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Case Report

Simultaneous Variants in the Origin of the Left Suprascapular Artery and with the Branches of the Right Subclavian Artery

Chen-Xi Xiao, Can-Min Zhang, Shu-Yue Yang, Zi-Han Yao, Hao-Rui Zhou, Xin-Tong Zheng and Hao-Min Zhang*

School of Medicine, Sun Yat-sen University, China

Abstract

The organogenesis of the suprascapular artery is mainly from the thyrocervical trunk or the subclavian artery, and the main branches of the subclavian artery in the neck are the internal thoracic artery, the thyrocervical trunk, and the cost cervical trunk. Here we report the rare variants with a cadaver. In specific, the left superior scapular artery originated from the internal thoracic artery; the right superior scapular artery, dorsal scapular artery, and transverse cervical artery together had one trunk from the subclavian artery. We analyzed the anatomical characteristics of this variant case and briefly discussed the clinical implications.

Keywords: Suprascapular artery; Dorsal scapular artery; Transverse cervical artery; Subclavian artery; Variation

Introduction

According to classic anatomical textbooks, the suprascapular artery usually arises from the thyrocervical trunk of the subclavian artery, although it may arise from the third part of the subclavian artery. After reaching the superior border of the scapula, it passes above (or under) the superior transverse ligament, and enters the supraspinous fossa. Then it descends behind the scapular neck and anastomoses with the artery of the scapular region. Its muscular branches supply sternocleidomastoid, subclavius, and infraspinatus. Its branches also supply the skin and muscle of the scapular region [1].

In most cases, the dorsal scapular artery arises from the third part of the subclavian artery. It reaches the superior scapular angle and supplies the rhomboids, latissimus dorsi, and the inferior portion of the trapezius. The superficial cervical artery passes the floor of the posterior triangle and ascends deep to the anterior part of the trapezius. It supplies the trapezius together with the adjoining muscles and the cervical lymph nodes. About a third of the superficial cervical and dorsal scapular arteries arise in common from the thyrocervical trunk, with a superficial and a deep branch.

We present a case of an occurrence of the left suprascapular artery arising from the internal thoracic artery and the variant branches arising from the right subclavian artery in a human adult formalin-fixed cadaver. The arteries were discovered during dissection in the medical gross anatomy laboratory at Sun Yat-sen University School of Medicine in an older male Chinese cadaver.

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***Corresponding author:** Chen-Xi Xiao, School of Medicine, Sun Yat-sen University, China, E-mail: xiaochx6@mail2.sysu.edu.cn

Case Presentation

We present a case of an occurrence of the left SA arising from the internal thoracic artery and the variant branches arising from the right subclavian artery in a formalin-fixed cadaver of a man. The arteries were discovered during dissection in the medical gross anatomy laboratory at Sun Yat-sen University School of Medicine in an old male Chinese cadaver.

The original variation of the left suprascapular artery

An anatomical variation in organogenesis of the left SA was discovered during the dissection of the male cadaver (Figure 1 and 2). In order to have a clear view of SA in the root of the neck, clavicles from both ends have been cut off. The anomalous left SA originated from the proximal part of the internal thoracic artery. It then crossed laterally over the terminal of the anterior oblique ramus at the superior border of the first rib, the third segment of the supraclavicular artery, and the anterior row of the brachial plexus posteriorly. Afterward, the SA reached the suprascapular nerve, and when they reached the suprascapular notch, they passed above or underneath the superior transverse scapular ligament respectively, to reach the supraspinatus fossa thereby supplying blood and innervation to the posterior rotator cuff muscles.

Additionally, the left internal thoracic artery emanated from the left subclavian artery and went downward for 19.60 mm before emanating from the suprascapular artery at 25.63 mm above the first rib, with an angle of 63° between the SA and the internal thoracic artery. The left SA began at the posterior aspect of the clavicle, with 41.10 mm from the anterior midline and 23.64 mm from the thyroid neck trunk. Its organogenesis was 1.53 mm in diameter. The SA laterally crossed the center of the anterior oblique muscle at 7.81 mm from its origin, where its external diameter was measured at 1.47 mm. The SA then passed above the superior transverse scapular ligament at 63.33 mm from its origin, where its external diameter was measured at 1.14 mm. The organogenesis of the suprascapular artery from the internal thoracic artery here is rare, and its clinical significance will be discussed below in detail.

Branch variation of the right subclavian artery

During the dissection of the right side of the cadaver, it was

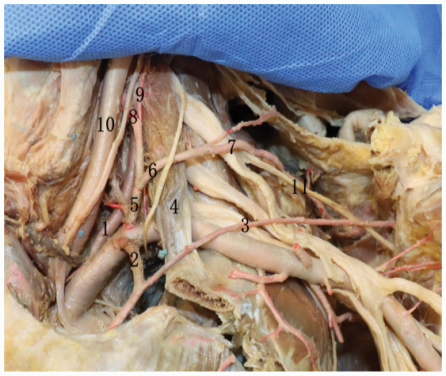

Figure 1: The anomalous left suprascapular artery. 1). vertebral artery 2). Internal thoracic artery 3). Suprascapular artery 4). Anterior oblique ramus 5). Thyroglossal trunk 6). Transverse cervical artery 7). Dorsal scapular artery 8). Inferior thyroid artery 9). ascending cervical artery 10). Common carotid artery 11). Suprascapular nerve.

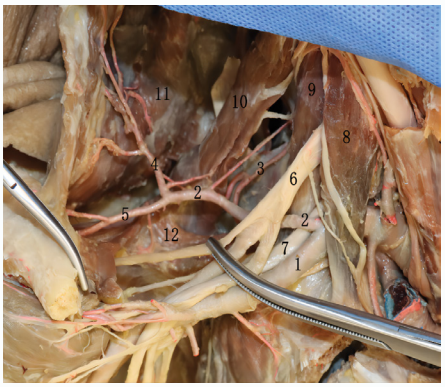

Figure 3: The anomalous right subclavian artery branch.1). Subclavian artery 2). The trunk of three arteries 3). Dorsal scapular artery 4). Transverse cervical artery 5). Suprascapular artery 6). Superior brachial plexus trunk 7). Middle brachial plexus trunk 8). Scalenus anterior 9). Scalenus posterior 10). Scapular elevator muscle 11). Trapezius muscle 12). Anterior serratus first muscle tooth.

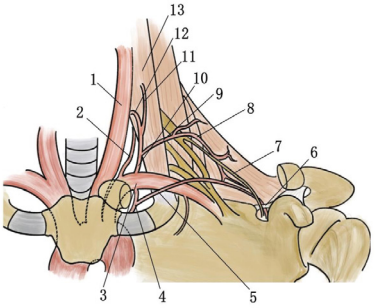

Figure 2: Pattern diagram of the anomalous left suprascapular artery. 1). Common carotid artery 2). Vertebral artery 3). Subclavian artery 4). Internal thoracic artery 5). Suprascapular artery 6). Superior transverse scapular ligament 7). Suprascapular nerve 8). Dorsal scapular artery 9). Transverse cervical artery 10). Thyroglossal trunk 11). Ascending cervical artery 12). Inferior thyroid artery 13). Anterior oblique ramus.

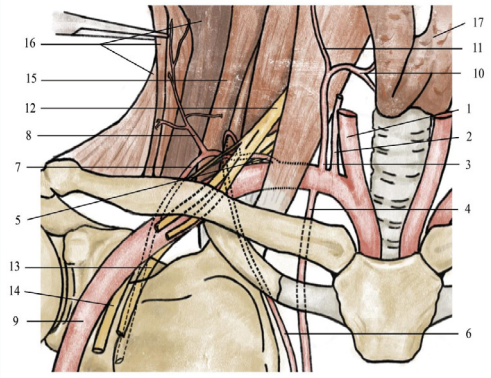

Figure 4: Pattern diagram of variant right subclavian artery branches. 1). Common carotid artery 2). Vertebral artery 3). Thyroid Neck Stem 4). Internal thoracic artery 5). The trunk of three arteries 6). Dorsal scapular artery 7). Suprascapular artery 8). Transverse cervical artery 9). Axillary artery 10). Inferior thyroid artery 11). Carotid ascending artery 12). Superior brachial plexus trunk 13). Middle brachial plexus trunk 14). Inferior brachial plexus trunk 15). Scapular elevator muscle 16). Trapezius muscle 17). Thyroid gland (turnover).

found that the branches of the subclavian artery on this side were also variant (Figure 3 and 4). The transverse cervical artery, dorsal scapular artery, and suprascapular artery together stemmed from a branch of the second part of the right subclavian artery, which is tentatively referred to as the trunk of the three arteries here because the naming of this branch is still controversial. The trunk crossed laterally from the level of the organogenesis, went across the gap between the superior and middle trunks of the brachial plexus, and gave rise to the dorsal scapular artery behind the superior brachial plexus. The trunk then crossed anterior to the scapularis raphe and divided into two branches, namely the transverse cervical artery and the suprascapular artery.

The main trunk emanated from the second part of the right subclavian artery, with an angle of 52° between the two. It was 23.64 mm distal to the organogenesis of the thyrocervical trunk and the starting external diameter was measured to be 3.09 mm. The dorsal scapular artery emanated from the inferior edge of the main trunk 36.24 mm from the organogenesis of the trunk. Its diameter was 2.07 mm. The dorsal scapular artery crossed anterior to the middle and posterior rhomboid muscles and posterior to levator scapulae, sending out muscle branches to the lower trapezius muscle and rhomboid muscles. Slightly lateral to the organogenesis of the dorsal scapular artery, the trunk also gave off a muscle branch that crossed posterior to the scapular raphe and supplied blood to it.

Then at 64.93 mm from the organogenesis, the trunk eventually bifurcated. The two branches were approximately at right angles, with a measured angle of 86°. One of them was the transverse cervical artery with an initial outer diameter of 3.16 mm. The transverse cervical artery passed obliquely and superiorly between the levator scapulae and trapezius muscles and gave off muscular branches to these two muscles. The other was the suprascapular artery, which started with an external diameter of 2.71 mm. The suprascapular artery descended laterally across the suprascapular notch to the supraspinatus fossa. At 6.03 mm from the organogenesis of the suprascapular artery, it gave off a branch to the first muscle tooth of the anterior serratus to nourish the anterior serratus muscle.

It is extremely rare that the transverse cervical artery and the suprascapular artery co-trunk from the subclavian artery. Its clinical significance will be discussed in detail below.

Discussion

In the case we report, the arterial origin variant and the travel

variant occurred on both the left and the right side. Unilateral variants alone have been rarely reported nationally and internationally, and now it is even rarer for both variants to occur in the same cadaver. Next, we will discuss the clinical significance of the variation in the origin of the left suprascapular artery.

Significance in related clinical conditions

Rotator cuff injury related: Current studies have shown that the actual incidence of rotator cuff injury is much higher than the clinical diagnosis rate, and most rotator cuff injuries are intra-tendon tears, with supraspinatus tendon tears being the most common [2]. The suprascapular artery, as one of the blood supply arteries of the supraspinatus tendon, is easily involved in rotator cuff injury, causing the impaired blood supply to the supraspinatus muscle and affecting the recovery of rotator cuff injury. Moreover, because the self-healing ability of rotator cuff injury is small, most of the injuries require surgical treatment to repair the rotator cuff [3], so understanding the alignment position and variation of the suprascapular artery can help to reduce the injury of the suprascapular artery during surgery.

Clavicle fracture related: Injury to the suprascapular artery from clavicle fractures is also more common. Clavicle fractures mostly occur in the middle 1/3 of the clavicle, and if the suprascapular artery alignment is close to this area, the suprascapular artery is easily damaged when the clavicle is fractured, while the suprascapular artery emits a branch that nourishes the clavicle [4], and this branch may also be damaged when the clavicle is fractured. In clinical anatomy, the suprascapular artery is occasionally seen to originate from the internal thoracic artery, when the suprascapular artery mostly travels posterior to the middle 1/3 of the clavicle, and once a clavicle fracture occurs, the possibility of injury to the suprascapular artery is extremely high [5]. When surgically treating clavicle fractures, attention should be paid to the alignment of the suprascapular artery to prevent secondary injury to the suprascapular artery.

Anterior oblique muscle syndrome related: Anterior oblique muscle syndrome can cause injury to the superior scapular artery. The superior scapular artery is mostly aligned anterior to the anterior oblique muscle, and when anterior oblique muscle syndrome occurs, the symptoms are mostly weakness and muscle pain in the upper extremity caused by the brachial plexus nerve entrapment, affecting mostly the structures that travel through the oblique muscle gap [6].

In some anatomical variants, the suprascapularis artery can travel in the oblique angle muscle gap, and the occurrence of anterior oblique angle muscle syndrome can compress the suprascapularis artery, leading to dystrophy in the muscles supplied by the suprascapularis artery, such as the supraspinatus, infraspinatus, and subclavian muscles, and the clinical manifestations corresponding to the damage of such muscles may disappear clinically, which helps in the diagnosis and treatment of anterior oblique angle muscle syndrome.

Surgical significance

Treatment of suprascapular nerve entrapment: Common clinical treatments for suprascapular nerve entrapment include suprascapular transverse ligament resection [7] and arthroscopic suprascapular nerve release [8]. The size and shape of the Suprascapular Notch (SSN) may be a factor in suprascapular nerve entrapment, and the poor anatomical relationship between the suprascapular notch and the transverse scapular ligament is likely to cause entrapment of the suprascapular nerve and also affect the blood supply to the suprascapular artery [9]. When performing suprascapular transverse scapular ligament resection, attention should be paid to the alignment and involvement of the suprascapular artery. When performing arthroscopic suprascapular nerve dissection, choosing a medial approach close to the suprascapular notch can reveal the nerve and artery alignment more clearly and help to protect its function [8].

Brachial plexus nerve block anesthesia: Traditional brachial plexus nerve block uses a blind exploration technique to locate and puncture the nerve through anatomical landmarks on the body surface [10], because the suprascapular artery has more variants and often travels near the brachial plexus nerve, it is very easy to damage the suprascapular artery when using the traditional puncture method, which can lead to adverse consequences such as rupture of the vessel and entry of anesthetic drugs into the vessel. Therefore, when performing brachial plexus nerve block anesthesia, the cervical vessels should be investigated in advance to prevent accidental injury to the vessels. Ultrasound-guided brachial plexus nerve block anesthesia is recommended clinically, and studies have shown that ultrasound-guided brachial plexus nerve block anesthesia is significantly more effective than traditional brachial plexus nerve block anesthesia [11].

Subclavian arteriovenous puncture: Subclavian vein puncture is often chosen at the second segment of the subclavian vein, where the anterior oblique tendon posterior to this segment helps to protect the nearby vascular nerves and prevent accidental injury during puncture. To find the second segment of the subclavian vein, it is usually necessary to find the lateral part of the anterior oblique muscle first, but the suprascapular and transverse cervical arteries often pass through here, and these two arteries may be damaged during the puncture. Therefore, when performing a subclavian vein puncture, the vascular nerve structure of this area should be explored first before determining the location of the puncture needle to reduce unnecessary vascular injury.

Lymph node dissection for head and neck tumor surgery: Head and neck tumors are very prone to lymph node metastasis, so lymph node dissection is needed to control the metastasis of tumors when radical surgery for head and neck tumors is performed, and sometimes the suprascapular artery needs to be ligated [12]. Therefore, understanding the possible changes in the origin and pathway of the suprascapular artery can help stop the progression of tumor growth and prevent further deterioration of the disease.

Flap graft significance

Suprascapular artery suprascapular branch, infrascapular branch, and acromion branch as the tip of the scapular gland bone flap graft: According to current clinical studies, the suprascapular artery is rich in vascular structure at the scapular gland and is often used as an alternative area for bone flap grafting, and the suprascapular branch, infrascapular branch and acromion branch of the suprascapular artery can be used as blood donor arteries to nourish the grafted bone flap, increasing the diversity of clinical bone flap preparation [13-15]. Understanding the alignment and branching of the suprascapular artery is the basis for the preparation of scapular gland bone flaps.

Supraclavicular artery flap graft: The supraclavicular artery flap graft is commonly used to repair defects after tumor resection in the oral cavity, oropharynx, and hypopharynx [16], which is relatively simple to prepare and can be passed to meet the needs of repairing defects and has a high clinical utility value. Occasionally, the supraclavicular artery can be seen to originate from the suprascapular artery, and

understanding the structural relationship between the subscapular artery and the supraclavicular artery is a necessary preparation before preparing the supraclavicular flap. However, the supraclavicular artery mostly originates from the transverse cervical artery, and the supraclavicular artery originating from the suprascapular artery is relatively rare, so its clinical significance remains to be studied.

The variation of the right three arteries' coaptation has mainly certain anatomical features and its clinical significance remains to be studied. So next, we will briefly explain the clinical significance of the right three arteries co-intersection in the context of our clinical experience and look forward to a more detailed additional explanation from other scholars.

1. The trunk, which travels among the brachial plexus nerves, may be injured during the brachial plexus anesthetic block procedure.
2. The trunk travels between the upper and middle trunks of the brachial plexus and may be subject to compression of the brachial plexus nerve, resulting in muscle weakness due to insufficient blood supply to the scapular region.
3. Surgery related to the subclavian artery may cause injury to the trunk or branches. Interventional treatment of subclavian artery stenosis, aorta-subclavian artery-carotid artery bypass surgery, and other surgical operations may cause medically induced damage to the trunk and branches.
4. The trunk or branches may be damaged during clavicle fracture and it may be difficult to sort out the complex relationship between the vessels when performing surgery.

Conclusion

We describe a rare bilateral variation of the arteries in the clavicular region, which has been seldom described in China. The variation in the distribution of the superior scapular artery gives it an increased probability of being injured and entrapped in the event of rotator cuff injury, clavicle fracture, or Naffziger's syndrome, whereas the clinical significance of the variation in its organogenesis lies more in linking the internal thoracic artery to the blood supply of the scapular muscles.

Ethics Approval Statement

This study was conducted in accordance with the Hippocratic Declaration, and ethical approval was obtained from the review committee of the School of Medicine at Sun Yat-sen University.

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