

# Variants of the thyrocervical trunk and its branches in human bodies

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## SUMMARY

The thyrocervical trunk or thyrobicervicoscapular trunk of Faraboeuf (TT) is a branch of the subclavian artery. In most cases, the following arteries arise from here: inferior thyroid artery (ITA), transverse cervical artery (TCA) and the suprascapular artery (SSA). However, this trunk can show many variants.

We dissected the supraclavicular region of 22 human bodies (12 males, 10 females) with the aim of studying the subclavian artery, and principally the TT (22 right trunks and 18 left ones), its disposition and number of branches, the existence of infundibular dilation, and the thickness of the branches. A statistical analysis of the data was performed. Our results show that the most frequent type of TT is that of 2 branches. No significant differences were found between the number of branches of the TT, nor with respect to sex or side. The infundibular region of the TT is an anatomical variant of considerable interest, this variant being more frequent in males on the right side and in trunks with a greater number of branches. The most frequent variants in our study with respect to the classic description were: the presentation of the ascending cervical artery (ACA) as a branch both of the TCA and of the TT; that of the TCA as a branch of the SSA or the subclavian, and the origin of the SSA directly from the subclavian artery itself. The calibre of the branches of one side or another was different, the most frequent observation being that the branches of the right side were thicker than those of the left. Our results confirm the high

variability of the TT and its branches, which must be considered of interest given the frequency with which this region is involved in both diagnostic and therapeutic procedures.

**Key Words:** Thyrocervical trunk – Anatomical variants – Infundibular dilation

## INTRODUCTION

The thyrocervical trunk or thyrobicervicoscapular trunk of Faraboeuf is a branch that originates from the anterosuperior side of the subclavian artery, distal to the vertebral artery, generally at the level of the internal thoracic artery.

In most cases it is a short, thick trunk from which the ITA (the principal branch), the TCA and the SSA arise, the ascending cervical artery (ACA) originating from the ITA (Williams and Warwick, 1985). This artery can exhibit many variants and these may not even be present if its branches originate directly from the subclavian artery itself (Testut and Latarjet, 1978).

Among the variations described, the infundibular dilation of the origin of the trunk or one of its branches in the case where they originate independently is especially important. This morphology, which is similar to that seen in other arteries (Abrams and Jönsson, 1983; Goebel et al., 1985), is the result of incomplete reabsorption during embryonic development and can mistakenly be considered pathological if its possible existence is not taken into consideration.

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## MATERIAL AND METHODS

In the present study we dissected 22 human bodies (12 males and 10 females), in each case studying the subclavian artery and its branches: principally the TT (22 right trunks and 18 left trunks). Only cadavers with no vascular pathology were included.

### *Anatomical intervention*

The supraclavicular region was dissected. The skin and subcutaneous cellular tissue was cut until the superficial cervical fascia was reached. Under the superficial fascia there is a second cellulofibrose plane: the investing layer of deep cervical fascia, divided into two parts by the omohyoid muscle. In the deep face of this second plane the following structures are found: in the upper part, the branches of the cervical plexus; in the lower part, the external jugular vein and the SSA.

In order to gain better access to the lower part of the region, a 6-8 cm portion of the clavicle must be sectioned. The prevertebral layer of deep cervical fascia was cut; the scalenus anterior muscle was separated, the deeper part of the fascia was lifted, and the scalenus posterior separated.

The subclavian artery is found behind the tendon of the anterior scalene and the SSA is observed here. In the celluloadipose tissue that fills the underlying space, the intrascapular portion of the subclavian artery is found and the TT with its branches, the ITA, the ACA, the TCA, and the SSA, can be identified (Testut et al., 1965).

### *Statistical analysis*

The following parameters were analysed: the number of branches of the TT; the number of infundibular dilations; the arterial variant according to its origin (frequency), and the thickness of the arterial branches (frequency). Each parameter was studied according to sex and age. In each result we obtained the mean, standard deviation and standard error. For data with Gaussian distributions, an analysis of variance (ANOVA) and a later study using Student's "t" and Newman-Keuls tests were performed. For the study of dependent variables (comparison between the left/right side of the same body), linear regression and Spearman's correlation were employed. Finally, for the evaluation of the non-parametric percentage data, the

statistical test of Z distribution was used. Calculations were made using Microsoft Office Windows Excel 5.0 and the SPSS 10.0 statistical package.

## RESULTS

### *Variability of the trunks*

Of the 40 subclavian arteries studied, we found TT in 38 (95%), 4 of which had four branches (Fig. 1A), 12 three branches (Fig. 1B) and 22 two branches (Fig. 1C). The only two cases in which this was absent corresponded to the right side in two males (Fig. 1D).

Separated according to side, of the 22 right subclavian arteries dissected we found a trunk of four branches in 2 cases, of three branches in 4, of two in 14 cases and no branches in 2. On the left side (18 subclavian arteries), we found 2 trunks with four branches, 8 with three and another 8 with two (Table 1).

Statistical comparison between the side and the number of branches of the TT was not significant ( $p=0.231$ ). The linear regression between the number of branches on each side with respect to the other was not significant. The same occurred with Spearman's correlation.

When separated according to sex, of the subclavian arteries dissected in females the TT was present in 20 cases (100%). None had four branches; 6 had three, and 14 had two. In males (20 subclavian arteries) we found trunks on 18 occasions (90%): 4 presented with four branches, 6 with three and 8 with two.

Statistical comparison between sex and the number of branches was not significant ( $p=0.65$ ). Correlation analysis did not show statistical significance.

Of the infrequent branches of the TT, we observed the internal thoracic artery in 4 cases (10%) (Fig. 1E).

### *Infundibular dilation*

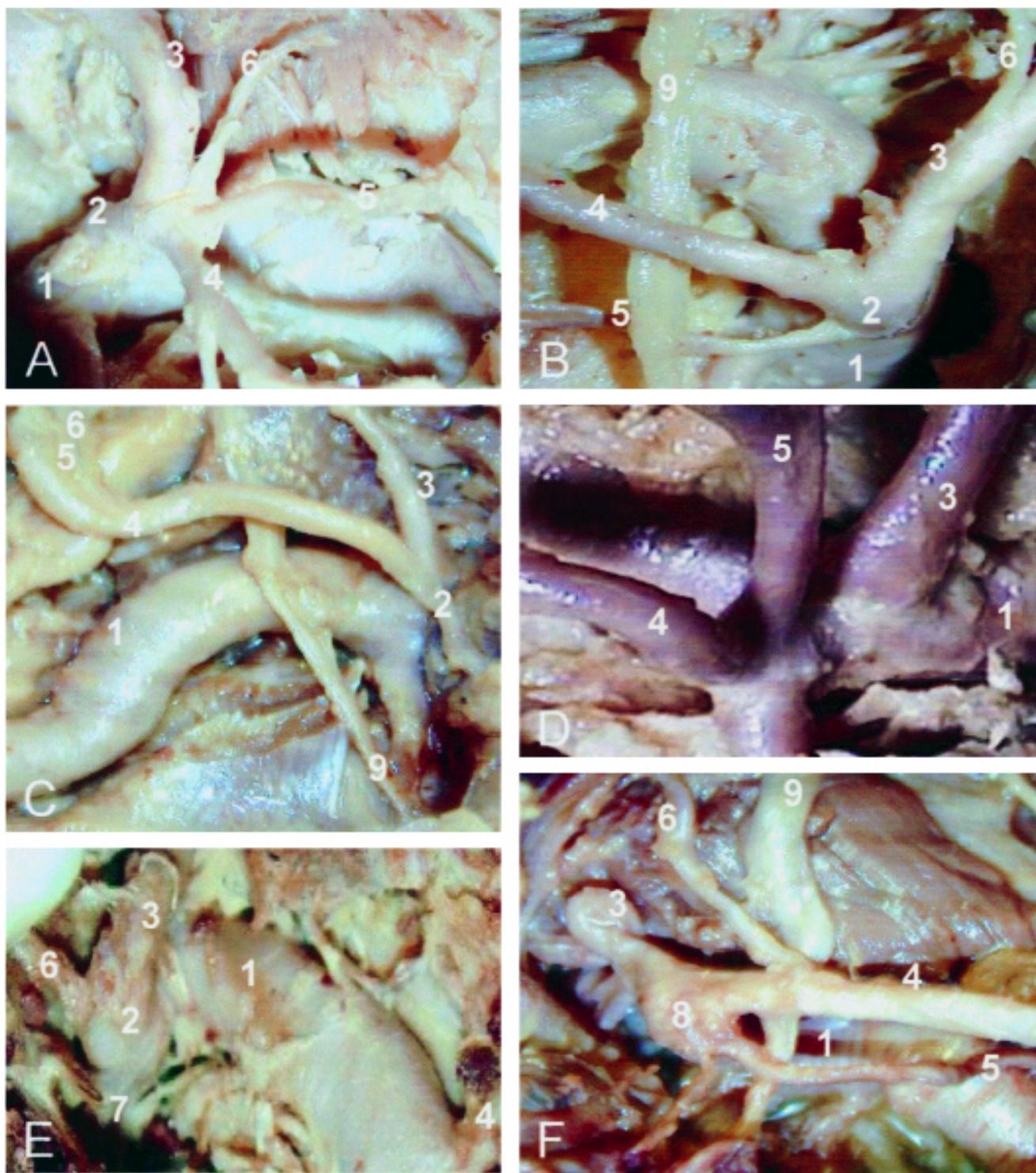
Of the 40 subclavian arteries dissected we found 6 infundibular dilations (15%): all in the TT and none in independent branches (Fig. 1F).

Distribution according to side: 4 infundibular dilations were right sided and 2 left sided.

Distribution according to sex: 4 infundibular dilations in males, all on the right side and 2 on the left side in females.

**Table 1.-** Percentages of the number of branches of the thyrocervical trunk (TT) according to side and sex.

Number of branches of the TT	Side		Sex		Total
	Right	Left	Male	Female	
4	9%	11%	20%	0%	10%
3	18%	44.4%	30%	30%	30%
2	63%	44.4%	40%	70%	55%
Absence of TT	9%	0%	10%	0%	5%



**Fig. 1.-** **A:** Thyrocervical trunk with four branches. **B:** Thyrocervical trunk with three branches. **C:** Thyrocervical trunk with two branches. **D:** Thyrocervical trunk absent. **E:** Internal mammary artery with origin in the thyrocervical trunk. **F:** Infundibular dilation of the thyrocervical trunk.  
 1: subclavian artery (*arteria subclavia*); 2: thyrocervical trunk (*truncus thyrocevalis*); 3: inferior thyroid artery (*a. thyroidea inferior*); 4: suprascapular artery (*a. suprascapularis*); 5: transverse cervical artery (*a. transversa cervicis*); 6: ascending cervical artery (*a. cervicalis ascendens*); 7: internal thoracic artery (*a. thoracica interna*); 8: infundibular dilation (*infundibulum*); 9: phrenic nerve (*nervus phrenicus*).

Distribution according to the number of branches of the TT: 2 infundibular dilations were in trunks with four branches (both on the right side in males) and 4 in trunks with three branches (2 on the right side in males and 2 on the left side in females) (Table 2).

The results of statistical analysis of the infundibular origin according to side and sex were not significant, with  $p=0.846$  and  $p=0.843$ , respectively.

**Table 2.-** Percentages of infundibular dilations according to the number of branches of the thyrocervical trunk (TT), side and sex.

	Number of branches of the TT				Side		Sex		Total	
	4	3	2	Absence	Right	Left	Male	Female		
Infundibular dilation		33.3%	66.6%	0%	0%	66.6%	33.3%	66.6%	33.3%	15%

### *Variability of the branches*

We found the following variants with respect to the typical morphology:

The ACA was observed in 36 cases (90%). It had the classic origin in the ATI in 16 cases (40%); in the TCA in 12 (30%); in the TT as an independent branch in 6 (15%), and 2 (5%) in the SSA.

Statistical analyses did not reveal significant differences on comparing the frequency of the classic origin in the ITA with that of its origin in the TCA ( $p=0.740$ ) nor as an independent branch in the TT ( $p=0.15$ ). The analysis did reveal significance on comparing the frequency of the classic origin of the ACA with that of its origin in the SSA ( $p=0.023$ ).

The TCA was found in 40 cases (100%), and had its origin in the TT in 32 cases (80%), in the SSA in 6 (15%) and in the subclavian in 2 (5%).

Clear statistical significance was seen in the relationship between the frequency of the origin of the TCA in the TT (classical variant) with respect to that of its origin in the subclavian and in the SSA. This was  $p(0.001)$  in both cases.

The SSA was observed in 36 cases (90%); it arose from the TT in 24 (60%), and directly from the subclavian artery in 12 (30%).

No statistical significance was seen when the frequency of origin of the SSA in the trunk (classical origin) was related to that of its origin in the subclavian ( $p=0.112$ ).

The ITA was dissected in the 40 cases studied (100%); it had its origin in the TT in 38 (95%) and in the subclavian in 2 (5%). This result was statistically significant ( $p<0.0001$ ).

### *Calibre of the branches of the TT*

Of the cases studied, we were able to perform bilateral assessment of 18 cadavers (8 males and 10 females). Thus, a total of 36 trunks was available.

In all 18 cases (100%), differences were seen in the calibre of the branches of each side. The calibre of the branches was greater on the right side in 14 cadavers (77%): 8 (44%) of which were females and 6 (33%) males. The calibre was larger on the left side in 4 cases (22.2%): 2 females (11.1%) and 2 males (11.1%). The results of the statistical analysis were significant ( $p=0.037$ ).

### DISCUSSION

Clinical interest in the subclavian artery and its branches is justified by their considerable anatomical variability (Kadir, 1991), which is seen equally in males and females, both on the right and left side. Of the branches of the subclavian, the TT is the one most subject to variations (Testut and Latarjet, 1978; Daseler and Anson, 1959; Phillips, 1989). It is important to bear in mind these variants due to the high frequency with which this region is involved in diagnostic and surgical procedures (Vorster et al., 1998; Yucel et al., 1999; Gold, 1981).

Of the dissected trunks, we observed that presentation with two branches was more frequent than with 3 or more. In an arteriographic study performed by Lopez Muñiz et al. (1999) the frequency of the number of branches of the TT was found to be similar to that described in this study. By contrast, Daseler and Anson (1959) described a TT of 3 branches as being the most frequent variant.

Regarding the variants described in the literature with their origin in the TT, we found no cases of bronchial arteries; no cases of deep cervical arteries, no cases of thyroid ima. By contrast, we did find the internal thoracic artery, whose frequency of origin in the TT was similar to that obtained in other series reported in the literature (Daseler and Anson, 1959). This artery is frequently used in procedures of coronary revascularisation; hence the importance of considering its possible origins (Vorster et al., 1998).

Infundibular dilation is an alteration of the development of a vessel defined as a disproportion of the diameter at the origin, excessively large in relation to the branches, with a progressive narrowing and a tent-shaped image in the first centimetres of the vessels (Fisher et al., 1997). The diverticulum of the TT does not appear described as such in texts on Vascular Radiology and Anatomy (Williams and Warwick, 1985; Testut and Latarjet, 1978; Abrams and Jönsson, 1983; Kadir, 1991).

This variant is more frequent on the right side, in males, and in trunks with a greater number of branches. The statistical analysis relating the presence of infundibular dilation with the side of presentation did not reveal significance, however, this being due to the reduced size of

the sample. In the above-mentioned angiographic study (Lopez-Muñiz et al., 1999) the statistical analysis revealed a significant difference. This demonstrates a greater frequency of the presentation of infundibular dilation on the right side, in agreement with the observations of the present study. With respect to the relationship between the presence of infundibular dilation and sex, the analysis was not significant in our study, but was significant in the angiographic one for similar reasons to the above.

The infundibular variant of the TT is another example illustrating the need for knowledge of the variants of the normal anatomy, since ignorance of such information could lead to diagnostic errors or inappropriate therapeutic approaches (Elariny et al., 1996; Abrokwah et al., 1996; Raso et al., 1995; Thomas and Ammar, 2000).

### Variability of the Branches

We were able to confirm the high variability in the distribution of the branches of the TT.

The ACA was the branch showing the greatest variability in the present study. The classic origin of this artery in the ITA is the most frequent, both in our study and in other works reviewed (Daseler and Anson, 1959; Yazuta, 1927; Dubrevil-Charnbardel, 1926; Röhlich, 1941). We observed an origin in the TCA with greater frequency than that of other series (Yazuta, 1927; Dubrevil-Charnbardel, 1926). The origin in the TT was more frequent than in one of the other series (Dubrevil-Charnbardel, 1926) and less frequent than in another (Yazuta, 1927).

In the classic literature (Williams and Warwick, 1985; Testut and Latarjet, 1978) the last two origins for the ACA are described as being the most frequent.

The most frequent origin of TCA in our study was the classic one; in the TT. In other series (Daseler and Anson, 1959), this origin is of secondary frequency with respect to the origin in the subclavian.

On studying the SSA, the most common origin of this artery can be said to be the classic one, i.e., in the TT (Williams and Warwick, 1985; Testut and Latarjet, 1978). This result is consistent with that obtained by other investigators (Daseler and Anson, 1959). The origin of this artery in the subclavian was much more frequent in our series than in those mentioned above.

Of all the branches of the TT, the ITA was the one showing the least variability, both in our study and in descriptions in the textbooks of Anatomy and later reviews (Williams and Warwick, 1985; Testut and Latarjet, 1978; Röhlich, 1941).

Finally, we found no bibliographic references related to the difference in the calibre of the

branches in the bilateral comparison. We observed a notable difference in the calibre of each side, the thicker branches being more frequent on the right side. This was confirmed statistically.

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