

VARIATION OF THE BIFURCATION OF BRACHIAL ARTERY: A CADAVERIC STUDY

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ABSTRACT

INTRODUCTION

Knowledge of variation in origin, course and bifurcation of brachial artery is significant for the vascular surgeons or radiologist for accurate diagnostic interpretation as well as while performing traumatic vascular repair, bypass procedures and constructive plastic surgeries. Therefore, the anatomical knowledge of the higher bifurcation of brachial artery is substantial for all cases of traumatic amputations and revascularization techniques. The present study aims to find out prevalence of variation of bifurcation of brachial artery in cadavers in the Department of Anatomy.

MATERIAL AND METHODS

An institutional based descriptive cross-sectional study was conducted on 15 formalin fixed embalmed adult human cadavers in the Department of Anatomy (Dissection Hall) at Universal College of Medical Sciences, Bhairahawa, Nepal. The study duration was from July 2021 to 15th October 2021. The finer dissection was made, the brachial artery was exposed, the level of variation was noted as well as length of brachial artery was measured then it was photographed by using digital camera.

RESULTS

In fifteen cadavers (right upper limb 15 and left upper limb 15), the site of termination was at the level of neck of radius 86.6% while, higher termination of brachial artery was observed in 2 upper extremities (6.7%) and, distal level of termination 2 (6.7%).

CONCLUSION

Knowing anatomical variations of arteries are of mandatory requirement for planning invasive and surgical treatment since lack of knowledge can cause serious vascular lesions. However, the prevalence of variation of bifurcation of brachial artery in our study is less than other similar studies. Hence, it may cause difficulty in clinical and surgical procedures.

KEYWORDS

Brachial artery, Bifurcation, Cadaver

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<https://doi.org/10.3126/jucms.v10i02.51287>

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INTRODUCTION

The brachial artery is the main artery of arm and continuation of 3rd part of axillary artery at lower border of teres major muscle ends in the cubital fossa opposite the neck of radius under cover of bicipital aponeurosis where it divides into radial and ulnar artery.¹ At first brachial artery is medial to the humerus, but gradually spirals anterior until it lies between the humeral epicondyles. The brachial artery is wholly superficial covered by skin, superficial fasciae and deep fasciae. Its pulsation can be felt throughout.² As it passes inferolaterally, the brachial artery accompanies the median nerve which crosses anterior to the artery. During its course through the arm, the brachial artery gives rise to unnamed muscular branches, humeral nutrient artery which arise from lateral aspect. The main branches of brachial artery that arise from medial aspect are the profunda brachial artery, superio ulnar collateral artery, inferior ulnar collateral artery and two terminal branches, i.e., radial and ulnar artery.¹⁻² The pulsation can be palpated on the anterior aspect of elbow which is commonly used brachial artery as well as to measure the blood pressure, cardiac catheterization for angioplasty and arterial grafting. Thus, any variation in brachial artery may cause difficulties during clinical and surgical procedures.³ An accurate knowledge of origin, course and branching pattern of these arteries of upper limb and its common variations is immensely important especially in the field of orthopedics, plastic and vascular surgeons, and radiologists and also for diagnostic and therapeutic approaches.⁴ Therefore, knowledge of higher division of brachial artery is substantial for all cases of traumatic amputations and revascularization techniques. Hence, higher level of bifurcation seeks a greater attention⁵.

MATERIAL AND METHODS

An institutional based descriptive cross-sectional study was carried out at the department of Anatomy, UCMS, Bhairahawa, Nepal. The ethical approval was taken from the IRC of the institution prior to the study (reference no. UCMS/ IRC/076/21). The study duration was from July 2021 to 15 October 2021. The embalmed cadavers were procured from the department of Anatomy, UCMS, and Bhairahawa, Nepal. Arm and forearm was dissected by taking incision with reference to Cunningham's dissection manual. Incisions will be extended both horizontally and vertically wherever the necessary. After that, skin, superficial and deep fasciae was cleaned and reflected to expose the brachial artery. The brachial artery was exposed proximally from its origin at lower border of teres major muscle; distally it was traced downward till upper one-third of forearm to evaluate any variations in the level of bifurcation artery. The length of brachial artery was measured in centimeter (cm) from lower border of teres major muscle to level of termination. In addition, the level of bifurcation was recorded proximally for higher bifurcation of brachial artery and distally for the ones termination at the level of radius. The data was entered in Microsoft excel and statistical analysis was done. Sample size was calculated by $N = Z^2pq/d^2$ with 95% confidence interval and 5% marginal error.

Inclusion criteria

Adult upper limbs irrespective of sex and race.

Exclusive criteria

Adult upper limb showing gross deformity
Asymmetry or partially amputated upper limb

Sample size

15 cadavers (30 upper limbs)

Materials

Instruments used to dissect out the cadavers
Scalpel with blade no 22
Scissors, fine and curved
Artery forceps straight and curved.
Forceps, tooth and non tooth

Other instruments used

Steel scale
Plastic numbering plates
Thread
Camera

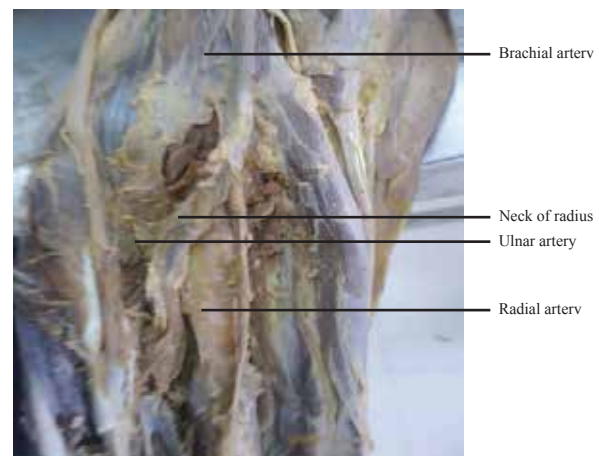


Figure 1. Bifurcation of brachial artery at the neck of radius

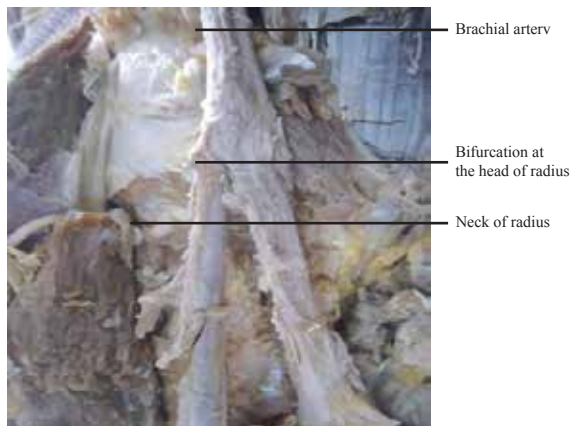


Figure 2. Bifurcation level above the neck of radius

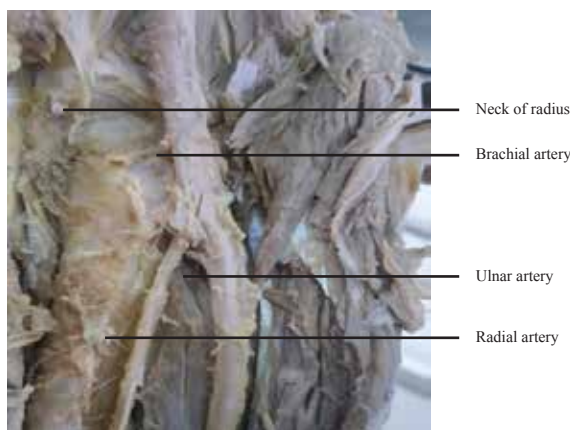


Figure 3. Bifurcation level below the neck of radius

RESULTS

It was observed that fifteen cadavers (15) or 30 upper limbs (right upper limbs 15 and left upper limbs 15)² upper limbs including both right and left of same cadaver showed higher bifurcation (6.6 %) which was 1.70 cm above the neck of radius. However, the lower level of termination 2 (6.6%) was below the neck of radius, which was measured 1.80cm below the neck of radius. In 26 (86.8%), it was found that the level of termination of brachial artery was at the neck of radius (Table 1) whereas the mean length of brachial artery at the neck of radius was 26.41 ± 0.76 cm while above the neck of radius was 24 cm and below the neck of radius 29.1 ± 0.10 cm (Table 2). It was reported that there was noticeable differences in the measurement of brachial artery between higher bifurcation and lower bifurcation level.

Table 1. Frequency of percentagen of the level of bifurcation of brachial artery

Level	Left (n)	Right (n)	Total number (%)
At the neck	13	13	26 (86.8)
Below the neck	1	1	2 (6.6)
Above the neck	1	1	2 (6.6)

Table 2. Length of brachial artery at different levels of bifurcation

Level	Mean (cm)	Minimu (cm)	Maximum (cm)	Standard Deviation
Length of brachial artery				
At the neck	26.41	25.00	28.00	0.76
Below the neck	29.10	29.00	29.20	0.10
Above the neck	24.00	24.00	24.00	-

DISCUSSION

Vascular variability in upper extremities is frequently observed. The present study has illustrated different levels of termination of brachial artery. It has been observed that among thirty specimens of upper limbs the bifurcation of brachial artery at the level of neck of radius was 86.6%, two specimens (6.6%) showed higher level of bifurcation while, 2 specimens (6.6%) showed the level of bifurcation was at the below the neck of radius. In many studies, prevalence of higher termination of brachial artery was found to be similar 6%, 6.5% and 7%.⁶⁻⁸ to present study. However, the findings from another authors illustrated greater prevalence of higher termination of brachial artery 10% and 12.5%.⁹⁻¹⁰ respectively. Similarly, some authors reported the greatest outcome 27.6%.¹¹ of higher bifurcation of brachial artery whereas some studies also demonstrate lower termination of brachial artery at the shaft of radius corresponding to radial tuberosity in 5.17%, and 8.6%.^{9,12}

Kaur et al revealed higher bifurcation of brachial artery into radial and ulnar artery 8 cm above the elbow joint.⁹ Similarly, Satyanarayana et al described a case of early division of brachial artery in the middle of right arm =20 cm and left arm = 21.5 cm above cubital fossa.¹³ where Singh et al observed found the bifurcation of brachial artery 7.5 cm and 10.5 cm respectively in the right and left upper limbs.¹⁴ Teli et al (2013) demonstrated high division of brachial artery into radial and ulnar artery into upper one third of arm 4 and, Madhyastha et al (2009) reported that they dissected corpse of a woman of 70 years old and found bifurcation of radial and ulnar artery occurring approximately at the upper third of arm around 4 cm distal to lower edge of teres major.¹⁵ In our study, we found termination level of brachial artery was 1.70 cm above the neck of radius. Meanwhile, lower termination of brachial artery was found in present study which was seemed 1.80 cm below the neck of radius corresponding to the shaft of radius. Sajida et al also witnessed lower termination of brachial artery ranged from 1.20 to 7.20 distal to intercondylar line at the level of radius. A study also reveals lower termination of brachial artery at the level of radial tuberosity in 8.6% of upper limbs.¹²

In this study, the mean length of brachial artery was 26.41 ± 0.76 cm at the neck of radius which ranged from 25 cm to 28 cm while, above the neck of radius (higher bifurcation level) was 24 cm and below the neck was 29.10 ± 0.10 cm. Other studies revealed the length of brachial artery was 26.29 cm and 27.1 cm respectively.^{16,17} With regards to variation in right and left upper extremity, the present data does not reveal any differences in the bifurcation of brachial artery in right and left upper limb which seemed bilateral symmetrical. Similarly, Singh et al (2010) reported that an unusual case of bilateral symmetrical higher bifurcation of

brachial artery into radial and ulnar with superficial course in right forearm.¹⁴ Junior et al, in 2011 conducted a study on 56 cadavers in which they encountered a case of high division of the brachial artery, located in the upper 1/3 rd in both arm, close to the axilla in a male cadaver (1.78%), placed 20 cm above the right cubital fossa and 21.5 cm from the left one. Incidence of a high division of the brachial artery is rare in general population, especially when it is bilateral.¹⁸

CONCLUSION

Learning anatomical variations of arteries is of mandatory requirement for planning invasive and surgical treatment since lack of knowledge can cause serious vascular lesions. The prevalence of variation of bifurcation of brachial artery in our study is less than other similar studies. Small sample size was taken because of minimal availability of cadavers which further limits the scope of study. Therefore, it is suggested that additional research with large sample size will be required to evaluate further accurate prevalence of variation in vasculature and its relation with the outcomes of clinical and surgical procedures.

ACKNOWLEDGEMENTS

The authors acknowledge the support from the staffs of department of Anatomy, UCMS-TH, Nepal for their co-operation and support in cadaver handling.

CONFLICT OF INTEREST

None

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