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Anatomical Variation of Brachial Artery and its Clinical Implications: A Cadaveric Study

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ABSTRACT

Background: Anatomical knowledge about the branches of Brachial artery and variations in the branching pattern is important for surgeons, physicians, radiologists, and interventionists since new diagnostic and therapeutic approaches can be proposed based on anatomical studies. An abnormal branching pattern in the vasculature of the upper limb is attributed to the embryonic development of the vascular plexus of the upper limb bud. Anatomical variation of high brachial artery bifurcation and these morphological variations of the brachial artery should be considered by surgeons when performing procedures in the brachial artery area.

Aim: Brachial artery is one of the important arteries from a clinical point of view the branching pattern of brachial artery is important in treatment of various diseases.

Material and Method: This study was carried out in the Department of Rachana Sharir, PGIA, Dr. Sarvapalli Radhakrishnan Rajasthan Ayurveda University Jodhpur. The dissection of the arm and forearm region was performed using standard techniques according to a strictly specified protocol.

Results: Brachial Artery bifurcates into Ulnar and Radial at a higher level than normal in specimen.

Conclusion: Brachial artery and its terminal branch variations are less common. However Brachial artery could Be bifurcated and then reunited. In this case, the brachial artery presented bifurcation one laterally and another one medially with the median nerve running between them. Both branches don't reunite but continue laterally and medially, respectively. In most cases, the brachial artery ends in the cubital fossa at the level of the radial neck, where it divides into two terminal branches, i.e., the radial and ulnar arteries.

Keywords: Bifurcation, Brachial artery, Ulnar artery, Radial artery, anatomical variations,

Introduction:

The brachial artery is the main artery of the arm which terminates by bifurcating into radial and ulnar arteries in the cubital fossa. This artery continues the axillary artery as it passes at the inferior border of the teres major muscle. In its course, the brachial artery gives off the nutrient artery of the humerus and muscular branches, it also has other branches, including the deep brachial artery, the superior ulnar collateral artery, and the inferior ulnar collateral artery. The deep brachial artery originates from the back of the brachial artery, continuing downward and passing the radial humeral groove along the radial nerve; it supplies blood to the triceps and branches into radial collateral and middle collateral arteries, which are involved in forming the anastomosis around the elbow joint. The superior ulnar collateral artery originates from the middle of the arm and goes to the posterior aspect of the medial epicondyle together with the ulnar nerve, which also anastomoses in the arterial network of the elbow. The inferior ulnar collateral branch begins above the elbow, then goes medially to the medial epicondyle and is part of the arterial anastomosis of the elbow joint.

The brachial artery is widely applied in many medical interventions, such as approaches for coronary, and endovascular procedures, peripheral vascular procedures, and vascular shunt for haemodialysis. Brachial artery pulse is easily detectable at the middle third of the arm on the brachial artery; therefore, this point allows to perform blood pressure measurement before bifurcating in radial and ulnar arteries. Anatomical variations of the upper extremities' arterial system are quite common; however, the brachial artery and its terminal branch variations are less common.

Brachial Artery is commonly used for determining blood pressure by applying sphygmomanometer cuff in the arm. Brachial artery in the cubital fossa is a convenient site for collecting arterial blood samples.

Awareness of variations of Brachial artery and its branches is important to avoid serious complications while treating the cases of arteriovenous fistulae, aneurysms, abscess and drainage in the region of axilla, arm or cubital fossa. Brachial artery is used in diagnostic angiography, cardiac catheterization for angioplasty, carotid stentin, transbrachial access for endovascular renal artery stenting, and embolectomy through arteriotomy. The Brachial Artery catheterization is gaining popularity because of early ambulation.

Case Presentation:

The following unexpected results were found during a normal dissection of the upper limb of a female cadaver, age about 55, for a final-year PG scholar student. A longitudinal incision was made at the left anterior arm region, beginning at the acromion process and proceeding up to the top part of the anterior forearm, with great care. Subcutaneous tissues were then removed, all the while paying close attention to the blood vessels, muscles, and nerves. After the muscles were reflected laterally and medially, the brachial artery's origin, path, branches, and termination were meticulously traced, all the way to the cubital fossa. It was found that the brachial artery bifurcated into medial and lateral branches in the proximal portion of the humerus.

The lateral branch persisted on its laterally directed path, running lateral to the median nerve and ending in the cubital fossa, which is where it proceeded into the forearm. The medial branch, on the other hand, proceeded along the medial side, medial to the median nerve, up to the cubital fossa, and into the forearm.

Fig- Brachial Artery bifurcates into Ulnar and Radial at a higher level than normal

Clinical Significance:

This anatomical variation can cause problems when measuring blood pressure and may interfere with the evaluation of angiographic images. During venepuncture, accidental puncture of superficially placed arteries may occur. It is also vulnerable to injury during limb surgeries. There have been reports of acute ischemia caused by embolic events in cases of high bifurcation of the brachial artery. However, this anomaly can be successfully treated with embolectomy once identified.

It is important to note that these anatomical variations have implications beyond surgical considerations. They also play a crucial role in diagnostic and therapeutic interventions. Awareness of these variations is necessary to prevent complications during arteriovenous fistulae treatment, aneurysm repair, and abscess drainage in the upper limb region. Additionally, the brachial artery is a vital site for blood pressure measurement and arterial blood sample collection, so knowledge of its variations is essential for accurate clinical assessments and diagnostic procedures.

Discussion:

Variations in vascular patterns are often caused by developmental anomalies in the formation of blood vessels in any part of the body. The most common variation of the brachial artery is the high division of the artery. If variations originate in the arm, the term "brachio" is combined with the corresponding region in the forearm (e.g., brachioradial, brachioulnar). The term "superficial" is added based on whether the arteries follow a normal or superficial course in the forearm. In our case, both the radial and ulnar arteries had a superficial course in the forearm, therefore they can be called "superficial" radial and ulnar arteries. Typically, when the ulnar artery has a high origin, its course is always superficial to the forearm flexors.

This study aims to delve into the anatomical variations of the brachial artery, specifically focusing on its branching pattern and the implications of these variations in clinical practices. The brachial artery is a crucial vessel of the upper limb, and understanding its normal and variant anatomy is essential for

various medical professionals, including surgeons, physicians, radiologists, and interventionists. An aberrant branching pattern can significantly impact surgical procedures, diagnostic interventions, and therapeutic approaches involving the brachial artery and its vicinity.

Variations in the vascular pattern of the upper limb can pose challenges during cardiac catheterization, intra-arterial injections, and angiographic procedures utilizing the brachial artery as an access point. Therefore, it is crucial to have a thorough understanding of the anatomical variations of the brachial artery, especially in clinical settings where precise knowledge of vascular anatomy is essential for successful outcomes.

The case presented in this study underscores the significance of thorough anatomical understanding, especially in clinical settings where precise knowledge of vascular anatomy is essential for successful outcomes. By meticulously dissecting and documenting the observed variation, the study contributes valuable insights into the anatomical diversity of the brachial artery, enhancing the understanding of potential variations that clinicians may encounter in practice.

Conclusion:

Blood pressure is commonly measured through the brachial artery, but due to its variation, there may be errors in the results. During surgical or cannulation procedures, the position of radial and ulnar arteries can confuse clinicians and the brachial pulse may be weak or absent. Additionally, if the brachial artery bifurcates higher, its branches become more superficial and are more vulnerable to injury. Intra-vascular injection into it can accidentally occur, leading to gangrene, thrombosis, and even amputation of the fingers or arm in severe cases.

Variations in the origin and course of the principal arteries of the upper limb are well-documented and can be caused by genetic influences, fetal position in utero, first limb movement, or unusual muscular development. Vascular anomalies in common surgical sites can increase the likelihood of damage during surgery and diagnostic procedures. Surgeons and radiologists need to be aware of possible arterial and muscular variations to prevent complications. A sound knowledge of possible variations in the branching pattern of the brachial artery can avoid complications.

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