

## ANATOMICAL SUPERFICIAL CERVICAL ARTERY AND PERFORATING BRANCHES USING MULTI-DETECTOR COMPUTED TOMOGRAPHY

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### SUMMARY

**Objectives:** To study the anatomy of the superficial cervical artery using multi-detector computed tomography **Subjects and methods:** A describe a case series of 31 patients who had performed multi-detector computed tomography and reconstructed the superficial cervical artery at the Hoa Hao Medical Diagnostic Center, Ho Chi Minh City. Patients are randomly selected. **Results:** We recorded the following results through the survey of 31 cases: average age  $57.52 \pm 14.06$  years. We note that 29/31 cases have to originate from the transverse cervical artery. The average length of the superficial cervical artery is  $83.02 \pm 25.78$  mm, and the average diameter is 2.45 mm. The distance from the position of fascial perforating branches to the horizontal spine of C7 and the occipital tail is respectively  $59.91 \pm 12.05$  mm and  $97.71 \pm 30.29$  mm. The average number of perforating branches is 1.40. **Conclusion:** Multi-detector computed tomography is useful in the investigation of the superficial cervical artery. However, it is difficult to investigate perforating branches.

\* Keyword: Superficial cervical artery; Transverse cervical artery; Perforating trapezius branches.

### INTRODUCTION

Superficial cervical artery comes from the transverse cervical artery, originating from the artery branch on the shoulder. The Superficial cervical artery passes through the trapezius muscles to the subcutaneous tissue and the skin tissue. Superficial cervical arteries join blood vessels around the shoulder blades. Because of anatomical characteristics, the superficial cervical artery flap was first reported by Nakajima and Fujino in 1984

[1]. Since then, Rei Ogawa and his colleagues developed it for use as a skin flap in 1990, and in 1993, they succeeded in removing it as a free flap. Since 1986, they have performed 41 superficial cervical artery flaps of all types from 32 patients to reconstruct cervical scars [2]. Later, when we reviewed the literature, we found that few studies used superficial cervical artery flaps. One of the main reasons is the lack of clinical data and anatomical images of the superficial cervical artery,

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so the use of this flap is relatively limited. Previous techniques commonly used to examine arteries were angiography, in which they injected the contrast material in veins and performed on a cadaver [3]. With the development of diagnostic imaging devices, multi-detector computed tomography could survey blood vessels with dimensions from 1mm. For the above reasons, we carried out this research: *To study the anatomy of the superficial cervical artery using multi-detector computed tomography.*

## SUBJECTS AND METHODS

### 1. Subjects

31 cases who were performed the MDCT to evaluate the superficial cervical artery at the Hoa Hao Medical Diagnostic Center, Ho Chi Minh City. The patient had selected randomly. Patients were carefully explained the procedure, purpose, and safety of this method and agreed to participate in the study.

### 2. Methods

\* *Study design:* A series of descriptive studies.

\* *Protocol of MSCT at Hoa Hao Medical Diagnostic Center:*

The patient was consulted and explained the process of MDCT Fasting carefully before shooting 6 hours.

In the supine position, intravenous iodine contrast is injected from the arm vein.

. Set machine parameters

- Using Toshiba Aquilion One (640 MSCT)

- Enter the full information data of the patient.

- Cut the thickness of the cutting layer thickness: 0.5 mm.

- Kv: 100, mAs: 150 - 250. Pitch 0.6 - 1,375

- Speed of rotation 0.33 - 0.5s

- FOV: Choose as small as possible.

- Contrast injection into a right arm vein

- Dose of contracted solution:  $\leq 1\text{mL/kg}$

Processing [6]:

- Step 1: Cut in two vertical and horizontal planes (coronal and axial)

- Step 2: Cut a thickness of 0.5 mm in front of the heart to locate the end of the abdominal aorta to set the density measurement point for the Bolus timing program.

- Step 3: CT-scan after contrast injection starts artery branches on the straps until the carotid artery is common on both sides.

\* *Reconstructing artery:*

Using specialized software (MIP, VR) regenerates the artery in different directions, prioritizing to exposing the superficial cervical artery and the transverse branches that provide the skin flap.

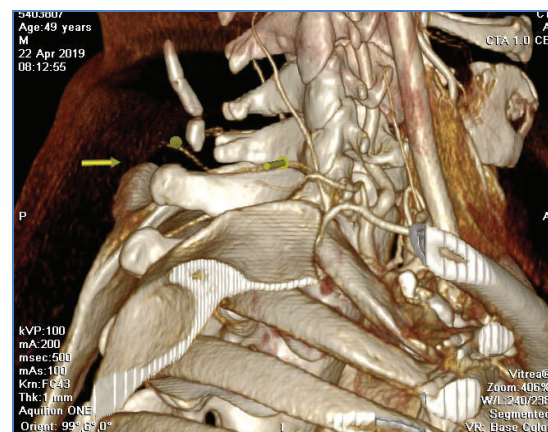


Figure 1: A superficial cervical artery through background angiogram (yellow arrow).

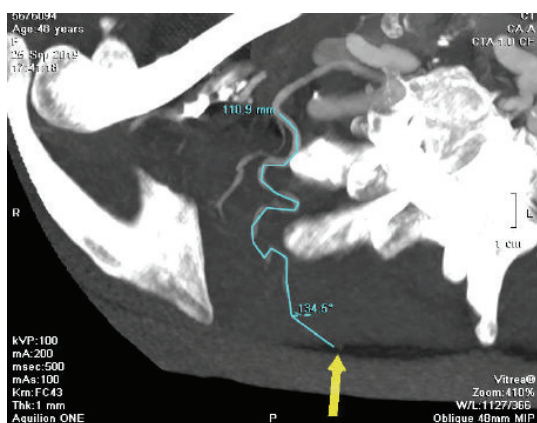
\* *Investigate features of superficial cervical arteries and perforating branches:*

- Determining the origin of the superficial cervical artery.
- The length (mm) of the artery is calculated from the root to the position of perforating fascia.
- Diameter (mm) of the superficial cervical artery.

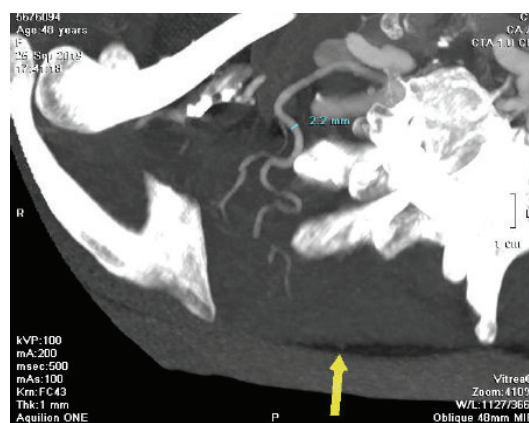
- Determining the location of origin and path of the two arteries related to other components.

- Determining the number of transverse branches of the superficial cervical artery. Determine the number of branches, paths, and related.

- Determine the distance from the perforating fascia to the spinous process of the C7 spine and the occipital bone.



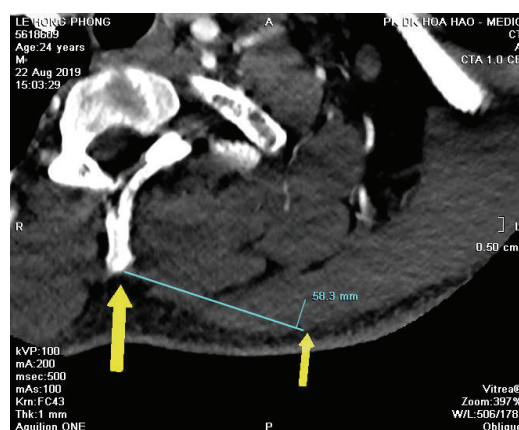
Length of superficial cervical artery from origin to position of perforating fascia



Diameter of superficial cervical artery



The distance from the position of perforating fascia to the occipital bone



The distance from the position of perforating fascia to the spinous process of C7 spine

*Figure 2: Characteristics of a superficial cervical artery in MDCT.*

\* *Data processing:* Data was collected and analysed by SPSS 20.0.

**RESULTS**

From 1/2019 to 12/2019, we collected 31 cases who had performed the MDCT and reconstructed the superficial cervical artery survey at Hoa Hao Medical Diagnostic Center - Ho Chi Minh City. The average age of patients was  $57.52 \pm 14.06$  years.

Regarding the origin of the superficial cervical artery, we note that 29/31 cases have an origin rising from the transverse cervical artery. There is 1 case derived from the thyrocervical trunk and 1 case originating from the cervico-dorso-scapular trunk.

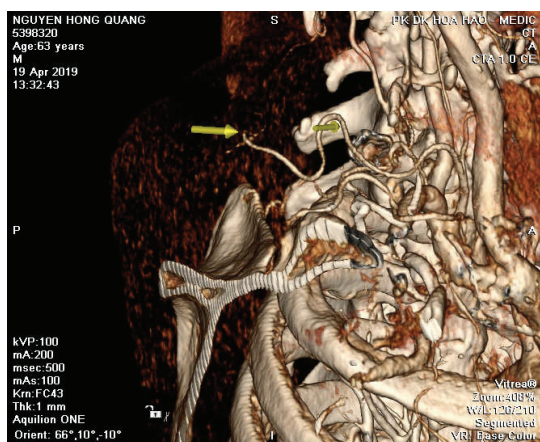
The superficial cervical artery with an average length from the origin to the perforating fascia is 106.7 mm. The average diameter is 1.84 mm, the highest is 2.2 mm, and the lowest is 1.3 mm. Regarding the superficial cervical artery position, the distance from the perforating fascia to the spinous process of the C7 spine and the occipital bone is  $39.17 \pm 9.95$  mm and  $133.97 \pm 19.811$ , respectively. The average number of perforating branches is 2.63, and the highest is 5 branches and at least 2 branches. In addition, we note that the average angle of the superficial cervical perimeter across the scale is  $144.59 \pm 21.62$  degrees.

*Table 1: Characteristics of patients.*

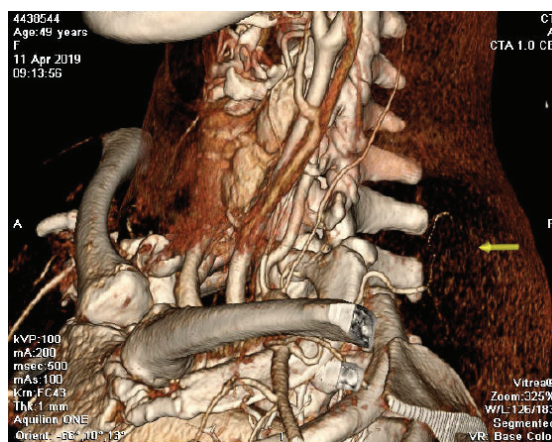
	<b>n (n = 31)</b>	<b>Ratio (%)</b>
Sex		
Male	15	48.4
Female	16	51.6
Age	$57.52 \pm 14.06$	

*Table 2: Anatomy of the superficial cervical artery.*

	<b>Mean</b>	<b>Range</b>
The length from the root to the position of perforating fascia (mm)	$83.02 \pm 25.78$	70.2 - 143.6
Diameter of superficial cervical artery (mm)	$2.45 \pm 0.41$	0.6 - 2.8
The distance from the position of perforating fascia to the spinous process of the C7 spine (mm)	$59.91 \pm 12.05$	22.0 - 85.5
The distance from the position of perforating fascia to the occipital bone (mm)	$97.71 \pm 30.29$	33 - 142.2
Number of branches	$1.40 \pm 0.62$	1 - 3
Angle of the superficial cervical perforating the fascia	$144.59 \pm 21.62$	95.4 - 177.2
Diameter of superficial cervical artery at the perforating fascial position (mm)	$1,17 \pm 0,15$	0.92 - 1.29



Originating from the thyrocervical trunk



Originating from the cervico-dorso-scapular trunk

Figure 3: Originating of the superficial cervical artery.

### DISCUSSION

Through an anatomical survey of superficial cervical arteries in 31 cases, we found that the superficial cervical artery had on average 1.40 branches, and the average length was 83.05 mm. This shows that the dorsal skin will have the blood supply plentiful, which is the basis for using the superficial cervical artery flap in reconstructed the posterior cervical defects. In addition, we found that the angle of the dorsal plane consistent with the superficial cervical perforating fascia was  $144.59 \pm 21.62$  degrees. This shows that turning the skin flap from the tip of the shoulder to the spine will reduce the lack of vascular twisting, reducing the proportion of the skin necrosis due to unsupply blood.

We found that the average length of the superficial cervical artery was 83.05 mm, suggesting that the expected flap length could be > 20 cm. Ogawa [2] reported 41 cases of superficial cervical

artery skin flap showing that 23/41 cases had flap length > 30 cm and 31/41 cases had flap width > 10 cm, skin flap size the largest one is 35 x 14 cm, and the smallest is 12 x 6 cm. With such flap size, the author only noted that 4/41 cases flap necrotic at distal part. This proves that the superficial cervical artery flap can get large in size and cover the high damage.

When investigating the origin of the superficial cervical artery, we found that 29/31 cases are originating from the transverse cervical artery; there is 1 case derived from the thyrocervical trunk and 1 case originating from the cervico-dorso-scapular trunk. By Weiglein [5], an analysis of 498 fresh cadavers showed that the origin of superficial cervical artery from the transverse cervical artery only accounted for 16%. Superficial cervical artery usually comes from the common body of the supraclavicular artery (20%) and the cervico-dorso-scapular artery (20%)

In 2019, another study by author Bulbul on the variants of the lateral cervical artery in 135 patients with 64-slice computed tomography with vascular contrast injection showed five types of

variations of the arterial branches. Lateral neck vessels. The author noted that 68% of superficial cervical artery THD originates directly from the body of the thyroid gland in the neck [7].

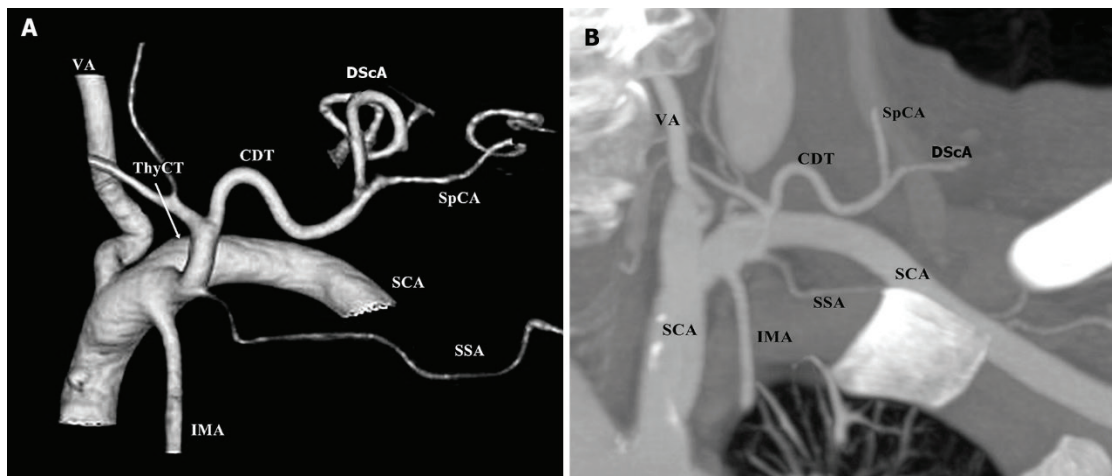


Figure 4: Anatomy variants of neck artery branches in MDCT [7].

CDT: Cervicodorsal trunk; CDST: Cervicodorsoscapular trunk; CST: Cervicoscapular trunk; DScA: Dorsal scapular artery; DST: Dorsoscapular trunk; IMA: Internal mammary artery; SCA: Subclavian artery; SpCA: Superficial cervical artery; SSA: Suprascapular artery; ThyCT: Thyro-cervical trunk; VA: Vertebral artery.

When we reviewed the literature, we found very few reports on the anatomy of the superficial cervical artery branch. Most superficial cervical arteries are referred to as a small branch of the transverse cervical artery. We note the diameter is on average 2.45 mm, the large diameter is 2.8 mm. Ogawa [2] found that all the diameters of the superficial cervical artery in 41 plastic surgery were larger than 0.7 mm. Philippe et al. studied the anatomical trapezius muscle on 58 cadavers confirming the superficial cervical artery branched blood supply to the middle and distal region of the trapezius muscle, the branches

through the muscle to the skin and in place perforating fascia, diameter is 0.7 mm or more [4]

Although there are many variations in the origin of the superficial cervical artery, the trans-muscular position of the superficial cervical artery is relatively constant across studies. Our study showed the correlation of the trans-muscular position of the superficial cervical artery with anatomical landmarks: the distance from the position of the trans-fascial superficial cervical artery to the C7 vertebral column and the external occipital fossa was  $59.91 \pm 12.05$  mm, respectively, and  $97.71 \pm 30.29$  mm.

This helps to locate the transverse position of the superficial cervical artery in practice during surgery.

### **CONCLUSION**

Multi-detector computed tomography is effective for examining the superficial cervical artery branch. However, this is an expensive method, so it is not widely available. In addition, MDCT scans cannot examine the perforating branches when crossing the superficial cervical artery's fascia and the perfusion region.

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