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THORACO-ACROMIAL ARTERY : A CADAVERIC STUDY OF ITS PEDICLE AND BRANCHES

Anatomy

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ABSTRACT

Background of study- A detailed knowledge of variations in the origin and branching pattern of Thoraco-acromial artery(TAA) is important during various reconstructive and microvascular surgeries.

Materials and methods- Hundred formalin fixed specimens were studied at Government Medical College, Kozhikode, Kerala, India over a period of four years.

Results- Normal quadrifurcation pattern was observed in majority of specimens (84%). The division of TAA into two trunks was seen in 9% followed by ramification into multiple branches in 4% specimens. Some specimens showed trifurcation (3%).

Conclusion- In this scenario of increasing reconstructive surgeries, a thorough knowledge on the anatomical variations of TAA will be helpful to surgeons as this artery provides vascular supply to Pectoralis Major Myo-Cutaneous flap.

KEYWORDS

Thoraco-acromial artery (TAA); Axillary artery (AA), Pectoralis Major Myo-Cutaneous (PMMC) flap.

INTRODUCTION

The Thoraco-acromial artery (TAA) is a short branch which arises from the second part of Axillary artery (AA). It pierces the clavipectoral fascia and divides into pectoral, acromial, clavicular and deltoid branches which supply the anterior portion of Deltoid, Pectoralis major & minor and an area of skin over clavipectoral fascia (Gray[1]). The knowledge of the variations of (TAA) is of anatomical and surgical interest. This information is useful for the surgeons dealing with the axillary region especially in case of reconstructive surgery. The anatomical variations of the terminal branches of TAA can compromise any surgery of the anterior shoulder area and should be better known by surgeons (Farhan & Selman[2]). Ducasse et al's[3] study confirmed the existence of a main arteriovenous pedicle vascularising the Pectoralis Major Myocutaneous Flap. As per their documents this pedicle originates from the TAA and rotation of this myocutaneous flap is achieved around this pedicle.

MATERIALS AND METHODS

After getting the clearance certificate from Institutional Research and Ethical Committees, a dissection study was conducted in 50 formalin fixed cadavers (100 specimens) , in the Department of Anatomy, Government Medical College, Kozhikode, Kerala, India over a period of four years. Exposure of axilla was done by classical incisions and dissection procedures. Both right and left axillary arteries and their branches were traced from their origin to termination. Thoraco-acromial artery was studied in detail, to see its origin and branching pattern. Variations were noted, photographed and tabulated.

RESULTS AND ANALYSIS

TAA showed variable branching pattern (Table1). The normal branching pattern of TAA was seen in 84%. Commonest variation noted in present study was the division of TAA into two trunks (clavipectoral and deltoacromial) which then subdivided into terminal branches - clavicular, pectoral, deltoid and acromial (Figure 1). This variation was detected in 9% of specimens studied. Multiple branches (more than 4) from TAA were seen in 4% (Figure 2). In this group of variation, the number of pectoral branches exceeded than the other branches in all except one specimen which showed two clavicular branches.

TAA divided into three branches in 3% of specimens (Figure 3). Two among this showed the absence of acromial branch. The other one showed the origin of deltoid branch directly from AA and pectoral, clavicular and acromial branches from TAA (Figure 4).

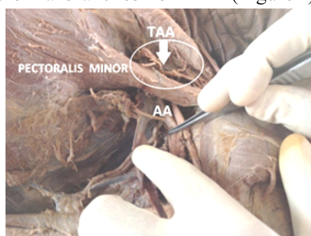

Figure 1 – Division of TAA into 2 trunks (Left axilla)

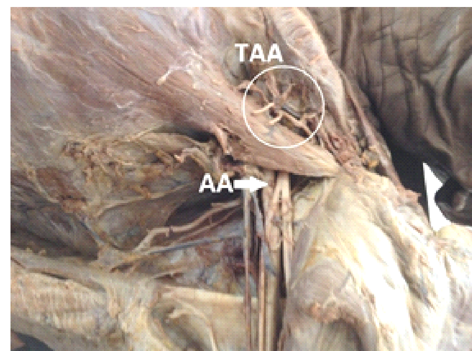

Figure 2 – Division of TAA into multiple branches (Left axilla)

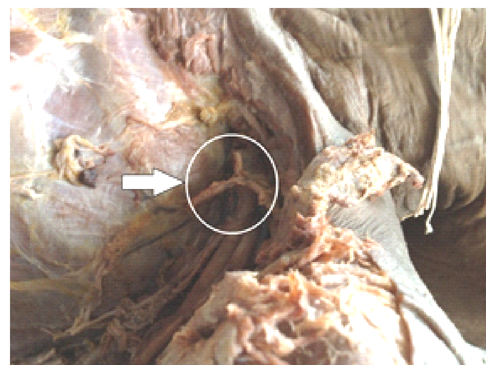

Figure 3 – Division of TAA into 3 branches (Left axilla)

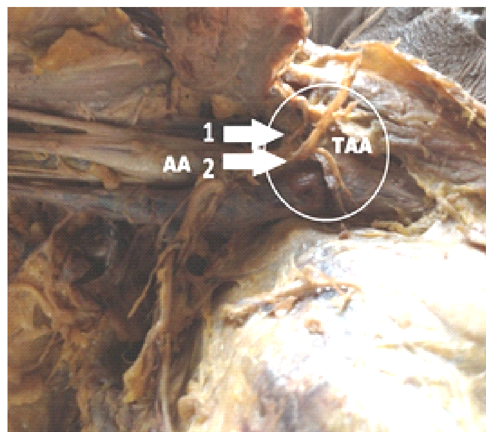

Figure 4 – Origin of deltoid branch directly from AA (Right axilla)

Table 1- TAA branching pattern

	TAA division		Total Number (100)	Percentage %
1	Normal pattern – Four branches		84	84
2	Three branches	Absent acromial branch	2	2
		Direct origin of deltoid branch from AA	1	1
3	Two trunks	Clavipectoral & Deltoacromial	9	9
4	Multiple branches	Pectoral & Clavicular	4	4

DISCUSSION

Pandey and Shukla[4] did a detailed study on the branching pattern of Thoraco-acromial artery (TAA). In their study TAA originated from the first part of AA in 13.4% of right axilla and 10.6% of left axilla. They grouped the variations in origin of the branches of TAA into three (a) First group showed deltoacromial and clavipectoral subtrunks of the TAA, originating directly from AA (b) Second group revealed clavicular branch of the TAA originating from the AA, whereas in the (c) third group all the classical branches of TAA, originated directly from the AA and there was no existence of the trunk of TAA. Their study showed higher incidence of variations in origin of TAA and its branches, on right side. Astik & Dave[5] documented the absence of main trunk of TAA with the origin of all its branches directly from the second part of AA. They also noticed the division of TAA into deltoacromial and clavipectoral subtrunks, which further divided into deltoid, pectoral, acromial and clavicular branches . They reported this variation in 5%. The absence of trunk of TAA with the origin of all branches directly from the second part of AA, was later reported by other investigators (Chitra & Anandhi[6], Jaishree H & Ashwini H[7]).

Nyemb et al[8] studied the location, number, and path of the terminal branches of TAA. In their study, the TAA gave at least two and at most four terminal branches: two bulky and constant branches (deltoid and pectoral branches) and two small and inconstant branches (acromial and clavicular branches). They observed anatomical variations in the path and localization of each terminal branch and thus cited that the deltoid and pectoral branches had a vertical downward or oblique path. In Maral et al's[9] study the TAA which arose as a short trunk from second part of AA, showed a trifurcation pattern. The branch situated medially was the pectoral branch and from this arose the clavicular branch. The deltoid branch arose in the middle from which acromial branch originated.

Daimi et al[10] reported the incidence of two TAAs; one from the first part and other from the second part of AA. One took origin from the superior aspect of first part of AA and the other one from the anterior aspect of second part of AA. Both divided into 3-4 terminal branches.

Park et al[11] classified the mode of origin of the pectoral branch of TAA. The pectoral branch could be directly derived from the TAA (type I). It could also arise from the TAA via a medial pedicle (type II) or a lateral pedicle (type III). These variations may have major clinical implications, since from an anatomical point of view, the arterial distribution of the pectoralis major muscle is by the pectoral branch of TAA, lateral thoracic artery(LTA) and anterior intercostal arteries. The variant origin of pectoral branch from subscapular artery(SSA) with the other branches from TAA was documented by Park et al[12].

Pant et al[13] described a common origin for TAA, LTA and SSA, by forming a dilated part (axillary bulb) below the inferior border of pectoralis minor muscle. Mohanty & Mamata[14] also reported a case in which Thoraco-acromial, Lateral thoracic, Alar thoracic, Sub scapular, Post circumflex humeral arteries originated from a common trunk.

An unusual origin of branches of TAA was documented by Troupis et al[15]. In their work, the AA gave origin to a superficial brachial artery and then continued as AA. Pectoral branch of TAA occurred before this division. After the division, AA gave off the other branches of TAA, namely clavicular, deltoid and acromial and also subscapular artery that later trifurcated into lateral thoracic, circumflex scapular and thoracodorsal arteries. Stook et al[16] classified the arteries arising from the proximal two-thirds of the AA into two classes: "deep arteries" including the lateral thoracic and superior thoracic arteries; and "superficial artery": thoraco-acromial artery.

A detailed cadaveric dissection study was carried out by Zhang et al[17] and they highlighted the clinical importance of TAA and its cutaneous perforators in reconstructive surgeries of head and neck region using TAA perforator flap. They documented that a constant TAA perforator was present in the septum between the clavicular and sternocostal heads of the pectoralis major muscle in most cases. The territory of the TAA perforator flap extended up to the fourth intercostal space inferiorly. Their study provided evidence of the vascular supply and the clinical application of TAA perforator flap. As per Kano et al's[18] reports the pedicled pectoralis major myocutaneous (PMMC) flap is widely used for the treatment of surgical defects following oral cancer resection and the conventional technique of harvesting a PMMC flap involves a single vascular supply from the pectoral branch of the TAA.

CONCLUSION

A detailed knowledge of anatomical variations in the origin and branching pattern of Thoraco-acromial artery will be of immense help to surgeons who deal with various reconstructive procedures using the Pectoralis Major Myo-Cutaneous flaps and microvascular grafts, because the nourishment of PMMC flaps depends on the vascular pedicle formed by Thoraco-acromial artery as cited in many clinical trials.

REFERENCES

1. Gray's Anatomy. The Anatomical basis of clinical practice. Susan Standring. Elsevier, Churchill Livingstone –39th ed.2005:844.
2. Farhan TM & Selman MO. Anatomical Study of Axillary Artery Variation. Fac Med Baghdad. 2010;52(3):324-327.
3. Ducasse A, Desphieux JL, Palot JP, Delattre JF, & Flament JB. Anatomical basis for the use of the pectoralis major myocuatneous flap in reconstructive surgery. Anat Clin.1984;5(4):245-249.
4. Pandey SK & Shukla VK. Anatomical variation in origin and course of the thoraco-acromial trunk and its branches. Nepal Med Coll J.2004;6(2):88-91.
5. Astik R & Dave U. Variations in branching pattern of the axillary artery: a study in 40 human cadavers. J Vasc Bras.2012;11(1):12-17.
6. Chitra PS & Anandhi V. A unique variation in branching pattern of axillary artery. International Journal of Anatomical Variations.2013;6:1-3.
7. Jaishree H & Ashwini H. Variation in the branching pattern of thoraco-acromial artery. Int J Cur Res Rev.2015;7(5):21-23.
8. Nyemb PMM, Fontaine C, Demondion X, Demeulaere M, Descmps S, & Ndoye JM. Anatomical variations of the trunk of origin and terminal branches of the Thoraco-acromial artery. MOJ Anatomy & Physiology.2018;5(1):57-61.
9. Maral T, Celik H, Hayran M & Kecik A. An anatomical variation of the thoraco-dorsal artery with comments on flaps based on the axillary artery. Eur J Plast Surg.1993;16:231-233.
10. Daimi SR, Siddiqui AU & Wabale RN. Variations in the branching pattern of axillary artery with high origin of radial artery. Int J Anat Var (IJAV).2010;3:76–77.
11. Park HD, Min YS, Kwak HH, Youn KH & Lee EW et al. Anatomical study concerning the origin and course of the pectoral branch of the thoracoacromial trunk for the pectoralis major flap. Surg Radiol Anat.2004;26(6):428-432.
12. Park JH, Lee JH & Choi IJ. The Pectoral Branch Arising from the Subscapular Artery: Case Report of a Rare Variation. Forensic Medicine and Anatomy Research.2016;4:41-45.
13. Pant MK, Hasan S, Sarangdhar & Zaidi SHH. Variation in branching pattern of the axillary artery – a case report. Int J Anat Var(IJAV).2013;6:47–48.
14. Mohanty SR & Mamata S. Clumping of Branches of Axillary Artery-A Case Study. Journal of Dental and Medical Sciences.2013;11(1):01-04.
15. Troupis TG, Michalinos A, Manou V, Vlastos D, Johnson EO, Demesticha T & Skandalakis P. Report of an unusual combination of arterial, venous and neural variations in a cadaveric upper limb. Journal of Brachial Plexus and Peripheral Nerve Injury.2014;9:2
16. Stook FP, Zonnevijlle EDH & Groen GJ. A reappraisal of the blood supply of the pectoralis minor muscle. Clin Anat.1994;7:1–9.
17. Zhang YX, Yongjie H, Messmer C & Ong YS et al. Thoraco-acromial Artery Perforator Flap: Anatomical Basis and Clinical Applications. Plastic and Reconstructive Surgery.2013; 131(5):759e–770e
18. Kanno T, Nariai Y, Tatsumi H, Karino M, Yoshino A & Sekine J. A modified pectoralis major myocutaneous flap technique with improved vascular supply and an extended rotation arc for oral defects: a case report. Oncol Lett.2015;10(5):2739-2742.