

REVIEW ARTICLE

Ultrasound-guided Stellate Ganglion Block

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ABSTRACT

Ultrasound has emerged as an important and inseparable tool in the field of anesthesiology and pain management. Its use is increasing everyday to aid in regional anesthesia and in chronic pain interventions. It is replacing fluoroscopy to guide many chronic pain interventions, especially the sympathetic blocks like stellate ganglion block, celiac plexus block, superior hypogastric plexus block, ganglion impar block, etc. Stellate ganglion block is used in the treatment of wide variety of chronic painful conditions of head, neck and the upper limb. Hence, it is one of the commonest procedures in chronic pain management. Stellate ganglion block is commonly performed under fluoroscopy guidance. Use of ultrasound during this procedure has shown to be as effective as the fluoroscopy-guided technique, more safe than fluoroscopy and can avoid radiation exposure. In this article, we have described the merits and demerits of the ultrasound-guided stellate ganglion blockade as compared to the fluoroscopy.

Keywords: Fluoroscopy, Stellate ganglion, Ultrasound.

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INTRODUCTION

Stellate ganglion block has been used to treat many chronic painful conditions like complex regional pain syndrome type I and II (CRPS I and II) of the upper limb, phantom limb pain, postherpetic neuralgia, ischemic pain due to vascular insufficiency like Raynaud's disease, arterial embolization, postmastectomy pain, hyperhidrosis of the upper limb, intractable angina, vascular headaches, postradiation neuritis, Paget's disease, sympathetically mediated pain in cancer patients, etc.^{1,2} Stellate ganglion block is technically an easy block to perform. Previously, it was practiced blindly which was replaced by fluoroscopy where the bony structures were utilized to

locate the target. In the recent years, ultrasound (USG) has been frequently used in the blockade of the stellate ganglion. Apart from visualizing the soft tissue structures in relation to the stellate ganglion like longus colli muscle, carotid sheath, USG also helps in locating the exact fascial plane for the successful blockade. It also helps in real time visualization of the drug spread and thus, avoiding the intravascular injection of the drug. Thus, ultrasound-guided technique may be much safer and successful as compared to fluoroscopy-guided technique.

Applied (Sono) Anatomy Relevant to the Stellate Ganglion (Fig. 1)

Stellate ganglion is formed by the fusion of lower cervical and first thoracic ganglion. It is 2.5 × 1 × 0.5 cm and lies over the neck of the 1st rib, between C7 and T1 vertebral level.³ The anatomical relations of the stellate ganglion are as follows:⁴

- Anteriorly
 - Subcutaneous tissue, sternocleidomastoid muscle, subclavian artery, and carotid sheath.
- Posteriorly
 - Anterior scalene muscle, sheath of the brachial plexus, neck of first rib, transverse process of C7, vertebral artery, and longus colli muscle.
- Laterally
 - Superior intercostal vein, superior intercostal artery and ventral ramus of first thoracic nerve.
- Medially
 - Prevertebral fascia, vertebral body of C7, esophagus and thoracic duct.

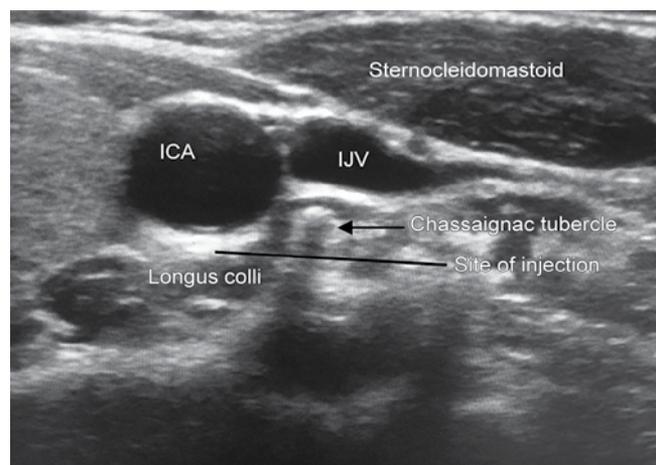


Fig. 1: Sonoanatomy of stellate ganglion (ICA: Internal carotid artery, IJV: Internal jugular vein)

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- Inferiorly
 - Pleural dome over the lung apex.

Location of the Ganglion

The exact plane of location of the stellate ganglion is very important as the success of the stellate ganglion block depends on the deposition of the drug in to this plane. The stellate ganglion is situated deep to the prevertebral fascia on the anterolateral surface of the longus colli muscle. Hence, the drug has to be deposited deep to the prevertebral fascia and superficial to the longus colli muscle for the successful blockade.⁵ It is difficult to detect this injection plane under fluoroscopy, only with the help of ultrasound, this plane can be easily identified.

Thickness of the Longus Colli Muscle

The longus colli (LC) muscle is an important structure in the cervical spine and has a critical role in stellate ganglion block. During conventional fluoroscopy-guided technique, the needle is withdrawn for up to 10 mm after contacting the bone to avoid intramuscular injection into longus colli. However, the thickness of the longus colli muscle at the level of C6 and C7 is not same in all individuals.⁶ Its thickness varies among individuals. The thickness of the LC muscle varies between 5 and 10 mm at C6 and C7 in cadavers and between 8 and 10 mm in magnetic resonance imaging (MRI) scans. Male patients have considerably thicker LC muscle than females. Ultrasound scan of the neck before the block provides an opportunity to assess the thickness of the muscle and can avoid intramuscular injection of the drug.

Relation of the Vertebral Artery to the Stellate Ganglion

The anatomical relation of the vertebral artery to the stellate ganglion is variable. It may lie posterior to the ganglion, anterior to the ganglion⁷ or lateral to the ganglion.⁸ Sometimes the vertebral artery may even pierce the ganglion.⁹ Avoiding the vertebral artery puncture is very important to prevent the intra-arterial injection of the local anesthetic. Although the vertebral artery enters the foramen transversarium at the level of C6 by which it is well-separated from the stellate ganglion, anatomical variations are known to occur and in one of the studies, the vertebral artery was lying outside the foramen transversarium in up to 7% of the cases.¹⁰ Studies have shown that injection of even a minimal dose of the local anesthetic into the vertebral artery can cause seizures as the injected local anesthetic directly reaches the brain.¹¹ Fluoroscopy will detect this intra-arterial placement of the needle after injection of the contrast but ultrasound has

shown to prevent the inadvertent injection of the local anesthetic into the vertebral artery.¹² Hence, ultrasound scores over fluoroscopy in this aspect.

The level at which the stellate ganglion block has to be done.

Though the stellate ganglion block can be done at C7 level, it is commonly done at C6 level. The advantage of the block at C7 level is that it is in close proximity to the ganglion and hence, a high success rate, less volume of the local anesthetic required to block the ganglion. But, the block at C7 has many draw backs. The chances of encountering a major vessel is high with anterior approach at C7 level than at C6 level (29 and 43% respectively).¹⁰ On the left side, the esophagus was located along the needle path in 39 of 60 cases at C7 level as compared to 22 of 60 cases at C6 level.¹³ These above mentioned observations make the block at C6 more favorable. The vertebral artery enters the foramen transversarium at the level of C6 thereby isolating itself from the stellate ganglion thus, making the C6 level block more safe.

CONCLUSION

Ultrasound-guided blockade of the stellate ganglion has been shown to be more safe and effective as compared to fluoroscopy-guided blockade. Ultrasound helps in identifying the correct fascial plane, prevents intravascular and intramuscular injections thus, improving the success rate and reducing the rate of complications.

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