ultrasound positioning and ultrasound settings.
- Understand the complications and corrective steps if encountered.

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### Anatomy Pearls

- The stellate ganglion is formed by the inferior cervical and first thoracic sympathetic ganglia and is located on the anterior surface of the longus colli muscle.
- The longus colli is just anterior to the transverse processes of the cervical vertebrae, anteromedial to the vertebral artery, posterior to the common carotid and jugular vein, and lateral to the trachea and esophagus.

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### Supplies and Setup

- Sterile towels
- Chlorhexidine-based soap
- 22G or 25G 3.5" needle
- Lidocaine 1% for skin—5 ml (if using 22G spinal needles)
- Isovue 300—3 ml
- Lidocaine 1% for injectate—2 ml
- Dexamethasone 10 mg
- 25G 1.5" needle for skin local
- 18G 1.5" needle to draw up medications
- Extension tubing (3") for contrast
- 5 ml syringe with 22G 1.5" needle for skin local
- 3 ml syringe with tubing for contrast
- 5 ml syringe for injectate (4 ml Bupivacaine 0.25% or preservative free lidocaine 1% + 1 ml dexamethasone 10 mg)

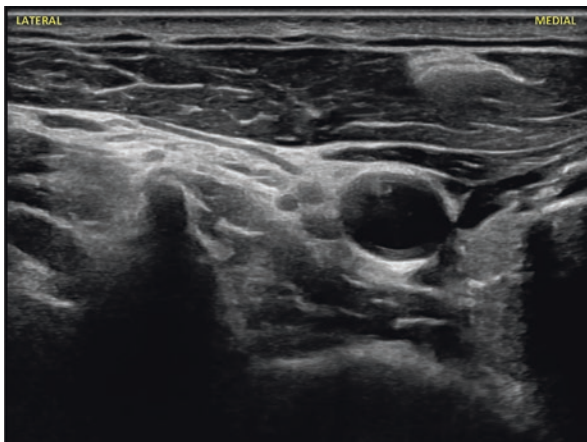
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### Patient Positioning

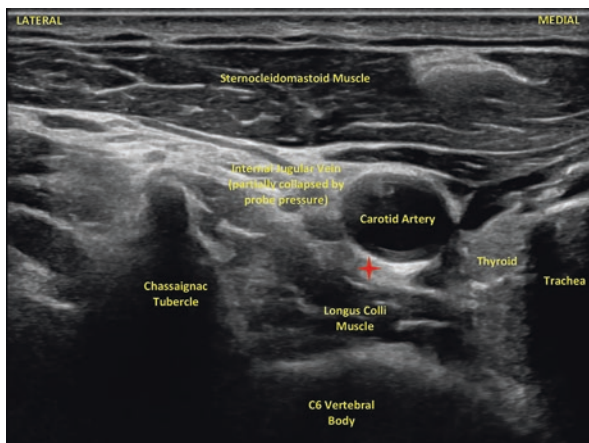
- Placed in the supine or seated position with the head in a neutral or maximum contralateral rotation.

## How to Perform the Procedure

1. Sterilely prep and drape with sterile towels.
2. Identify the medial border of the sternocleidomastoid muscle at the level of the cricothyroid notch via palpation.
3. Place linear high-frequency linear ultrasound transducer over medial border of the sternocleidomastoid muscle in the transverse position at the level of the cricoid notch (approximately at the C6 level). Images 20.1 and 20.2.
4. Identify the level of the C6 vertebral body which is distinct in its appearance with an anterior tubercle that is typically longer than the posterior tubercle (known as the Chassaignac/carotid tubercle). Also, identify the C6 nerve root, the carotid artery, the jugular vein, and the longus colli muscle.
  - (a) The C6 level is more easily identified via palpation and on ultrasound, but some clinicians prefer to inject at the C7 for closer access to the stellate ganglion, though medication should flow along the pre-fascial space in front of the longus colli muscle regardless of level.
  - (b) Once the C6 vertebral is identified, the transducer is moved caudally and slightly dorsally until the C7 transverse process comes into view. The C7 transverse process can be easily distinguished from the C6 transverse process by the lack of an anterior tubercle on the C7 transverse process, with the C7 nerve root located just anterior to the posterior tubercle. The C6 level is most commonly approached (see Pearls below).
5. Use color doppler to identify that the inferior thyroid, carotid, and vertebral arteries are not in proximity to the intended path of the needle.



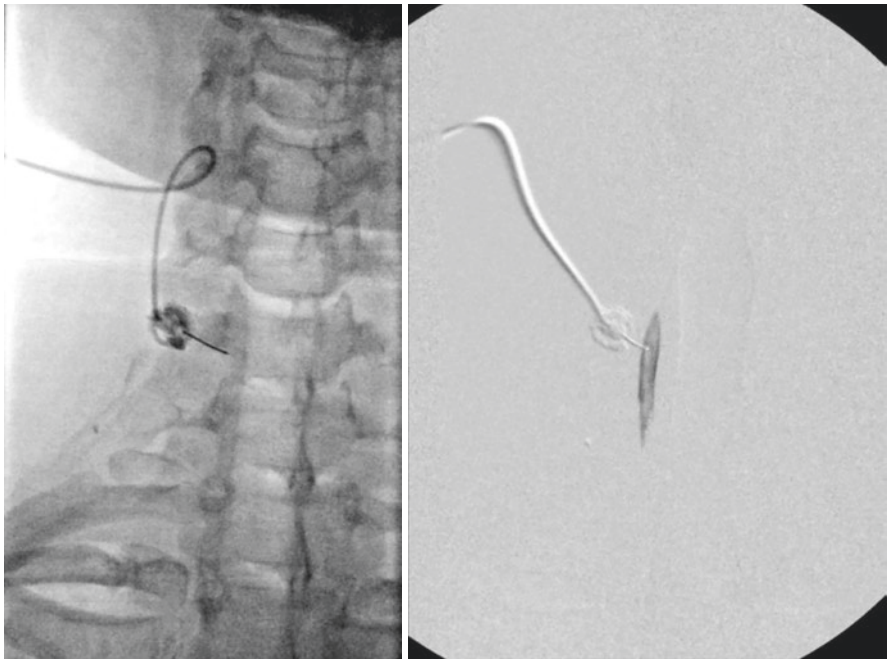
**Image 20.1** Ultrasound visualization of stellate ganglion block (unlabeled)



**Image 20.2** Ultrasound visualization of stellate ganglion block (anatomy labeled). Red cross indicates needle tip target at sympathetic chain

6. Identify the correct needle path to the anterior prefascial surface of the longus colli muscle where the sympathetic nerves and ganglion are located.
7. Typically, an in-plane approach can be used to advance the needle from lateral to medial avoiding all neurovascular structures. With this approach, head positioning may be important as maximum contralateral rotation or neutral head position may move relationship of neurovascular structures with your target and may be needed for safe needle path to the target. This lateral to medial approach helps avoid contact with both the thyroid and esophageal tissue, which will lie left of midline near trachea.
8. Utilize a 22 or 25-gauge, 3.5-in. spinal needle under continuous ultrasound guidance toward the anterior prefascial surface of the longus colli muscle while avoiding the carotid artery and other vessels previously identified by color Doppler. If a 25G needle is used, one option is to skip local topicalization with 1% lidocaine given this needle is also a 25G needle.
9. If fluoroscopy is used, once the needle is advanced just anterior to the longus colli muscle, the needle placement can be confirmed by visualizing the needle against the periosteum in the posteroanterior view along the anterior portion of the vertebral body.
  - (a) Needle placement against the anterior aspect of the vertebral body should confirm that the needle is not inadvertently transdiscal or in the spinal cord.
  - (b) If the needle strays postero-lateral, can pierce the vertebral artery.

- (c) If needle strays superior or inferior it can pierce the intervertebral disc.
  - (d) If needle strays ventro-medial it can pierce the trachea, thyroid, or esophagus.
  - (e) Ultrasound and fluoroscopy together can doubly confirm needle placement away from vital structures.
10. If fluoroscopy is used, contrast can be injected and seen to be tracking superiorly and inferiorly along the longus colli muscle where the sympathetic trunk runs (see Image 20.3).



**Image 20.3** X-ray visualization of stellate ganglion area

11. When correct placement is concerned and after gentle aspiration, injectate is injected under real-time ultrasound imaging to observe the ballooning of the anterior prefascial space of the longus colli muscle and pushing up of thyroidal tissue.
12. Withdraw needle and place pressure on the injection site to avoid hematoma or ecchymosis
13. Following procedure ipsilateral Horner's syndrome can be seen.

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## Checkpoints to Mastery

### Beginner

- Familiarize knob settings of ultrasound probe including adjustment of image depth, gain, and utilization of doppler.
- Consistent distinguish muscle, tendons, vasculature, and neural anatomy.
- Place ultrasound probe on the C6 and C7 vertebral bodies and identify carotid artery, vertebral artery, esophagus, trachea, thyroid, sternocleidomastoid, scalene, and the longus colli musculature.

### Intermediate

- Maintain ultrasound probe in optimized position as needle is advanced in plane to US probe.
- Utilize doppler imaging to verify that there are no blood vessels in path of needle.
- Visualize needle tip just lateral to the longus coli musculature at the C6 level.

### Advanced

- Confirm needle placement under fluoroscopy.
- Visualize contrast flow under fluoroscopy along the longus colli musculature.
- Visualize the ballooning of the anterior prefascial space of the longus colli muscle.
- Observe postprocedural Horner's syndrome suggestive of sympathetic block.

### Pitt Pain Pearls and Pitfalls

- Turning the head in maximum contralateral rotation may increase the distance between the trachea and neurovascular structures with the carotid artery.
- Utilize doppler to confirm carotid and vertebral arterial flow. With additional pressure of the ultrasound probe, the internal jugular and vertebral veins can be compressed so utilize doppler to confirm location as well.

- Asking patients to avoid swallowing during the procedure can help prevent inadvertent piercing of the esophagus or other medial structures.
- If the carotid artery blocks access to the cervical sympathetic chain, the ultrasound transducer can be slowly moved laterally to help delineate a more lateral needle trajectory to avoid the carotid artery.
- While the stellate ganglion is located closest to the skin at the level of the seventh cervical and first thoracic vertebrae, when using the landmark technique, it is most commonly blocked at the C6 level to avoid the possibility of pneumothorax as the dome of the lung lies at the C7–T1 interspace in many patients.

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## References

1. Lee YS, Wie C, Pew S, Kling JM. Stellate ganglion block as a treatment for vasomotor symptoms: clinical application. *Cleve Clin J Med.* 2022;89(3):147–53. <https://doi.org/10.3949/ccjm.89a.21032>.
2. Wen S, Chen L, Wang TH, Dong L, Zhu ZQ, Xiong LL. The efficacy of ultrasound-guided stellate ganglion block in alleviating postoperative pain and ventricular arrhythmias and its application prospects. *Neurol Sci.* 2021;42(8):3121–33. <https://doi.org/10.1007/s10072-021-05300-4>.
3. Goel V, Patwardhan AM, Ibrahim M, Howe CL, Schultz DM, Shankar H. Complications associated with stellate ganglion nerve block: a systematic review. *Reg Anesth Pain Med.* 2019;rapm-2018-100127. Advance online publication. <https://doi.org/10.1136/rapm-2018-100127>
4. Wang D. Image guidance technologies for interventional pain procedures: ultrasound, fluoroscopy, and CT. *Curr Pain Headache Rep.* 2018;22(1):6. <https://doi.org/10.1007/s11916-018-0660-1>.

## Further Reading

Ultrasound-Guided Stellate Ganglion Block, *Comprehensive Atlas of Ultrasound-Guided Pain Management Injection Techniques*, 2nd Edition, Waldman.  
Stellate Ganglion Block: Fluoroscopic Guidance, *Atlas of Image-Guided Spinal Procedures*, 2nd Edition, Furman.