

# Atypical Course of Vertebral Artery Identified by Ultrasound Prescan before Performing a Stellate Ganglion Block

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## Abstract

Ultrasound provides direct visualization of blood vessels and soft tissues around the sympathetic chain and potentially minimizes injury to these critical anatomic structures when performing stellate ganglion block (SGB). We report an atypical left vertebral artery course detected during an ultrasound prescan before performing a SGB. The left vertebral and inferior thyroid arteries were identified on the longus colli muscle's ventral surface at the C6 level. This report was the first to demonstrate ultrasound images of a vulnerable vertebral artery to intravascular injection. The study emphasized the importance of identifying the sonoanatomy before performing procedures involving the anterior cervical vertebrae.

**Keywords:** Stellate ganglia, ultrasonography, vertebral artery

## INTRODUCTION

Ultrasonography of the vulnerable inferior thyroid vessels has been suggested a major source of vascular injury during a stellate ganglion block (SGB), and the relevant sonoanatomy in potential needle injury was also demonstrated.<sup>[1,2]</sup> The first case of cardiac arrest, triggered by an unintentional vertebral artery injection during left SGB under ultrasound guidance, was reported.<sup>[3]</sup> However, no ultrasound imaging findings of anatomically vulnerable and variable vertebral artery that contributes to arterial puncture were presented. Therefore, there was an opinion that the physician may have injected local anesthetic into the inferior thyroid artery rather the vertebral artery.<sup>[4]</sup> We report the ultrasound imaging findings of an atypical course of a left vertebral artery detected during a prescan before performing SGB.

## CASE REPORTS

### Case 1

A 25-year-old man was diagnosed with occipital headache. We considered performing SGB. The patient was placed in a supine position, and his head was turned to the right side. A model LOGIQ™ E10 7–14 MHz, multifrequency linear US transducer (General Electric Healthcare, Milwaukee, WI, USA),

was applied for prescan. The transducer was transversely oriented over the left side of the neck, and the transverse process of the sixth cervical vertebrae was located at the cricoid cartilage level. We identified the coexistence of the left vertebral and inferior thyroid arteries between the common carotid artery and the longus colli muscle at the C6–C7 level on ultrasound [Figure 1]. We confirmed the atypical course of the vertebral artery by color Doppler studies [Figure 2a and b]. It entered at the transverse foramen at the C5 level.

### Case 2

A 55-year-old woman was diagnosed with left herpes zoster ophthalmicus. We conducted SGB of the left neck and ultrasound prescan as described in case 1. Ultrasound imaging in the short-axis view indicated that the left vertebral and inferior thyroid arteries ran anteriorly at the C6 transverse process [Figure 3a and b]. It was oriented cranially and entered the transverse foramen of the C5 transverse process.

## DISCUSSION

We report ultrasound images of the left vertebral artery located in the simulated needle path at the C6 level in SGB. Information

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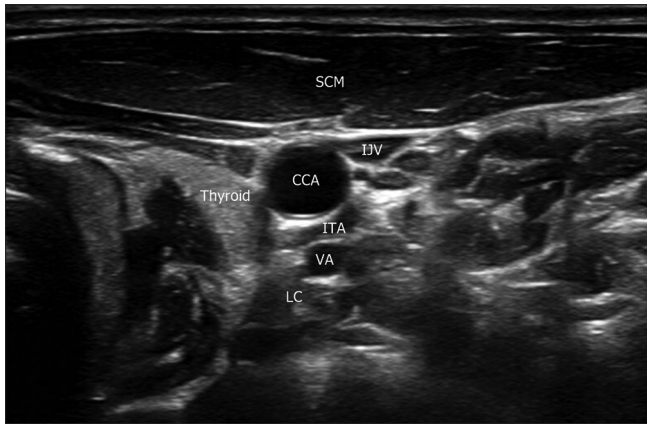
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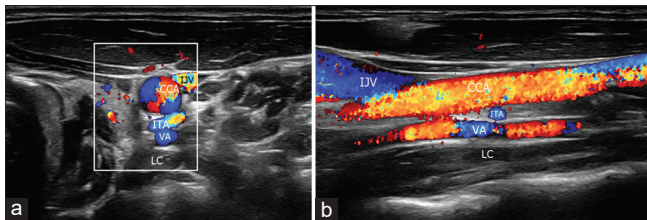
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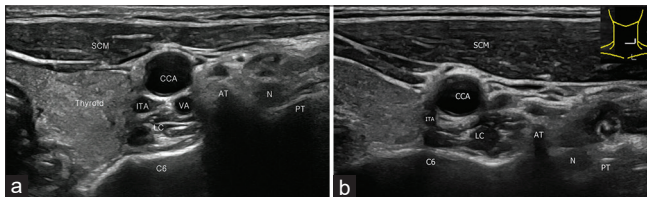
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**Figure 1:** A 25-year-old male was diagnosed with occipital headache. Ultrasound image in the short-axis view at C6–C7 level using a linear transducer. VA: Vertebral artery, LC: Longus colli muscle, CCA: Common carotid artery, ITA: Inferior thyroid artery, IJV: Internal jugular vein, SCM: Sternocleidomastoid muscle



**Figure 2:** Color Doppler ultrasound images in the short-axis (a) and long-axis (b) views. VA: Vertebral artery; LC: Longus colli muscle; CCA: Common carotid artery, ITA: Inferior thyroid artery, IJV: Internal jugular vein



**Figure 3:** A 55-year-old woman was diagnosed with left herpes zoster ophthalmicus. Ultrasound images in the short-axis view at C6 (a). Normal sonoanatomy in a representative patient (b). VA: Vertebral artery, LC: Longus colli muscle, CCA: Common carotid artery, ITA: Inferior thyroid artery, SCM: Sternocleidomastoid muscle, N: C6 nerve root, AT: Anterior tubercle, PT: Posterior tubercle

on the anatomical variation of the vertebral artery is clinically essential for performing safe interventional procedures. The vertebral artery typically runs anteriorly at the C7 level before it enters the foramen of the C6 transverse process. Using the anterior paratracheal approach at the C6 level in SGB may reduce the chance of vertebral artery injury. The anatomical variations of the prevertebral segments of the vertebral artery encountered in cervical spine procedure have been reported. The left vertebral artery origin from the aortic arch instead of subclavian artery arch was more likely to not only have a more medial course over the cervical vertebral bodies but also to enter a transverse foramen that was more cranially located than

the normal C6 entrance of the vertebral artery.<sup>[5-7]</sup> Vertebral artery injury may occur at higher levels, where the artery is exposed on the ventral surface of the transverse process.<sup>[1]</sup> In addition, tortuous vertebral arteries are more common on the left side.<sup>[8]</sup> These anatomical variations suggest that SGB using the anterior paratracheal approach is more likely to injure the vertebral artery, especially on the left side.<sup>[9]</sup> However, the ultrasound image findings of an anatomically hazardous vertebral artery, located in the simulated needle path of SGB, has not been presented yet, although image analysis was conducted based on the computed tomography images of the atypical courses.

In our cases, we recognized the sonoanatomy of the vertebral artery related to potential arterial injury in procedures involving the anterior cervical vertebrae while performing prescan. The left vertebral and inferior thyroid arteries were identified on the longus colli muscle’s ventral surface at the C6 level. Narouze<sup>[1,2]</sup> suggested that the inferior thyroid artery was vulnerable to injury during SGB when it crossed behind the carotid artery from lateral to medial at C6–C7 level using ultrasound images. In particular, our ultrasound findings showed a rare anatomical relationship between the vertebral and inferior thyroid arteries at the C6 level. This sonoanatomy demonstrated that the vertebral artery was a potentially hazardous structure even if the inferior thyroid artery coexisted.

## CONCLUSION

We highlighted the role of these images as the first of its kind, involving an ultrasound prescan of vulnerable and variable vertebral artery to intravascular injection. The findings underscored the need for physician awareness of the ultrasound imaging findings, indicative of a vertebral artery, with an increased risk of a puncture during interventional procedures involving the anterior cervical vertebrae.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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