**Variant Route of the Subclavian Artery**

**Potential Cause of Thoracic Outlet Syndrome**

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**Introduction**

The Thoracic Outlet is the region located between the base of the neck and shoulder, just inferior to the clavicle. It contains three important structures for the function of the upper extremity. The brachial plexus, a bundle of nerves that supplies sensory and motor innervation. The subclavian artery that supplies blood to the extremity and the subclavian vein that drains the extremity. Compression of these structures can result in vascular and/or neurological changes leading to Thoracic Outlet Syndrome (TOS). TOS can result from abrupt movements, hypertrophy of the neck muscles and anatomical variations in which the neurovascular bundle is compressed. Symptoms of TOS include muscle weakness, muscle atrophy, paresthesia, discoloration, swelling, numbness and pain in the upper extremity. Symptoms can vary depending on the cause of neurovascular bundle compression and what part of the bundle is being acted upon.

**Thoracic Outlet Syndrome**

Thoracic outlet syndrome (TOS) is a collection of symptoms as a result of impedance of the neurovascular bundle that supplies the upper extremity. Compression of one or more parts of this bundle can occur in three important spaces. The interscalene triangle, between the anterior and middle scalene muscles. The costoclavicular space, between the clavicle and the first rib. The subpectoral space, between the pectoralis minor muscle and the third and fourth ribs. TOS could be caused from trauma, medical conditions or anatomical variations.

**Normal Thoracic Outlet**

The thoracic outlet is the anatomical ring between the neck and shoulder, on top of the thorax but inferior to the clavicle. It is bordered by the manubrium, the first rib and the first thoracic vertebrae. Three muscles are present in this region. The anterior and middle scalene muscles extend from the transverse processes of cervical vertebrae to attach onto the first rib and the subclavius muscle attaches from the under surface of the clavicle to the first rib. Typically, the brachial plexus and the subclavian artery pass between the two scalene muscles before passing under the clavicle. The subclavian vein passes under the clavicle but anterior to the anterior scalene.

**Variant Case**

An anterior (A) and lateral (B) view of the thoracic outlet of our cadaver. The anterior scalene (AS) muscle can be seen as a single belly that splits into two pieces (AS1 and AS2) before inserting into Rib1. The subclavian artery (SC) which typically travels deep to the anterior scalene can be seen passing between the two parts of the muscle. The brachial plexus (C5, C6, C7, C8 and T1) can be seen in its typical placement coursing between the anterior scalene and the middle scalene muscle (MS). The thyrocervical trunk (TcT) and internal thoracic artery (IT) can be seen in their typical placement branching off the subclavian artery just medial to the anterior scalene muscle.

**Case Report**

During a routine cadaver dissection of the head and neck in a chiropractic anatomy laboratory, an anatomical variation was observed on the right side root of the neck of a 85-year-old female cadaver (variant case; see below). In this region the right subclavian artery was observed piercing the anterior scalene muscle while passing over the first rib. The anterior scalene had two separate attachment points on rib 1, one anterior to the subclavian artery and one posterior to the subclavian artery. The proximal fibers of the anterior scalene blended seamlessly with each other as they attached to the transverse processes of C3 to C6. Significantly, no part of the brachial plexus was observed piercing the anterior scalene but located in its normal position between the anterior and middle scalene muscles.

**Conclusion**

In this case, we hypothesize that with this specific variant the patient would experience vascular TOS symptoms rather than neurogenic as a result of the possible occlusion of the right subclavian artery. The right subclavian artery is responsible for supplying the right upper extremity with some branches into the head and neck. An occlusion would be occurring in the scalene triangle as the artery passes through the variant muscle. Vascular (arterial in our case) symptoms include severe pain, coldness in the hands and fingers, paresthesias, pallor and increased risk of thrombosis. Treatment can be done conservatively, often involving postural training, stretching and mobilization exercises. If unsuccessful, surgical decompression is common. This case would present with arterial TOS which typically involves more severe symptoms than the other types of TOS. It is important for clinicians to consider anatomical variations such as the one observed here to accurately diagnosis and treat TOS.

**References**


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**Type**

**Possible Cause**

<table>
<thead>
<tr>
<th>Neurogenic</th>
<th>Compression of the Brachial Plexus</th>
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<tbody>
<tr>
<td>Vascular</td>
<td>Compression of Subclavian Artery or Vein</td>
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<tr>
<td>Non Specific</td>
<td>Combination of Neurogenic and Vascular symptoms</td>
</tr>
</tbody>
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**Symptoms**

- Tenar wasting (Gilliat-Sumner hand)
- Paresthesia in arm or fingers
- Pain in the upper extremity and neck
- Weakened grip
- Cyanosis of the hand
- Thrombosis of the upper extremity
- Pallor in one or more digits
- Weak or no pulse in the affected arm
- Cold fingers, hand or arm
- Arm fatigue with activity
- Paresthesia in arm or fingers
- Weakness of arm or neck

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**Variant Case**

- Thenar wasting (Gilliatt-Sumner sign)
- Cyanosis of the hand
- Arm fatigue with activity
- Paresthesia in arm or fingers
- Weakness of arm or neck

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