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Anatomical investigations of the cutaneous branches of the circumflex scapular artery and their communications

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SUMMARY. **The vascular anatomy of the cutaneous branches of the circumflex scapular artery and their communications with perforators supplying adjacent territories are described, based on dissections of 20 scapular regions. The cutaneous branches of the circumflex scapular artery are distributed in three areas by the ascending, horizontal and descending branches. The existence of the ascending branch was constant, confirming the reliability of the ascending scapular flap.**

Anatomical investigations of the horizontal and descending branches of the circumflex scapular artery have been carried out by Dos Santos (1980), Gilbert (1980), Mayou *et al.* (1982) and Nassif *et al.* (1982), and as a result, the scapular and parascapular flaps have been developed and used for various reconstructions. Kim *et al.* (1987) also described the arterial network and communications between the circumflex scapular artery, the thoracodorsal artery and others within the dorsal thoracic fascia.

In some anatomical textbooks, a significant branch of the circumflex scapular artery running in an upward direction is shown (Manchot, 1889; Pernkopf, 1964; Lanz and Wachsmuth, 1972). Based on this cutaneous branch, Maruyama (1991) described the ascending scapular flap and used it successfully in the treatment of axillary burn scars.

There has been no report on the anatomy of the ascending cutaneous branch of the circumflex scapular artery in any detail, so we carried out anatomical investigations of the cutaneous branches of the circumflex scapular artery.

Materials and methods

Twenty scapular regions in adult cadavers fixed in formalin were dissected. In 8 scapular regions, a lead oxide mixture was injected. Anatomic dissections were made on half of the back from the iliac crest to the acromion and neck, preserving the dorsal thoracic fascia.

The cutaneous branches of the circumflex scapular artery

We investigated the distributions, directions, diameters and communications of the cutaneous branches after the point at which the circumflex scapular artery perforated the dorsal thoracic fascia through the triangular space of the axilla. The common trunk was measured at the point where it perforated the dorsal thoracic fascia. The terminal branches were measured at the bifurcation. If there were multiple terminal branches, the largest branch was measured.

The communicating vessels of the ascending branch

We also investigated the perforators which communicate with the ascending branches directly concerning their number, location, diameters and origin, in the same 20 scapular regions.

The eight scapular regions containing lead oxide mixture were radiographed using xerography, and we studied how the cutaneous branches of the circumflex scapular artery linked with the adjacent vascular territories.

Results

The circumflex scapular artery originated from the subscapular artery, and divided into several branches. The first branch arose deep and entered the sub-

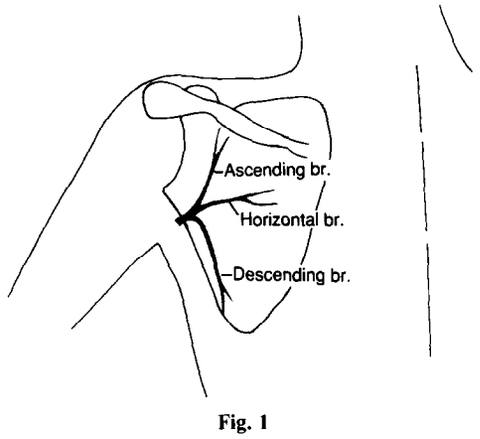

Fig. 1

Figure 1—The cutaneous branches of the circumflex scapular artery are distributed in three areas: the ascending, horizontal and descending branches.

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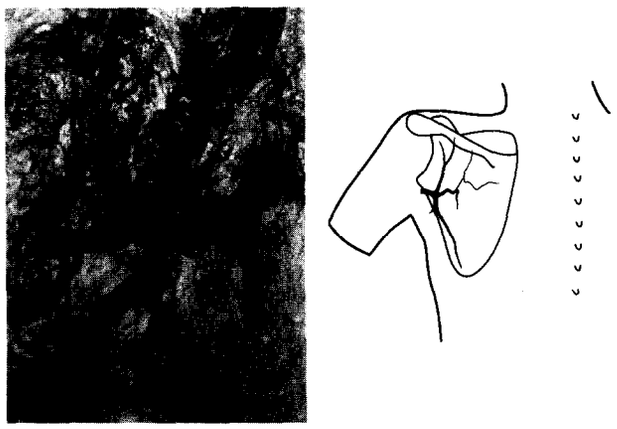

Fig. 2

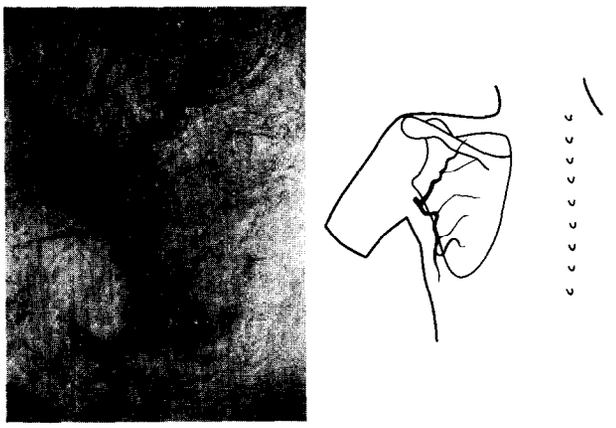

Fig. 3

Figure 2—The ascending, horizontal and descending branches in a dissection. **Figure 3**—Dominant ascending and descending branches and a diminutive horizontal branch.

Table Diameters of the cutaneous branches of the circumflex scapular artery

	Number	Diameter (mm)	Mean (mm)
Common trunk	20/20	0·8–1·4	1·2 (±0·2)
Ascending br.	20/20	0·2–1·2	0·6 (±0·3)
Horizontal br.	20/20	0·1–1·2	0·4 (±0·3)
Descending br.	20/20	0·4–1·2	0·8 (±0·1)

scapularis muscle, and ran between the muscle and the deep surface of the scapula. Then three or four branches arose and supplied the lateral border of the scapula, the teres major, supraspinatus and teres minor muscles. Finally, the cutaneous branch passed through the triangular space, perforated the dorsal thoracic fascia, and divided into several terminal branches within the fascia. In 19 cases, one cutaneous branch passing through the triangular space was observed. In one case two cutaneous branches perforated the dorsal thoracic fascia, one passing through the triangular space and the other one passing below the teres major muscle.

The cutaneous branches of the circumflex scapular artery

The cutaneous branches of the circumflex scapular artery were distributed in three areas: horizontal and downward directions, and also in an upward direction. These are the horizontal, descending and ascending branches (Figs 1, 2 and 3).

In all cases, ascending, horizontal and descending

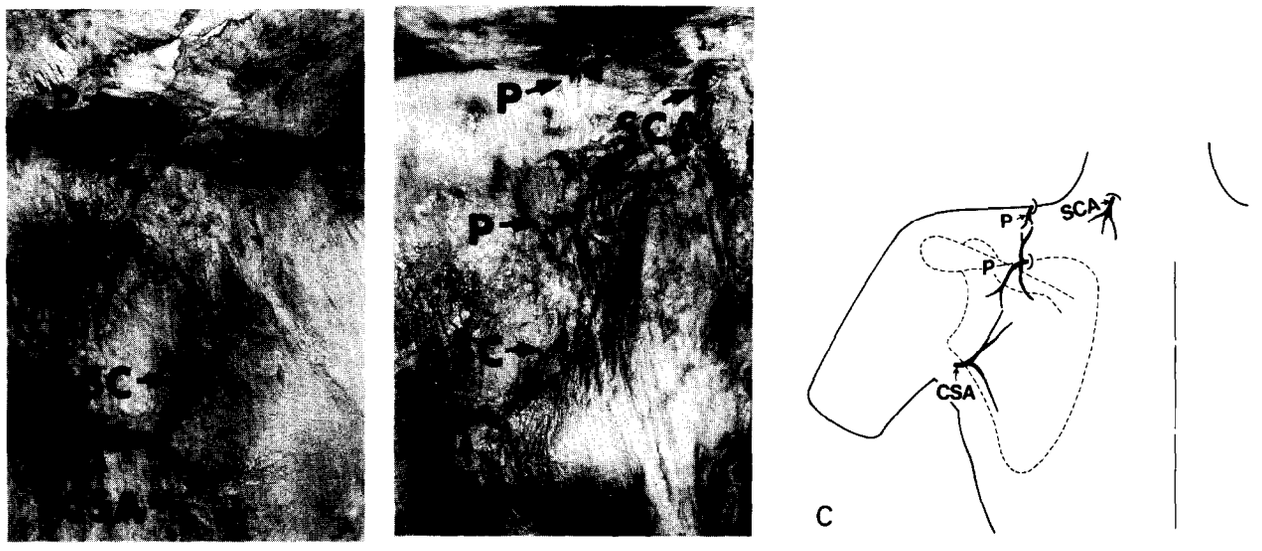

Fig. 4

Figure 4—(A) The ascending branch communicating with the perforating (through the trapezius muscle) branch of the superficial branch of the transverse cervical artery above the spine of the scapula. CSA: circumflex scapular artery; ASC: ascending branch; P: perforating branch of the superficial branch of the transverse cervical artery. (B) The perforating branch communicating with the next perforating branch of the superficial branch of the transverse cervical artery superiorly. The ascending branch also connects with the perforating branch of the superficial cervical artery through the trapezius muscle toward the neck. P: perforating branch of the superficial branch of the transverse cervical artery; SCA: perforating branch of the superficial cervical artery. (C) Schematic diagram of (B).

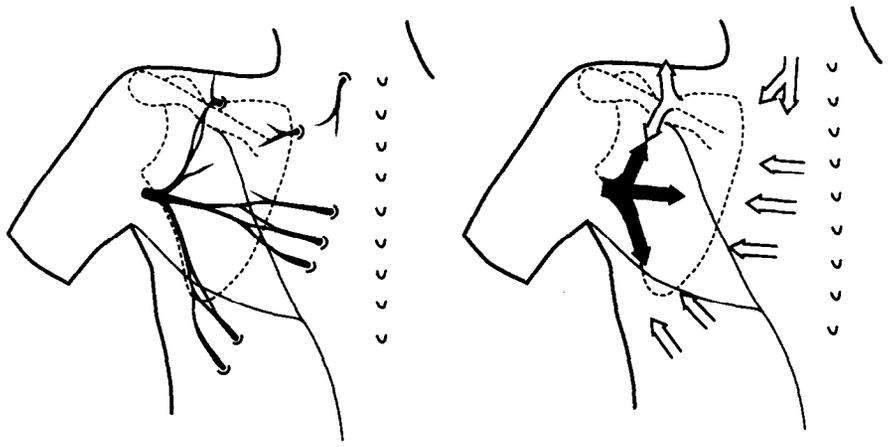

Fig. 5

Figure 5—The cutaneous branches of the circumflex scapular artery form a vascular network with the perforating branches of the transverse cervical, suprascapular, intercostal and thoracodorsal artery and others.

Fig. 6

Figure 6—Angiogram of the scapular region including the dorsal thoracic fascia. CSA: circumflex scapular artery; ASC: ascending branch; P: perforating branch of the superficial branch of the transverse cervical artery.

branches were found. Each mean diameter was 0.6, 0.4 and 0.8 mm respectively, while that of the common trunk was 1.2 mm (Table).

These results indicate the constant existence of the ascending branch as well as horizontal and descending branches.

The communicating vessels of the ascending branch

In the investigation of the communicating vessels of the ascending branch of the circumflex scapular artery, one, two or three branches of the transverse cervical artery or suprascapular artery which perforated through the trapezius muscle were found in all cases (Fig. 4A). The locations of the perforators were on a parallel line to the spine of the scapula 1 cm above it. A concentration of the perforators was found above the middle of the spine of the scapula. The mean diameter of the largest branch in each case was 1.0 ± 0.2 mm. Twenty six perforators in 18 cases arose from the superficial branch of the transverse cervical artery. Nine perforators in 5 cases arose from the suprascapular artery.

The ascending branch also connected with the branch of the superficial cervical artery which perforates through the trapezius muscle near the base of the neck (Fig. 4B and C).

The horizontal branch communicated mainly with the posterior branches of the intercostal artery, and the descending branch communicated mainly with the musculocutaneous perforators of the intercostal and thoracodorsal artery through the latissimus dorsi muscle.

These cutaneous branches of the circumflex scapular artery and the perforating branches of the transverse cervical, suprascapular, intercostal and thoracodorsal artery form the vascular network within the dorsal thoracic fascia (Fig. 5).

Study of the angiograms also supported these results (Fig. 6).

Discussion

Our investigations have defined more clearly the division of the cutaneous branches of the circumflex scapular artery. Furthermore, the constant existence of the ascending branch was indicated, so the reliability of the ascending scapular flap (Maruyama, 1991) was substantiated.

The concept of three axes based on the ascending, horizontal and descending branches of the circumflex scapular artery allows many more flap designs in the scapular region.

Cormack and Lamberty (1986) described how the

dynamic territories would extend over their anatomical territories into the area of decreased intravascular pressure. Taylor (Taylor and Palmer, 1987; Taylor *et al.*, 1990) used the angiosome and venosome concepts to describe how the arterial and venous networks of the integument are continuous systems of linked vascular territories.

In clinical cases, the ascending scapular flap (Maruyama, 1991) has been extended to the neck, while the cervicoscapular flap (Hyakusoku *et al.*, 1990) based on the superficial cervical artery has been extended to the scapular region using the above principles of vascular communications.

Similarly a flap based on the perforating branch of the transverse cervical artery above the spine of the scapula might be extended to the scapular region using direct communications with the ascending branch of the circumflex scapular artery.

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References

Cormack, G. C. and Lamberty, B. G. J. (1986). *The Arterial Anatomy of Skin Flaps.* Edinburgh, Churchill Livingstone, p. 6.

Dos Santos, L. F. (1980). Retalho escapular: um novo retalho livre microcirurgio. *Revista Brasileiria de Cirurgia*, **70**, 133.

Gilbert, A. (1980). Le lambeau scapulaire. *Vième Reconstres Internationale de Micro Chirurgie, 1980.*

Gilbert, A. and Teot, L. (1982). The free scapular flap. *Plastic and Reconstructive Surgery*, **69**, 601.

Hyakusoku, H., Yoshida, H., Okubo, M., Hirai, T. and Fumiiri, M. (1990). Superficial cervical artery skin flaps. *Plastic and Reconstructive Surgery*, **86**, 33.

Kim, P. S., Gottlieb, J. R., Harris, G. P., Nagle, D. J. and Lewis, V. L. (1987). The dorsal thoracic fascia: anatomic significance with clinical applications in reconstructive microsurgery. *Plastic and Reconstructive Surgery*, **79**, 72.

Lanz, T. and Wachsmuth, W. (1972). *Praktische Anatomie.* 3rd Ed. Berlin, Springer-Verlag, p. 367.

Manchot, C. (1889). *Die Hautarterien des menschlichen Korpes.* Leipzig, Vogel.

Maruyama, Y. (1991). Ascending scapular flap and its use for the treatment of axillary burn scar contracture. *British Journal of Plastic Surgery*, **44**, 97.

Mayou, B. J., Whitby, D. and Jones, B. M. (1982). The scapular flap. An anatomical and clinical study. *British Journal of Plastic Surgery*, **35**, 8.

Nassif, T. M., Vidal, L. and Baudet, J. L. (1982). The parascapular flap: a new cutaneous microsurgical free flap. *Plastic and Reconstructive Surgery*, **69**, 591.

Pernkopf, E. (1964). *Atlas der topographischen und angewandten Anatomie des Menschen.* München, Urban & Schwarzenberg, p. 25.

Taylor, G. I. and Palmer, J. H. (1987). The vascular territories (angiosome) of the body: experimental study and clinical applications. *British Journal of Plastic Surgery*, **40**, 113.

Taylor, G. I., Caddy, C. M., Watterson, P. A. and Crock, J. C. (1990). The venous territories (venosome) of the human body: experimental study and clinical implications. *Plastic and Reconstructive Surgery*, **86**, 185.

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