ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 01 | January - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A CADAVERIC STUDY OF VARIATION IN THE BRANCHING PATTERN OF THE AXILLARY ARTERY IN INDIAN POPULATION (SAGAR, M.P) & IT'S CLINICAL SIGNIFICANCE

Clinical Anatomy

Dr. Aayshri Srivastava PG Student 3rd Year Department Of Anatomy Bundelkhand Medical College, Sagar M.P

Dr. Siddharth Shankar Roy Professor & Head Department Of Anatomy Bundelkhand Medical College, Sagar M.P

Dr. Vishal Bhadkaria Associate Professor Department Of Anatomy Bundelkhand Medical College, Sagar M.P

ABSTRACT

Background: - The axillary artery is a continuation of the subclavian artery which begins at the outer border of the first rib & ends at the inferior border of the Teres major and continue further distally as the brachial artery. The pectoralis minor muscle crosses anteriorly and divides the artery into three parts, proximal, posterior and distal parts in relation to the muscle.There are mainly 6 named branches of Axillary artery; 1st part gives one branch i.e. superior thoracic artery; 2nd part gives two named branches i.e. lateral thoracic artery & thoraco-acromial artery and the 3rd part gives three named branches i.e. Subscapular artery, Anterior circumflex humeral artery & the Posterior circumflex humeral artery. Subscapular artery further divides into circumflex scapular and thoraco-dorsal arteries. **Aims &Objectives:** -To study the variations in branching pattern of axillary artery in human cadavers making it worthwhile to take any anomaly into consideration. And to correlate the findings with the available literature. The type and frequency of these vascular variations is well understood and documented. Also to calculate Prevalence of the present study and measure its significance with previous known studies. **Material &Methods:-** The formalin preserved 50 cadavers [100 limbs] in the Department of Anatomy of Bundelkhand Medical College, Sagar, M.P, India were studied in duration of 2yrs. Cadaver withdeformed or traumatized upper extremities & autopsied bodies were excluded from the study.All the branches of three parts of axillary artery carefully cleaned and studied. Variations in the branching pattern arising from three parts of axillary artery was recorded. **Results:-** In this study, 53 specimens showed no variations in all the 3 parts of Axillary artery [53%]. In 47 specimens, showed variation in branching pattern of axillary artery [47%]. Prevalence shown in present study becomes 47%.Out of 47 specimens, 03 specimens showed variation in all the 3parts of axillary artery [6.4 %].03 specimens showed variation in both 1st& 2nd part of axillary artery [6.4 %].19 specimens showed variation in both 2nd& 3rd part of Axillary artery [40.40%].22 specimens showed variation in only 3rd part of axillary artery [46.80 %] . **Conclusion:-** The axillary artery extends from the outer border of first rib to lower border of teres major. The course of axillary artery was normal. The axillary vein accompanied the artery Antero medially throughout its course.Number of named branches arising from the axillary artery ranges from 03 - 07, and the most commonly observed number was 6 in 56% of specimens. The superior thoracic artery arose from first part of axillary artery in all the limbs. The thoraco acromial artery arose from the second part of axillary artery in 83%. In 85 specimens, the Lateral Thoracic artery originates from the second part of axillary artery (85%). In 92 specimens, the ACHA originates from the third part of axillary artery (92%). In 74 specimens, the PCHA originates from the third part of axillary artery (74%) .The Subscapular artery was present in 92 specimens (92%);In 66 out of 92 specimens, the SCA originates from the originates from 3nd part of axillary artery (71.74 %). Normally PBA originates from Brachial artery but in this study, 02 specimens showed its origin from Axillary artery [02%] of which 1 specimen showed its origin from 2nd part while 1 specimen showed from 3rd part of axillary artery. Knowledge of the axillary artery, branching pattern and its variation is important during antegrade cerebral perfusion in aortic surgery, in treating the axillary artery thrombosis, medial arm skin flap, in reconstruction of axillary artery in case of traumatic injury and in axillary – coronary bypass shunt procedures. So, the normal anatomy and variations of axillary artery are very important to the Anatomists, Surgeons, Anesthetists, Radiologists, Cardiologists and Plastic surgeons for accurate diagnostic and therapeutic interventions.

KEYWORDS

Axillary artery, upper limb, brachial plexus, subclavian artery, Superior thoracic artery, axilla, Lateral thoracic artery, Thoraco-acromial artery, subclavian artery, circumflex scapular artery, thoraco-dorsal artery, ACHA, PCHA, Profunda brachii artery.

INTRODUCTION

The axillary artery is the continuation of Subclavian artery which begins at the outer border of the first rib, ending normally at the inferior border of the Teres major and continues distally as the brachial artery.

The pectoralis minor muscle crosses anteriorly and divides the artery into three parts, proximal, posterior and distal parts to the muscle.**[1]**

The Axillary artery anatomically divides into three parts; the first part begins from the outer border of the first rib and extends to the medial border of pectoralis minor. It lies along with the axillary vein & brachial plexus within the axillary sheath.

The second part of the axillary artery lies posterior to the pectoralis minor.

The third part lies between the lateral border of the pectoralis minor and the inferior border of the teres major. **[1]**

Branches Of Axillary Artery :

- **First Part Gives 1 Branch :-** superior thoracic artery.
- **Second Part Gives 2 Branches:-** lateral thoracic artery - thoraco-acromial artery.
- **Third Part Gives 3 Branches :-** Subscapular artery - anterior circumflex humeral artery - posterior circumflex humeral artery.**[2]**

The subscapular artery further divides into circumflex scapular and thoraco-dorsal arteries. Sometimes an alar thoracic artery arise from the second part of axillary artery, supply fat and lymph nodes in the axilla **[3].**

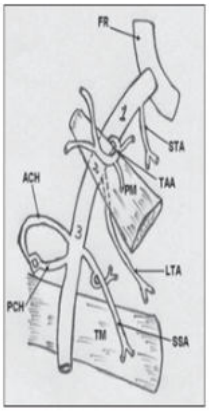

Figure 1: Schematic diagram showing normal branching of the axillary artery. 1 - first part, 2 - second part, 3 - third part, FR - first rib, STA - superior thoracic artery, TAA - thoraco acromial artery, LTA - lateral thoracic artery, SSA - subscapular artery, ACH - anterior circumflex humeral artery, PCH - posterior circumflex humeral artery, PM - pectoralis minor, TM - teres major

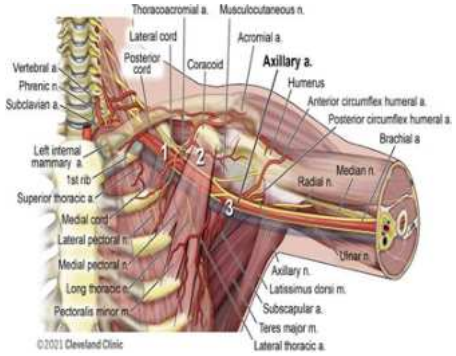

Figure –2 : Course and relations of axillary artery

Anatomic variations in the major arteries of the upper limb have been reported. **[2]**

Accurate knowledge of the normal and variant arterial anatomy of the axillary artery is important for clinical procedures in this region **[3].**

Branches of axillary artery are used for coronary bypass and flaps in reconstructive surgeries. Sound knowledge of variation in branching pattern is important for surgeons' attempting to reduce old dislocations, especially when the artery is adherent to the articular capsule**[3].**

Variation in the origin, course and branching pattern of the axillary artery have received much importance to anatomists, radiologists and surgeons particularly vascular surgeons. Knowledge about variations of axillary artery is essential insurgeries for lymph node resection in the axilla and pectoral region, in mastectomy and reconstructive surgeries of breast, surgical repair of shoulder joint and vascular procedures like antegrade cerebral perfusion in aortic surgery. **[2].**

Normally, in embryos ,the seventh cervical intersegmental artery enlarges and becomes dominant vessel of axilla. C6, C7 and T1 segmental arteries degenerate slowly. The numerous alternatives that exist during the formation of upper limb vessels seem to be responsible for anomalous arterial branching patterns. **[1,3,4]**

In addition,injuries of the brachial plexus are quite common and require exploration and repair. The axillary artery variation is a concern during these procedures **[5,12–14].**For better clinical procedures, detailed knowledge of anatomical relationships of the axillary artery and distribution of its branches is crucial Therefore, topography of the axillary artery and its branches should be studied and their association needed to be discussed. **[5,15–18].**

MATERIALS AND METHODS –

It is an Observational study. The source of data is formalin preserved cadavers in the Department of Anatomy of Bundelkhand Medical College, Sagar, M.P, India.

Inclusion Criteria: All the formalin preserved cadavers available during study period in the Department of Anatomy will be included.

Exclusion Criteria:- Cadaver with deformed or traumatized upper extremities will be excluded from the study.Autopsied bodies are also excluded.

Sample Size 100 limbs (i.e 50 cadavers)
Duration Of Study: 1.5years[July 2023 to dec 2024]

Dissection Method: 100 upper limbs from embalmed 50 cadavers allotted for dissection in the Department of Anatomy, Bundelkhand Medical College, Sagar, M.P will be used for the study.

The cadaver was placed in supine position with both arms abducted and laterally rotated and the palms facing up.Two transverse incisions will be made, first at the level of anterior axillary fold, second incision just above the level of the cubital fossa. A vertical incision connecting the midpoints of these lines will be taken.The skin, superficial fascia were removed ; adipose tissue cleared to expose the axillary artery. Pectoralis major muscle deflected; then the Pectoralis minor muscle was also reflected. The axillary artery was identified and cleared.The branching patterns and variations of the axillary artery were analyzed.The branching points of the axillary artery were analyzed and divided into three parts by key muscle [Pectoralis minor].

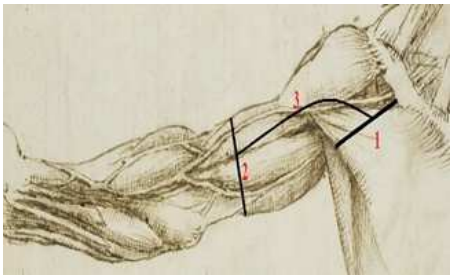

Figure 3- incision steps to approach Axillary artery.

All the branches of three parts of axillary artery carefully cleaned and studied. Variations in the branching pattern arising from three parts of axillary artery will be recorded.

All statistical analyses were conducted using SPSS (version 20.0, IBM SPSS®; Chicago, IL).

RESULTS :

The axillary artery in 100 upper limb specimens preserved in formalin are taken for the study. By the conventional dissection method all the specimens are studied in detail and the findings are as follows.

I. Number Of Named Branches Arising From The Axillary Artery.

In the 100 upperlimb specimens the number of named branches arising from the axillary artery range from 03- 07. The most common number of named branches of axillary artery is 06 (56 %).The results are as shown in the table no. 09

Table 09 : Number of named branches from axillary artery- Present study

No .of named branches	No of specimens	Percentage (%)
07	01	01
06	56	56
04	32	32
03	11	11

II. Origin Of Superior Thoracic Artery

In the study of 100 upper limb specimens the superior thoracic artery was present in all 100 specimens (100%) In all 100 specimens ,the superior thoracic artery originates from the first part of axillary artery(100 %)

Table 10 : Origin of Superior thoracic Artery- Present study

ORIGIN	No. of Specimen	Percentage (100 %)
From 1st part	100	100%
From 2nd part	0	0
From 3rd part	0	0
Absent	0	0

III. Origin Of Thoraco-Acromial Artery

In the study of 100 upper limb specimens the Thoraco- acromial artery was present in all 100 specimens (100%) In 06 specimens ,the Thoraco- acromial artery originates from the first part of axillary artery(06 %)In 83 specimens ,the Thoraco- acromial artery originates from the second part of axillary artery (83%)In 11 specimens ,the Thoraco- acromial artery originates from the Common trunk which originates from 2nd part of axillary artery(11 %)

Table 11: Origin of Thoraco- acromial Artery- Present Study

ORIGIN		No. of Specimen	Percentage %
From 1st part		06	06
From 2nd part	Directly	83	83
	Common trunk	11	11
From 3rd part		0	0

IV. Origin Of Lateral Thoracic Artery

In the study of 100 upper limb specimens the Lateral Thoracic artery was present in all 100 specimens (100%).In 85 specimens ,the Lateral Thoracic artery originates from the second part of axillary artery (85%).In 13 specimens ,the Lateral Thoracic artery originates from the Common trunk which originates from 2nd part of axillary artery (13

%).In 02 specimens ,the Lateral Thoracic artery originates from the Common trunk which originates from 3rd part of axillary artery(02%).

Table 12 : Origin of Lateral Thoracic Artery- Present Study

ORIGIN		No. Of Specimen	Percentage %
From 2nd part	Directly	85	85
	Common trunk	13	13
From 3rd part	Directly	00	00
	Common trunk	02	02

V. Origin Of Anterior Circumflex Humeral Artery

In the study of 100 upper limb specimens the Anterior circumflex humeral artery was present in all 100 specimens (100%).In 92 specimens ,the ACHA originates from the third part of axillary artery (92%).In 08 specimens ,the ACHA originates from the Common trunk which originates from 3rd part of axillary artery(08 %).

Table 13: Origin of Anterior Circumflex Humeral Artery- Present study

ORIGIN		No. of Specimen	Percentage %
From 2nd part	Common trunk	02	02
From 3rd part	Directly	74	74
	Common trunk	24	24

VI. Origin Of Posterior Circumflex Humeral Artery

In the study of 100 upper limb specimens the Posterior circumflex humeral artery was present in all specimens (100%).In 74 specimens ,the PCHA originates from the third part of axillary artery (74%).In 02 specimens ,the ACHA originates from the Common trunk which Originates from 2nd part of axillary artery(02%).In 24 specimens ,the ACHA originates from the Common trunk which originates from 3nd part of axillary artery(24 %)

Table 14 : Origin Of Posterior Circumflex Humeral Artery- Present Study

ORIGIN		**No. of Specimen**	**Percentage %**
From 3rd part	Directly	92	92
	Common trunk	08	08

VII.Origin Of Subscapular Artery And Its Two Branches [Thoraco-dorsal & circumflex scapular]

In the study of 100 upper limb specimens the Subscapular artery was present in 92 specimens (92%).In 66 out of 92 specimens, the SCA originates from the originates from 3nd part of axillary artery (71.74 %).In 11 out of 92 specimens ,the SCA originates from the Common trunk which originates from 3nd part of axillary artery(11.96 %).In 15 out of 92 specimens ,the SCA originates from the Common trunk which originates from 2nd part of axillary artery(16.30 %)

Table 15: Origin Of Subscapular Artery- Present Study

ORIGIN		**No. of Specimen**	**Percentage %**
Branches directly from Subscapular artery		92	92
TDA & CSA	CT from 2nd part	3	3
	CT from 3rd part		
TDA+ CSA	CT from 2nd part	2	2
TDA+ CSA	CT from 3rd part	3	3

In 08 specimens ,the SCA was absent but its both branches was arising from common trunk with other named branches of Axillary artery (08 %).Out of which 2 specimens shows origin of TDA + CSA from common trunk arising from 2nd part of AA.

3 Specimens shows origin of TDA + CSA from common trunk arising from 3nd part of AA.3 specimens shows origin of TDA from common trunk arising from 2nd part of AA while CSA from common trunk arising from 3nd part of AA.

Table 16: Thoraco- dorsal artery & circumflex scapular artery origin- present study

ORIGIN		No. of Specimen (92)	Percentage %
From 2nd part	Common trunk	15	16.30
From 3rd part	Directly	66	71.74
	Common trunk	11	11.96

VIII. Origin Of Profunda Brachii Artery

Normally PBA originates from Brachial artery but in this study, 02 specimens showed its origin from Axillary artery [02%] of which 1 specimen showed its origin from 2nd part while 1 specimen showed from 3rd part of axillary artery.

Table 17 : Origin Of Profunda Brachii Artery- Present Study

Variation in which part	No. of Specimens	Percentage %
1st + 2nd + 3rd part [all the 3 parts]	03	6.4
1st + 2nd part	03	6.4
2nd + 3rd part	19	40.40
Only 3rd part	22	46.80

IX. Parts Wise Variation In Branches Of Axillary Artery

In this study, 53 specimens showed no variations in all the 3 parts of Axillary artery [53%].In 47 specimens, showed variation in branching pattern of axillary artery [47%].

Out of 47 specimens, 03 specimens showed variation in all the 3parts of axillary artery [6.4 %].03 specimens showed variation in both 1st& 2nd part of axillary artery [6.4 %].

19 specimens showed variation in both 2nd& 3rd part of Axillary artery [40.40%].22 specimens showed variation in only 3rd part of axillary artery [46.80 %]

Table 18: Variation In Branching Pattern [present Or Not] – Present Study

ORIGIN	No. of Specimen	Percentage %
From 2nd part of AA	01	01
From 3rd part of AA	01	01
From Brachial artery	98	98

Table19 : Part Wise Variations- Present Study

VARIATIONS	No. of Specimens	Percentage %
No any Variations	53	53
Variations Present	47	47

X. Variation In Branching Patterns

A. Variation pattern shown in 1st part of Axillary Artery

06 specimens showed origin of Thoraco- acromial artery from the 1st part of AA.

B. Variation pattern shown in 2nd part of Axillary Artery

2nd part of AA showed 8 types of variation in branching pattern as follows:

Table 20: Variation pattern shown in 2nd part

S.No.	Patterns		No. of Specimens
01	Common trunk	LTA + SCA	06
02	Common trunk	LTA+SCA+ PCHA	01
03	Origin of PBA		01
04	Common trunk	TAA+LTA +SCA	06
05	Common trunk	TDA +CSA +PCHA	02
06	Common trunk	TAA+SCA	01
07	Common trunk	TAA+TDA	04
08	No named branches		01

C. Variation Pattern Shown in 3rd Part Of Axillary Artery

3rd part of AA showed 7 types of variation in branching pattern as follows:

Table 21: Variation pattern shown in 3rd part of Axillary Artery- Present study

S.No.	Patterns		No. of Specimens
01	Common trunk	TDA + CSA + PCHA	02
02	Common trunk	SCA + PCHA	11
03	Common trunk	LTA + TDA + CSA	01
04	Common trunk	ACHA+ PCHA	08
05	Origin of PBA		01
06	Common trunk	PCHA + CSA	04
07	Common trunk 1	PCHA + Common trunk 2	01

		Common trunk 2 {LTA + SCA}	

Calculation Of Prevalence:
the Prevalence becomes 47%

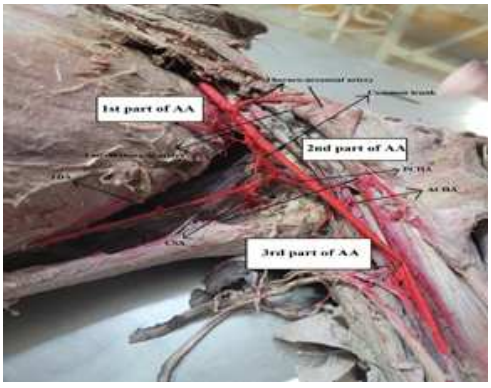

Figure : 5- Right limb showing Variation [TAA arising from 1st part; Common trunk for TDA,CSA & PCHA from 2nd part while 3rd part shows only ACHA origin]

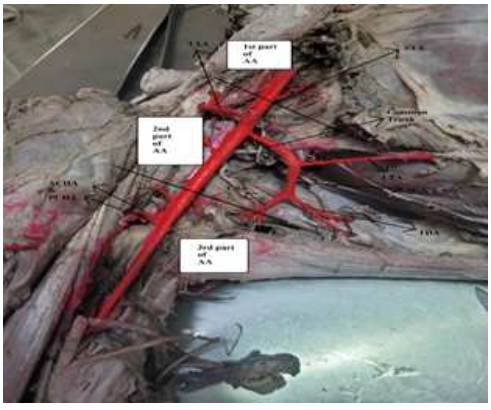

Figure 7: Left limb showing variation in 2nd part [Common trunk giving rise to LTA & SCA]

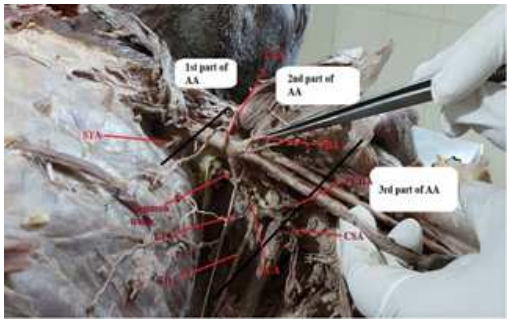

Figure 9 : Left limb showing variation in 2nd part [Common trunk giving rise to LTA; SCA & PCHA] and origin of PBA from 2nd part of AA

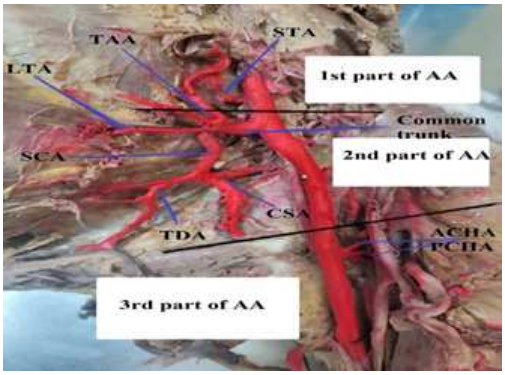

Figure 11: Left limb showing variation in 2nd part [Common trunk giving rise to TAA; LTA & SCA]

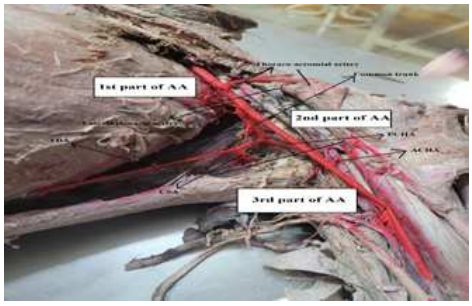

Figure 13 : Left limb showing variation in 2nd part [Common trunk giving rise to TDA; CSA & PCHA]

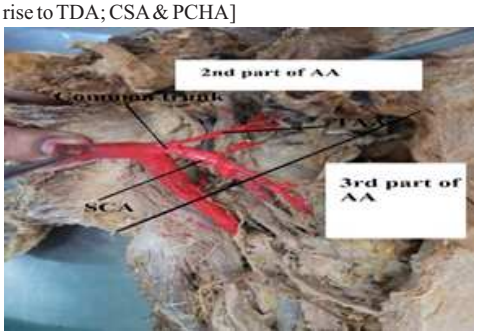

Figure 15: Right limb showing variation in 2nd part [Common trunk giving rise to TAA & SCA]

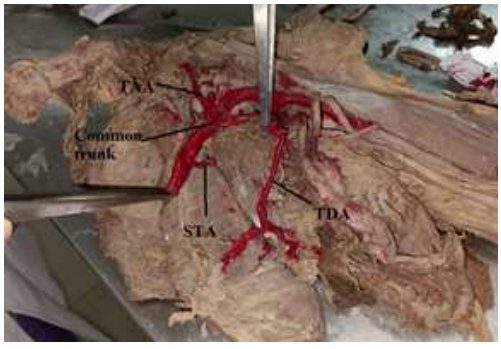

Figure 17: Left limb showing variation in 2nd part [Common trunk giving rise to TAA & TDA].

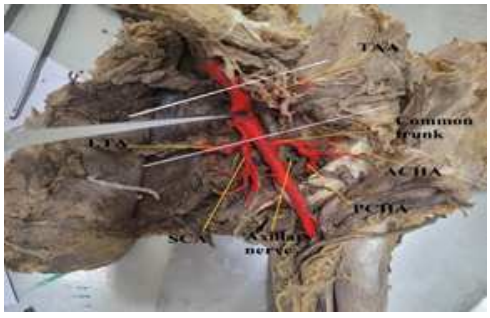

Figure 19: Left limb showing variation in 3rd part of AA [Common trunk giving origin to ACHA & PCHA]

Figure 21: Right limb showing variation in 3rd part of AA [Common trunk giving origin to PCHA & CSA]

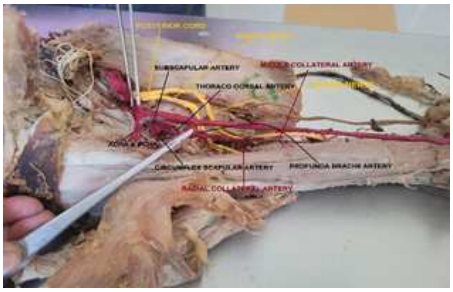

Figure 23: Right limb showing variation in 3rd part of AA [origin of PBA from 3rd part]

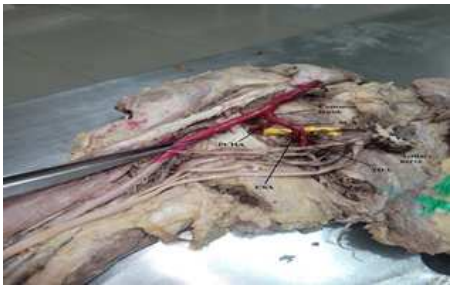

Figure 25: Right limb showing variation in 3rd part of AA [Common trunk giving origin to PCHA & SCA]

Figure 27: Left limb showing variation in 3rd part of AA [Common trunk giving origin to PCHA; CSA & TDA]

DISCUSSION

According to G.J,Romanes, Susan Standring, Hollinshead, E. Skandalakis, Richard S. Snell, six named branches are arising from the axillary artery , one branch from the first part, two branches from the second part, three branches from the third part of axillary artery .

Donald F Huelke (1959) observed the number of named branches from the axillary artery ranges from 2-7 , most common number is 6 (37.3%).

Mohammad A. Abdalla (2007) observed 2-9 branches and the commonest number was 5 branches . He also observed that the second common number was 6 branches in 38% of cases.

In the present study , the number of named branches of axillary artery ranges from 03-07 and the most common number being 06 branch (56 %) which is greater than Heulke and M.A. Abdalla and less than G.J. Romanes , Susan Standring and Hollinshead.

G.J. Romanes (1964) ,Hollinshead (1969), Susan Standring (2008), Chummy S. Sinnatamby and Richard S Snell observed that the superior thoracic artery arises from the first part of axillary artery .

Degaris and Swartey (1928) observed , the superior thoracic artery arising from the first part of axillary artery in 96.9% of specimens.

Donald F .Huelke (1959) reported that the superior thoracic artery arises from the first part of axillary artery in 86.6% of specimens.

In the present study , the superior thoracic artery arises from the first part of the artery in all the specimens (100%) which is greater than the above authors.

G.J. Romanes (1964), Hollinshead (1969), Susan Standring (2008) and Chummy S. Sinnatamby (2012) quoted that the thoraco - acromial artery arises from the second part of axillary artery and pierces the clavipectoral fascia and divides into clavicular, pectoral, acromial, and deltoid branches. Donald F Huelke (1959) observed that the thoraco acromial artery arose from the second part of axillary artery in 68.5% of cases.Mohammad Ahmad Abdalla (2007) observed that the thoraco acromial artery arises from the second part of the axillary artery in 88% of cases.In the present study ; the thoraco– acromial artery arises from the second part of axillary artery in 94 % of cases [83 % direct & 11% from common trunk]. Which is greater than the studies of Donald F. Huelke (1959) and Mohammad Ahmad Abdalla (2007) and more or less equal to the studies of G.J. Romanes (1964) , Hollinshead(1969) Susan Standring (2008) and Chummy S .Sinnatamby (2012).Rajesh Astik (2014) observed that the thoracoacromial artery was absent in 10% of cases, where all the four classical terminal branches of the thoraco acromial artery arise directly from the second part of the artery.In the present study ; the thoraco– acromial artery were present all 100 specimens out which 06 originated from 1st part and remaining all 94 from 2nd part.

G.J. Romanes (1964), Hollinshead (1969), Susan Standring (2008) and Chummy S. Sinnatamby (2011) quoted that the lateral thoracic artery is a branch from the second part of axillary artery, it runs along the lower border of the teres minor muscle.Donald F Huelke (1959) observed , the lateral thoracic artery arising directly from the second part of axillary artery in 52.2% of specimens and from a common trunk along with subscapular artery from the second part of axillary artery in 14.1 % of upperlimb specimens.Mohammad Ahmad Abdalla (2007) noted that the lateral thoracic artery arises directly from the second part of axillary artery in 82% of cases. Common trunk origin of lateral thoracic artery with subscapular and posterior circumflex humeral artery in 4% of cases. It was absent in 2% of specimens.Rajesh Astik et al (2012) in his study of 80 upperlimbs observed that the origin of lateral thoracic artery from subscapular artery is 20%.In the present study the lateral thoracic artery arise from the second part of axillary artery in 98% of specimens {85 direct & 13 from common trunk} &and which is greater than the studies of Donald F. Huelke (1959) and M.A. Abdalla (2007) .

D.J. Romanes (1964), Hollinshead (1969), Charles A. Rockwood (2004) , Susan Standring (2008), and Chummy S. Sinnatamby (2011) quoted that the anterior circumflex humeral artery is a small branch arises from lateral side of the third part of axillary artery.

Donald F. Huelke (1959) observed that the anterior circumflex humeral artery arises as a direct branch from the third part of axillary artery in 80.3% and in common trunk in 11.2% of specimens.

Mohammad A. Abdalla (2007) observed the anterior circumflex humeral artery arising from the third part of axillary artery as a direct branch in 80% of limbs and in common trunk with posterior circumflex humeral artery in 16% .In the present study , the anterior circumflex humeral artery arises from the third part of axillary artery as a direct branch in 92% of cases which is greater than the studies of above authors. The common trunk origin of Anterior circumflex humeral artery is in 08% of cases, which is less than the above authors .

D.J.Romanes (1964), Hollinshead (1969), Susan Standring (2008) Chummy S. Sinnatamby (2011) quoted that the posterior circumflex humeral artery is a larger branch than the anterior circumflex humeral artery, arises directly or by a common trunk with anterior circumflex humeral artery from the 3rd part of the axillary artery.

Donald F. Huelke (1959) observed that the posterior circumflex humeral artery arose from the third part of axillary artery in 78.7% of limbs as a direct branch and in common trunk of origin with anterior circumflex humeral artery in 11.2% of cases.

Mohammad A. Abdalla (2007) observed that the posterior circumflex humeral artery arising from the third part of axillary artery as a direct branch in 58% of specimens . In common with anterior circumflex humeral artery in 16% of specimens and with subscapular artery in 18% of specimens it arises from the third part of axillary artery.

Samta Gaur (2012) observed in 4% of specimens posterior circumflex

humeral artery is a large trunk arises with the subscapular artery .In the present study, the posterior circumflex humeral artery arises from the third part of axillary artery as a direct branch in 74% of specimens which isless thanHeulke (1959) and greater than M.A.Abdalla (2007).It arises in common trunk in 24% of specimens which is lower than the Huelke& equal to M.A Abdalla. Also in common trunk origin from the 2nd part in 02% of specimens which is lesser than M.A Abdalla. Mohammad A. Abdalla (2007) observed in 4 % of specimens , the posterior circumflex humeral artery arose from second part of axillary artery in common.

G.J. Romanes (1964), Hollinshead (1969), Charles A. Rockwood (2004), and Chummy S. Chinnatamby (2011) quoted that the subscapular artery is the largest branch , takes origin from the third part of axillary artery.

De Garis and Swartley (1928) noted that the subscapular artery arises from the third part of axillary artery in 94.1% of cases and rarely from the second part in 5.1% of cases Donald F.Huelke (1959) observed that Subscapular artery arises directly from the 3rd part of the axillary artery in 79.2% cases & it arise from the second part of the axillary artery in 15.7% cases.

Mohammad A.Abdalla (2007) observed that the subscapular artery arises from the third part of the axillary artery in 80% and from the second part of axillary artery in 16% of cases.In the present study , the subscapular artery arises from the third part of axillary artery in 83.70 % {71.74% directly & 11.96% from common trunk} . This is greater than the studies of Heulke (1959) and M.A.Abdalla(2007) ;but lesser than the study of Degaris and Swartley (1928) .

Also in the Present study SCA arise from the second part of axillary artery via common trunk in 16.30% of cases. This is also greater than the studies of Heulke (1959) and M.A.Abdalla (2007) ;and nearly coincides with the study of Degaris and Swartley (1928) .

CONCLUSIONS

The axillary artery in the upper limb of 50 adult cadaveric specimens have been studied in detail by dissection method. The study was carried out under the following headings:

1. Number of named branches.
2. Origin of superior thoracic artery.
3. Origin of thoraco acromial artery.
4 Origin of lateral thoracic artery.
5. Origin of subscapular artery.
6. Origin of anterior circumflex humeral artery.
7. Origin of posterior circumflex humeral artery.
8. Origin of named branches of subscapular artery.
9. Origin of Profunda brachii artery.
10. Variation in branching pattern of Axillary artery part wise.

The findings were observed and correlated with the studies of many workers.

53 specimens showed no variations in all the 3 parts of Axillary artery [53%]; In 47 specimens, showed variation in branching pattern of axillary artery [47%]. Max. variation {22 specimens} showed variation in only 3rd part of axillary artery [46.80 %].

The variations in the branching pattern of axillary artery were due to defect in the development of vascular plexus of upper limb bud. This occurred due to arrest in the development of vessels followed by regression, retention or reappearance which result in variations in the origin and course of the arteries.

Knowledge of the axillary artery, branching pattern and its variation is important during antegrade cerebral perfusion in aortic surgery, in treating the axillary artery thrombosis, medial arm skin flap, in reconstruction of axillary artery in case of traumatic injury and in axillary – coronary bypass shunt procedures.

So, the normal anatomy and variations of axillary artery are very important to the Anatomists, Surgeons, Anesthetists, Radiologists, Cardiologists and Plastic surgeons for accurate diagnostic and therapeutic interventions.

Financial Support & Sponsorship –
Nil

Conflicts Of Interest
None

REFERENCES-

[1] Standring S, Johnson D, Ellis H, Collins P. Gray's anatomy. 39th ed. Churchill Livingstone: London 2005.p.856.
[2] Uglietta JP, Kadir S. Angiographic study of variant arterial anatomy of the upper extremities. Cardiovasc Int Radiol 1989;12:145-8.
[3] Mc Comarck LJ, Cauldwell MD, Anson BJ. Brachial and antebrachial arterial patterns: A study of 750 extremities. Surg Gynecol Obstet 1953;96:43-54.
[4]. Lengele B, Dhem A. Variations of the vasculonervous elements of the human axilla. Report of three cases. Arch Anat Histol Embryol 1989;72:57-67.
[5] Cavdar S, Zeybek A, Bayramicli M. Rare variation of the axillary artery. Clin Anat. 2000;13:66-8.
[6]. Standring, S.; Borley, N. R.; Collins, P.; Crossman, A.R.; Gatzoulis, M. A., Healy, J. C.; Johnson, D.; Mahadevan, V.; Newell, R. L. M. & Wigley, C. B. Gray's anatomy. The anatomical basis of clinical practice.Edinburgh, Elsevier, 2008.
[7]. D.F Huelke "The Variation in origin of branches of the Axillary artery".Anat Rec 1959; 135:33-41.
[8] O. K. Nwawka, E. Casaletto, S. W. Wolfe, "USG imaging of brachial plexus trauma in gunshot injury," Muscle & Nerve,vol. 59, no. 6, pp. 707–711, 2019.
[9] S. F. Johnson, S. B. Johnson, W. E. Strodel, D. E. Barker, and P. A. Kearney, "Brachial plexus injury," The Journal of Trauma, vol. 31, no. 11, pp. 1546–1550, 1991.
[10] J. A. McLaughlin, R. Light, and I. Lustrin, "Axillary artery injury as a complication of proximal humerus fractures," Journal of Shoulder and Elbow Surgery, vol. 7, no. 3, pp. 292–294,1998.
[11] S. Gili, A. Abreo, M. GóMez-Fernández, R. Solà, C. Morros, and X.Sala Blanch, "Patterns of distribution of nerves around axillary artery evaluated by USG and assessed by nerve stimulation during axillary block," Clinical Anatomy, vol. 32, no. 1, pp. 2–8, 2019.
[12] H. Lee, J. Bang, S. Kim, and H. Yang,"The axillary vein and its tributaries are not in mirror image of axillary artery and its branches" PLoS One,vol. 14, no.1, article e0210464,2019.
[13] E. Clarke, R. S. Tubbs, M. Radek, R. Haładaj, M. Tomaszewski,and G. Wysiadecki, "Unusual formation of the musculocutaneous and median nerves: a case report refined by intraneural dissection and literature review," Folia MorphologicaOnline ahead of print.
[14] M. A. Stone, H. E. Ihn, A. M. Gipsman et al., "Surgical anatomy of the axillary artery: clinical implications for open shoulder surgery," Journal of Shoulder and Elbow Surgery, vol. S1058-2746, no. 20, pp. 30786–30788, 2020.
[15] Patnaik VVG, Kalsey G, Singla RK. Branching pattern of Axillary artery- a morphological study. J Anat Soc India. 2000;49:127-32.
[16] Patnaik,Kalse G, Singla RK."The Bifurcation of axillary artery in its 3rd part"- a case report.JAnat Soc.India.2001;50:166-69.
[17] Adachi B. (1928) Das Arteriensystem der Japaner. Acta Scholae Medicinalis, Universitatis Imperalis in Kyoto 9 (suppl. 2): 1926-1927.
[18] Aizawa Y, Ohtsuka K & Kummaki K.(1995). Examination onthe courses of arteries in the axillary region I. The Course of Subscapular Artery System, esp the Relationships Between the Arteries and posterior Cord of Brachial Plexus. Kaibogaku Zasshi. Dec.70(6).554-568.
[19] Anson BJ & Maddock WG. Colanders Surgical Anatomy. In: Shoulder- Axillary Region, 3rd Edition. Philadelphia & London, WB Saunders Co. 1982:728-32.
[20] Anson, B.J., Wright, R.R. and J.A. Wolfer (1939) Blood supply of the mammary gland. Surg., Gynecol. Obstet. 69:468-473.
[21] Asim Kumar Datta (2012)" Essentials of human anatomy 4th edition"p 47-48.
[22] Bergman AR, Thompson SA, Afifi AK, Saadeh FA.Cardiovascular System, Compendium of human anatomic variations. Baltimore Munich : Urban and Schwazenberg; 1988;74-75.
[23] Bhargava, I. (1956) Anomalous branching of axillary artery. J. Anat. Soc. India. 5:78-80.
[24] Boyd JD, Clark WE& Hamilton WJ. Cardiovascular system & Blood vessels. In: Textbook of Human Anatomy. New York& London, Macmillan Co. Ltd. St. Martins Press. 1956: 341-46.
[25] Charitou A,Athanasiou T, Morgan IS, DelSR.Use of Cough can predispose to the axillary artery thrombosis after the Robicsek procedure. Interact Cardiovascular Thorac Surg. 2003;2:68-9.
[26] Charles A.Rockwood , Jr(2004)Gross Anatomy of the shoulder,Vol.I ,78-81.
[27] Chummy S. Sinnatamby (2011) , Last anatomy – Regional and Applied 12th edition ; 51-52.
[28] Daimi SR, Siddiqui AU, Wabale RN. The Variations in branching pattern of the axillary artery with high origin of radial artery. Int.J Anat Var. 2010;3
[29] DeGaris C.F., Swartley W.B.(1928) The axillary artery in white and negro stocks.Am. J Anat.41: 353-397.
[30] George, B. M.; Nayak, S. & Kumar, P. Clinically significant neurovascular variations in the axilla and the arm – a case report.. Boston; Little Brown Co. Neuroanatomy, .; 1992; 6(1):36-38, [31] Hamilton WJ, Mossman HW. Cardiovascular system. In: Human embryology. 4th ed. Baltimore: Williams and Wilkins, 1972; 271-290.
[32] Heuston, F.T. (1885) Notes on some anatomical anomalies. Transactions - Royal Academy of Medicine in Ireland 3:453-456.
[33] Hitzrot, J.M. (1901) "A composite study of axillary artery in man" Johns Hopkins Hosp. Bull.12:136-145.
[34] Hollinshead WH. Anatomy for surgeons in general surgery of upper limb; The back and limbs. Volume3. New York:Heber- Harper Book;1958. p. 290-300.
[35] Hollinshead, W. H. & Rosse, C. Text Book of Anatomy. 4th Ed. Harper & Row, Philadelphia, 1985;187-189.
[36] Huber GC. The vascular system. In: Piersol's Human Anatomy. Philadelphia, London & Montreal, 9th Ed. Vol.1. J.B. Lippincott Co. 1930: 767-91.
[37] Jain SR et al. Variation in the origin of branches of axillary artery- A case report ,IJRRMS Vol-3 No.2 Apr - Jun 2013.
[38] Jakubowicz, M. and M. Bruska.(1980) "Case of variations in the arterial vascularization of upper limb"Folia Morphologica, Warsaw39:55-59.
[39] John E .Skandalakis (2004) , surgical anatomy – the embryologic and anatomic basis of modern surgery vol .I ; 142-143.
[40] Johnson, D. & Ellis, H. Pectoral girdle and upper limb. In: Standring, S. Ed. Gray's Anatomy 39th ed. Edinburgh, Elsevier, 2005;845.
[41] Jurjus AR, Correa-De-Aruaujo R, Bohn RC. Bilateral double axillary artery: embryological basis and clinical implications. Clin Anat 1999; 12:135-140.
[42] Karamursel S, Bagdatl D, Demir Z, Tuccar E, Celebioglu S. Use of medial arm skin as a free flap. Plast Reconstr Surg. 2005;115:2025-31.
[43] Khaki A.A., Shoja M.M.A., Khaki A. (2011) A rare case report of subscapular artery. Int. J. Anat. Embryol. 116: 56-59.
[44] Konarik, M., Katchlik, D., and V. Baca. (2014) A coincidental variation of the axillary artery: the brachioradial artery and the aberrant posterior humeral circumflex artery passing under the tendon of the latissimus dorsi muscle. Bos J Basic Med Sci 2014:1995-

2014.
[45] Miller, R.A. (1939) Observations upon arrangement of the axillary artery and brachial plexus. Am. J. Anat. 64:143-163.
[46] Neeta V Kulkarni(2016), Clinical anatomy (A problem solving approach) third edition, 141-144.
[47] P'an, Ming-Tzu. (1940) The origin of the branches of the axillary artery in the Chinese. Am. J. Physical Anthropol. 27:269-279.
[48] Pandey SK, Shukla VK. Anatomical variation in origin and course of the thoracoacromial trunk and its branches. Nepal Med Coll J. 2004 ; 6: 88-91.
[49] Pandey SK,Gangopadhyay AN, Tripathi SK, Shukla VK. (2004)" The Anatomical variations in the Termination of Axillary artery and its clinical Implications" Med. Sci. Law 44(1); p 61-66.
[50] Pellegrini, A. 1906 Le arteriae subclavia e axillaris nell' uomo studiate col metodo statistico. Arch. Ital. Anat. Embriol., 5: 205 and 466.
[51] Poynter, C.W.M.(1922) " The Congenital anomalies of arteries and veins of the human body with bibliography" The University Studies of the University of Nebraska. 22:1 p106.
[52] Raghu J, Satheesha Nayak B, Somayaji SN, Raju S, Srinivasa Rao S, et al.(2013) " A Typical Branching Pattern of Axillary Artery in South Indian Cadaver" – A Case Report Anatomomy Physiol 3: 118. doi:10.4172/2161- 0940.1000118 .
[53] Ramesh RT, Shetty P, Suresh R. Abnormal branching pattern of the axillary artery and its clinical significance. Int J Morphol. 2008;26:389-92.
[54] Ramsay, A.(1813) "Account of the unusual conformations of some muscles and vessels". Edinburgh Medical and Surgical Journal 8:281-283.
[55] Renan uflacker ,M.D(1997) The Atlas of vascular anatomy , an Angiographic Approach ,
[56] Romanes GJ. Cunningham's manual of practical anatomy. Volume1. 15th ed. Oxford: ELBS; 1992. p. 29-31.
[57] Saeed M, Rufai AA, Elsayed SE, Sadiq MS. Variations in the subclavian-axillary arterial system. Saudi Med J. 2002;22:206-12.
[58] Samta gaur et al, A Cadaveric Study of Branching Pattern of the Axillary Artery Int J Biol Med Res. 2012; 3(1): 1388-1391
[59] Sanioglu. S, Sokullu.O, Ozay. B, et al. Safety of unilateral antegrade cerebral perfusion at 22deg. C systemic hypothermia.The Heart Surg Forum. 2008;11:184-7.
[60] Saralaya .V., Joy .T., Madhyastha. S., Vadgaonkar .R., Saralaya,. S(2008) " The Abnormal branching of axillary artery: A subscapular common trunk." A case report. Int. J. Morphol. 26: 963-966.
[61] Snell R. Clinical Anatomy for medical students. 7th ed. 2004;475-477.
[62] Sudeshna Majumdar et al,Basic and Applied Anatomy A Study on Axillary Artery and its Branching Pattern among the Population of West Bengal, India. IJAE Vol. 118, n. 2: 159-171, 2013.
[63] Susan Standring editor. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 40th ed. 2008. Churchill-Livingstone: Elsevier. ISBN 978-0-443- 06684-89.
[64] T.S.Ranganathan (2012) , A textbook of human anatomy.,56-58.
[65] Tan C B, Tan C K." An unusual course and relations of the human axillary artery". Singapore Med J 1994; 35: 263-264.
[66] Thorek P. Superior Extremity-Axillary and Pectoral region. In: Anatomy in Surgery. 2nd Ed. Philadelphia, London & Montreal, J.B. Lippincott Co. 1951: 673-75.
[67] Trotter, M., Henderson, J.L., Gass, H., Brua, R.S., Weisman, S., Agress, H., Curtis, G.H. and E.R. West brook(1930) "The origins of the branches of axillary artery in Whites and American Negroes"Anat. Rec. 46:133-137.
[68] Vasudha S, Theresa J, Sampath M,Rajanigadha V& Shurti S.(2008). Abnormal Branching of Axillary Artery:Subscapular Common Trunk. A case Report. Int. J. Morphol. 26(2).963-966.
[69] Vatsala A R et al , A morphological study of axillary artery and its branching pattern , International Journal of Anatomy and Research, Int J Anat Res 2014, Vol 2(1):266-69. ISSN 2321- 4287.
[70] Vijaya PS, Venkata RV, Satheesha N, Mohandas R, Sreenivasa RB, Narendra " A rare variation in branching pattern of axillary arteries". Indian J Plast Surg. 2006;39:222-3.
[71] William P.L, Bennister L.H, Berry M.M,Collins P, Dyson M, Dussek J.E & Ferguson MW(1995). Gray's Anatomy in cardiovascular system. Gabella G. Ed. 38th Ed. Churchill Livingestone. Edinburg .1537-1538.
[72] Winslow.R (1883) " A study of the malformations, variations, and the anomalies of the circulatory apparatus in humans". Annals of Anatomy and Surgery 7:18-19.
[73] Wollard HH. The development of principal arterial stems in the forelimb of the pig. Contrib Embryol. 1922;14:139-54.
[74] Yoshinaga.K, Kodama. K, Kameta. K, Karasawa. N, Kanenaka. N, Kohno .S & Suganuma T(2006) "A rare variation in the branching pattern of axillary artery" Indian. J.Plast. Surg.39.222-223.