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# The subscapular artery and the thoracodorsal branch: an anatomical study

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*The motive for this research was the use of the muscles of the scapular region in transposition, transplantation and reparative surgery and the need for more detailed knowledge of the blood supply to these muscles. In addition, the subscapular arterial tree may be used as a source of microvascular grafts to replace damaged or diseased portions of arteries, particularly in the hand and forearm. The research was conducted on 60 sides of corpses of adults of both sexes. It was noticed that the subscapular artery was present in 96.7% of cases and originated laterally to the pectoralis minor muscle in 76.7% of cases. The average calibre was 5.0 mm, and in 73.2% of cases it measured between 4.0 and 5.9 mm. The average length was 18.0 mm, ranging from 10.0 to 29.9 mm (76.7%). It presented in its course important relations with the axillary nerve (69%) and with the radial nerve (82.8%). Its branches were collateral (subscapular muscle — 61.3%) and terminal (except for the circumflex scapular artery), leading to the following muscles: serratus anterior (43.9%), latissimus dorsi (27.6%), and subscapular (23.3%). The thoracodorsal artery, one of the terminal branches, most frequently showed a calibre of between 2.0 and 3.9 mm (70.3%), collateral branches in 85.0%, was mainly distributed to the subscapular muscle (36.7%) and to the serratus anterior muscle (29.0%) and had terminal branches to the following muscles: latissimus dorsi (44.1%), serratus anterior (40.5%) and the subscapular (12.5%). The serratus anterior muscle received one branch in 39.5% and two branches in 41.9%, while the latissimus dorsi muscle received one branch in 66.7% and two branches in 23.1%.* (Folia Morphol 2008; 67: 58–62)

**Key words: morphology, vascular anatomy, vascularisation of the axillary region**

## INTRODUCTION

The use of muscle patches, myocutaneous, osteomuscular and even muscle fascia in reconstructive surgery of the head, neck and limbs is becoming increasingly frequent. The, the subscapular arterial tree may also be used as a source of microvascular grafts to replace damaged or diseased portions of arteries, particularly in the hand and forearm [10].

The development of reparative surgery has demanded more detailed anatomical knowledge of the blood supply and innervation of muscles in general and of those with more significant surgical application in particular [1, 5, 9].

Anatomy textbooks do not describe these structures with the necessary depth, either because they were designed at a time when this type of surgery was only

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in its early stages, or because descriptions of the structures mentioned above were not their main objective.

The muscles of the scapular and axillary regions, mainly the serratus anterior and the latissimus dorsi, are among those most commonly used in reparative surgery [2, 12].

Despite the importance of the applications, the books that referred to in the research revealed much uncertainty concerning the blood supply to these muscles. Van Thienem [11] mentions the angular artery, while Fontaine et al. [4] reaffirm the anatomical variations of the arteries mentioned above and add their description of a case of blood supply of the serratus anterior by the first intercostal artery.

The current importance of knowledge of blood supply to the muscles of the scapular region and the controversies that persist in the literature were the reasons for our study of the subscapular artery and its thoracodorsal branch, focusing on new objectives which have not yet been dealt with thoroughly in the existing literature. It is our sincere hope that this study proves useful for surgeons specialising in reparative surgery.

## MATERIAL AND METHODS

Thirty adult corpses, of both sexes, aged 26 to 78 and preserved in formaline 10% formed the subject of the study. The dissections were performed on the axillary regions on both sides, 60 axillary arteries in all.

To dissect, we placed the superior limb on a 45° abduction, and the incision, through skin and subcutaneous tissue, went from the central point of the axilla to the medial epicondyle, towards the arm, and then on to the costal margin towards the thoracic wall. The patches thus formed were folded medially and laterally, exposing the entire extension of the axillary region. The axillary artery was then exposed until the subscapular artery and the radial and axillary nerves could be identified. The subscapular artery was carefully dissected, accompanying its collateral branches as far as the thinnest. We then exposed the thoracodorsal artery, identifying the distribution of its collateral and terminal branches.

In the measurements, made with a caliper ruler, we kept the vases in their original positions in the body to avoid diameter and length changes.

## RESULTS

### Subscapular artery

The subscapular artery was present in 96.7% of cases as the right branch of the axillary artery. Where it was absent (3.3%), the circumflex scapular artery and the thoracodorsal artery originated directly from the axillary artery (Fig. 1). Taking the pectoral minor muscle as a reference, the origin of the subscapular artery occured posterior to the muscle (2nd portion) in 15.0% and lateral to the muscle (3rd portion) in 76.7%. The most frequent calibres were between 4.0 and 5.9 mm (73.2%), 1.4 mm being the lowest, 11.6 mm the highest and 5.0 mm the average. The length of the subscapular artery until its division into the terminal branches most frequently measured between 10.0 mm and 29.9 mm (76.7%), 3.6 mm being the shortest, 43.5 mm the longest and 18.0 mm, the average.


**Figure 1.** Subscapular artery missing, thoracodorsal (t) and circumflex scapular (ce) arteries originate from the axillary artery (ax); a, b, c — branches of the thoracodorsal artery to the serratus anterior muscle; d, e — branches of the thoracodorsal artery to the latissimus dorsi muscle.

### Relations between the subscapular artery and the nerves

In 69% of cases the artery was near the axillary nerve. In 32.8% the artery crossed the nerve anteriorly and in 27.6% the artery crossed it posteriorly (Fig. 2).


**Figure 2.** Subscapular artery and the thoracodorsal branch; a — axillary artery, b — axillary nerve, c — subscapular artery, d — collateral branch of the subscapular artery to the subscapular muscle, e — circumflex scapular artery, f — thoracodorsal artery, g — collateral branch of the thoracodorsal artery to the latissimus dorsi muscle, h — terminal branch of the thoracodorsal artery to the latissimus dorsi muscle, i — terminal branch of the thoracodorsal artery to the serratus anterior muscle.


**Figure 3.** Terminal branches of the subscapular artery; a — subscapular artery, b — lateral thoracic artery, c — circumflex scapular artery, d — thoracodorsal artery, e — branch to the subscapular muscle, f — branch to the serratus anterior muscle, g — branch to the subscapular muscle, h — branch to the latissimus dorsi and teres major muscles, i — branch to the subcutaneous tissue of the axilla.

In 82.8% of cases there was a relation between the radial nerve and the subscapular artery. In 51.7% the artery crossed it anteriorly and in 27.6%, posteriorly.

### The collateral and terminal branches of the subscapular artery

In 67.2% of cases there were collateral branches, most frequently one (31.1%) or two (29.3%). The collateral branches of the subscapular artery were more commonly distributed to the subscapular muscle (61.3%) (Fig. 2) and to the shoulder joint (19.3%). In general, the subscapular artery showed two terminal branches (81.1%), the circumflex scapular and the thoracodorsal, while in the remaining cases (18.9%) there were three terminal branches (Fig. 3). The sites to which these headed are shown in Table 1.

### The thoracodorsal artery

Where the artery begins, it shows calibres ranging from 2.0 to 3.9 mm (70.3%), 0.5 mm being the lowest and 5.0 mm the highest.

**Table 1.** Distribution of the terminal branches of the subscapular artery (except the circumflex scapular artery)

| | |
|---|---|
| Latissimus dorsi m. | 32 (27.6%) |
| Serratus anterior m. | 51 (43.9%) |
| Subscapular m. | 27 (23.3%) |
| Teres major m. | 3 (2.6%) |
| Subcutaneous tissue | 3 (2.6%) |
| Total | 116 (100.0%) |

**Table 2**. Distribution of the collateral branches of the thoracodorsal artery

| | |
|---|---|
| Subscapular m. | 33 (36.7%) |
| Serratus anterior m. | 26 (29.0%) |
| Latissimus dorsi m. | 13 (14.4%) |
| Teres major m. | 3 (3.3%) |
| Teres minor m. | 1 (1.1%) |
| External intercostal m. | 1 (1.1%) |
| Subcutaneous tissue | 13 (14.4%) |
| Total | 90 (100.0%) |

**Table 3.** Distribution of the terminal branches of the thoracodorsal artery

| | |
|---|---|
| Latissimus dorsi m. | 60 (44.1%) |
| Serratus anterior m. | 55 (40.5%) |
| Subscapular m. | 17 (12.5%) |
| Teres major | 3 (2.2%) |
| Subcutaneous tissue | 1 (0.7%) |
| Total | 136 (100.0%) |

### The collateral and terminal branches of the thoracodorsal artery

In 85% of cases collateral branches of the thoracodorsal artery were found most commonly either one branch (35.0%) or two (33.3%). The distribution of these branches can be found in Table 2. There were most frequently two (72.9%) or three (11.9%) terminal branches. Their destinations are presented in Table 3. When the collateral and terminal branches are taken together, the relation of the muscles supplied by the thoracodorsal artery is shown in Table 4, with the respective number of branches in Table 5.

**Table 4.** General distribution of the branches (collateral and terminal), of the thoracodorsal artery to the muscles of the region (Fig. 2)

| | |
|---|---|
| Serratus anterior m. | 51 (86.5%) |
| Latissimus dorsi m. | 50 (84.8%) |
| Subscapular m. | 37 (62.7%) |
| Teres major and minor | 7 (11.9%) |

## DISCUSSION

In general, our results are similar to the findings in the literature consulted as far as the subscapular artery is concerned [8]. However, there are contributions to be made concerning the distribution of the branches of the thoracodorsal artery. In the findings of Rowsell et al. [8] the serratus anterior muscle received branches of the artery in 99% of cases and the subscapular muscle in 15%, but nothing is mentioned about the latissimus dorsi muscle. Our research showed branches to the following muscles: serratus anterior in 86.5%, latissimus dorsi in 84.8% and subscapular in 62.7%. In this study the serratus anterior receives two branches in 41.9% and one in 39.5%, while in the research of Rowsell et al. [8] the muscle received two branches in 24% and one in 72%. Many authors only cite branches of the thoracodorsal artery to the serratus anterior and latissimus dorsi muscles [3, 6, 7, 13].

Another contribution of this research was to show the relations of the subscapular artery with the axillary and radial nerves. In 69% of cases, the subscapular artery evidently approaches the axillary nerve, crossing it anteriorly (32.8%) or posteriorly (27.6%). In 82.8% of cases there is a relation between the subscapular artery and the radial nerve; the artery crosses it anteriorly in 51.7% and posteriorly in 27.6%.

On the basis of our results we can draw the following conclusions:

**Table 5.** Number of branches of the thoracodorsal artery to the muscles of the region

| | Serratus anterior m. | Latissimus dorsi m. | Subscapular m. |
|---|---|---|---|
| One | 17 (39.5%) | 26 (66.7%) | 18 (72.0%) |
| Two | 18 (41.9%) | 9 (23.1%) | 5 (20.0%) |
| Three and four | 8 (18.6%) | 4 (10.2%) | 2 (8.0%) |
| Total | 43 (100.0%) | 39 (100.0%) | 25 (100.0%) |

— The subscapular artery is constant (96.7%) and originates most commonly at the third portion of the axillary artery (76.7%). Its most frequent dimensions are calibre ranging from 4.0 to 5.9 mm (73.2%) and length ranging from 10.0 to 29.9 mm (76.7%). On its course it presents important relations with the axillary nerve (69.0%) and radial nerve (82.8%), crossing them anteriorly or posteriorly. Apart from terminal branches, it may show collateral branches (67.2%), mainly to the subscapular muscle (61.3%). It shows two terminal branches (81.1%): the circumflex scapular and thoracodorsal arteries.

— The thoracodorsal artery shows, in general, a calibre ranging from 2.0 to 3.9 mm (70.3%). It presents collateral branches (85.0%) that head mainly to the subscapular (36.7%) and serratus anterior (29.0%) muscles. Its terminal branches, generally two (72.9%), most frequently head to the latissimus dorsi (44.1%), serratus anterior (40.5%) and subscapular (12.5%) muscles. It sends branches to 86.5% of the serratus anterior muscles, 84.8% of the latissimus dorsi muscles and 62.7% of the subscapular muscles researched.

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