[Case Report] High Bifurcation and Anatomical Variation of the Brachial Artery

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Abstract

Background: The brachial artery provides the main arterial supply to the arm and is the continuation of the axillary artery. It is critical that potential morphological and structural variations be taken into consideration in everyday surgical practice, as a lack of awareness could lead to fatal consequences. The major variations in the arterial patterns reported are the higher origin of the radial and ulnar arteries.

Objective: The aim was to determine and find out the variations in the division pattern of the main artery of the arm; the brachial artery.

Case report: During dissection of the right part of the upper limb, I found the brachial artery as it courses with the median nerve, which was crossing the posterior surface of the brachial artery in the arm. The brachial artery was found bifurcating at the middle third of the arm into the radial artery and the ulnar artery. When pharyngeal arches form during the fourth and fifth weeks of development, each arch receives its artery. These arteries, the aortic arches, arise from the aortic sac, the most distal part of the truncus arteriosus.

Conclusion: The implication of this anatomical variation is very important to conduct clinical procedures, particularly

orthopedic, plastic, and vascular surgeries.

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Keywords: Anatomical variation, Brachial artery, Bifurcation, Radial artery, Ulnar artery.

1. Background

The brachial artery provides the main arterial supply to the arm and is the continuation of the axillary artery. It begins at the inferior border of the teres major and ends in the cubital fossa, opposite the neck of the radius where, under the cover of the bicipital aponeurosis, it divides into the radial and ulnar arteries. The brachial artery, relatively superficial and palpable throughout its course, lies anterior to the triceps and brachialis. At first, it lies medial to the humerus where its pulsations are palpable in the medial bicipital groove. It then passes anterior to the medial supra-epicondylar ridge and trochlea of the humerus. 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 many unnamed muscular branches, and the humeral nutrient artery, which arises from its lateral aspect. The main named branches of the brachial artery arising from its medial aspect are the profunda brachii artery (deep artery of the arm) and the superior and inferior ulnar collateral arteries [1].

It is critical that potential morphological and structural variations be taken into consideration in everyday surgical practice, as a lack of awareness could lead to fatal consequences. Moreover, an intimate knowledge of arterial anatomy of upper extremities and its common variations is indispensable for limb surgeons. Appreciation of variations in the upper extremity vasculature is essential to prevent injury, thrombosis, gangrene, and even amputation of limbs, particularly in patients requiring dialysis or undergoing arteriography. Accurate knowledge of the course and relations to surrounding structures is of great importance for surgeons, radiologists, anatomists, and routine patients as well [2].

The major variations in the arterial patterns reported are the higher origin of the radial and ulnar arteries[3]. Sometimes the brachial artery divides at a more proximal level than usual. In this case, the ulnar and radial arteries begin in the superior or middle part of the arm, and the median nerve passes between them. The musculocutaneous and median nerves commonly communicate between them [1]. In this case report, variations of the brachial artery, compared with a pattern reported previously.

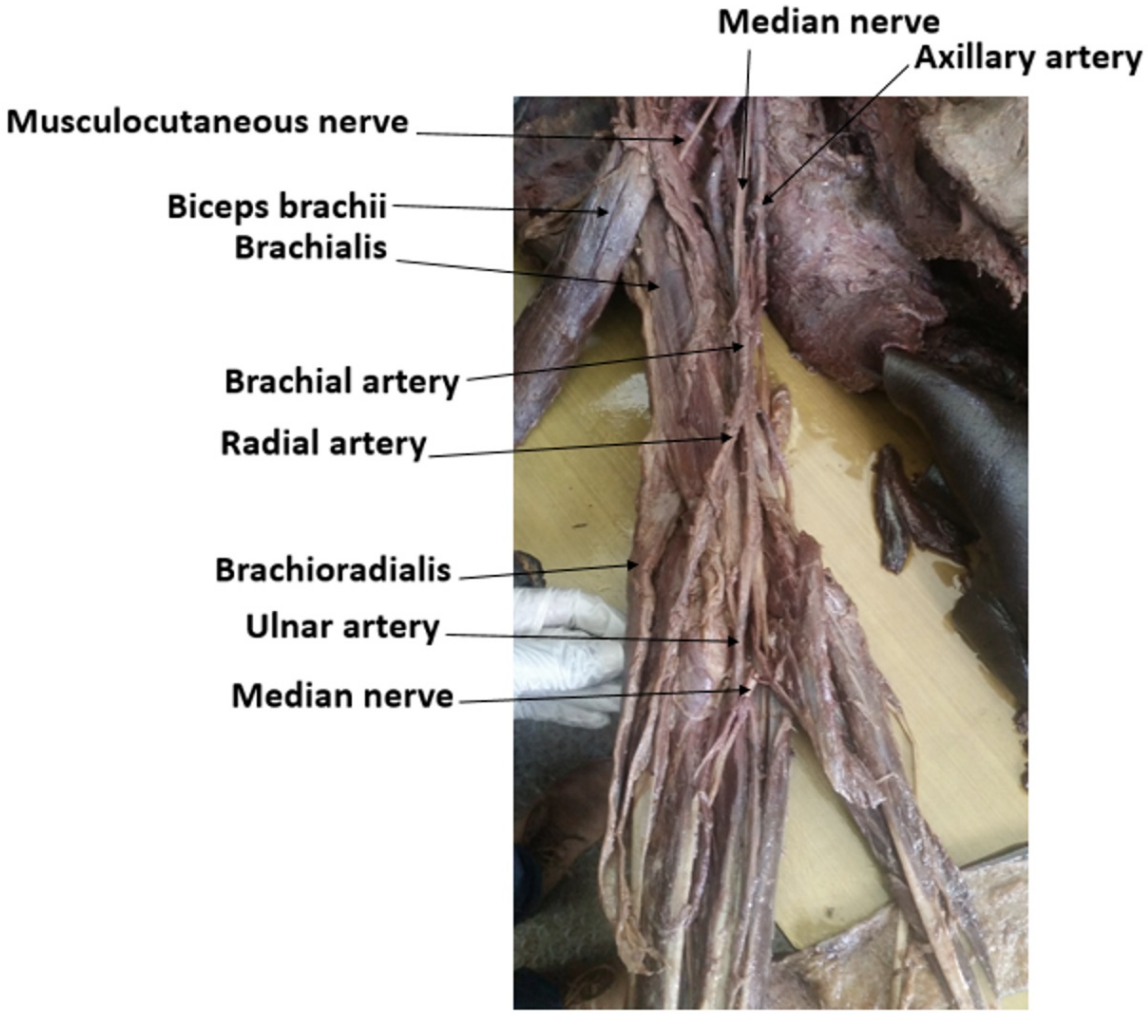

Figure 1. Radial artery arising at a higher level in the right arm.

2. Case report

During a routine dissection of the upper limb in the Anatomy laboratory at the Department of Medicine for pre-clinical-I students at Wachemo University, an unusual arterial variation was observed in a 65-year-old male cadaver preserved in formaldehyde solution. The dissection was started with a skin incision of the anterior compartment of the arm, and using blunt dissection with a probe, we demonstrated the superficial veins of the arm. Then, the muscle in the anterior arm was separated to dissect deep structures in the arm and axilla. We used scissors to open the anterior surface of the axillary sheath and identified the axillary vein, which was formed by the joining of the two brachial veins. To enhance the dissection of the arteries and nerves in the axilla, the axillary veins with their tributaries were removed. The axillary artery was surrounded by the brachial plexus. The brachial plexus was then retracted and preserved during the dissection of the axillary artery and its branches. While dissecting the axilla, we found the musculocutaneous nerve as it enters the coracobrachialis muscle (Figure 1).

During dissection of the right part of the upper limb, we found the brachial artery as it courses with the median nerve, which was crossing the posterior surface of the brachial artery in the arm. The brachial artery was found bifurcating at the

middle third of the arm into the radial artery and the ulnar artery (Figure 1). The radial artery crossed the superficial surface of the brachialis muscle in the arm and crossed the cubital fossa to enter the deep surface of the brachioradialis muscle in the forearm. The brachial artery continued as the ulnar artery in the forearm. Branching patterns of the radial and ulnar arteries in the forearm and hand were usual. The left arm showed no unusual vascular observations.

3. Discussion

Blood vessel development occurs by two mechanisms: (1) vasculogenesis, in which vessels arise by coalescence of angioblasts, and (2) angiogenesis, whereby vessels sprout from existing vessels. The major vessels, including the dorsal aorta and cardinal veins, are formed by vasculogenesis. The remainder of the vascular system then forms by angiogenesis. The entire system is patterned by guidance cues involving vascular endothelial growth factor (VEGF) and other growth factors (Figure 2). When pharyngeal arches form during the fourth and fifth weeks of development, each arch receives its artery. These arteries, the aortic arches, arise from the aortic sac, the most distal part of the truncus arteriosus [4].

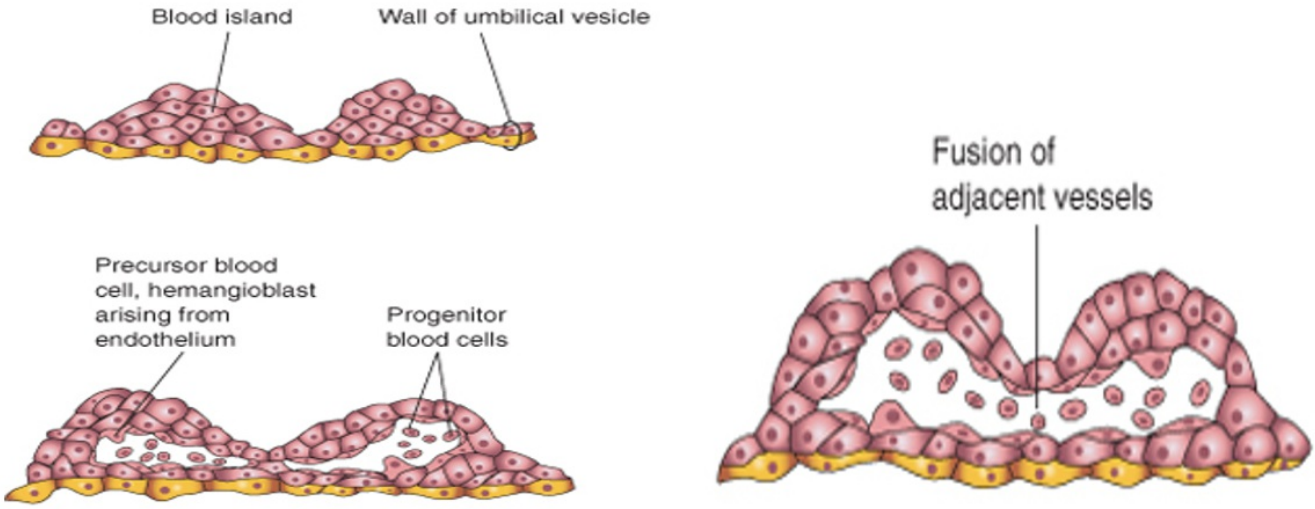

Figure 2. Successive stages in the development of blood and blood vessels [4].

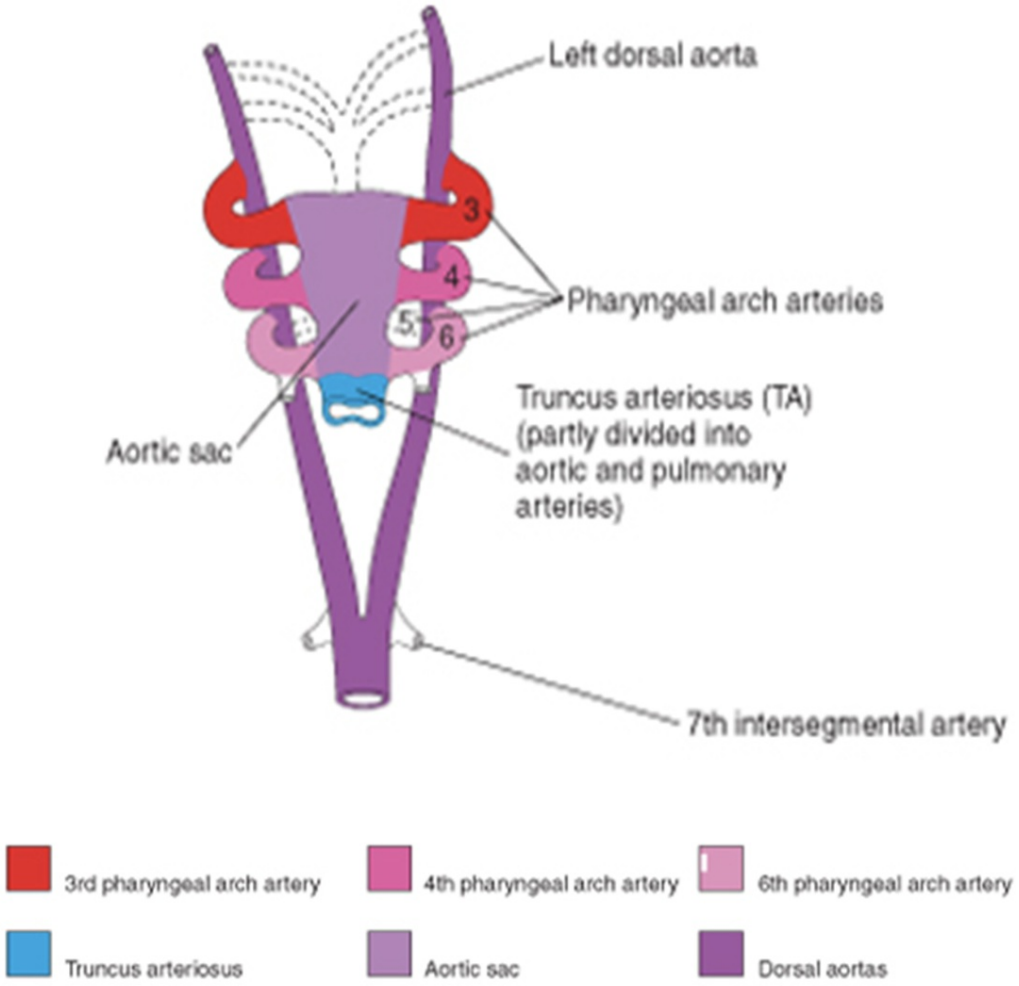

Figure 3. Pharyngeal arch artery [4].

In the upper limb bud, the axis artery is derived from the lateral branch of the seventh intersegmental artery, which is the subclavian artery. The proximal part of the main trunk of this artery forms the axillary and brachial arteries, and its distal part persists as the anterior interosseous artery and deep palmar arch. Radial and ulnar arteries are the last to appear in the forearm from the axis artery, which is the brachial artery. Initially, the radial artery arises more proximally than the ulnar artery. Later, it establishes a new connection with the main trunk at or near the level of the ulnar artery. The upper portion of its original stem usually disappears to a large extent. Persistence of the upper portion of the radial artery arising from the brachial artery proximal to the origin of the ulnar artery followed by failure of development of the new connection of the radial artery with the brachial artery at the level of the origin of the ulnar artery causes this type of anomaly [5][6].

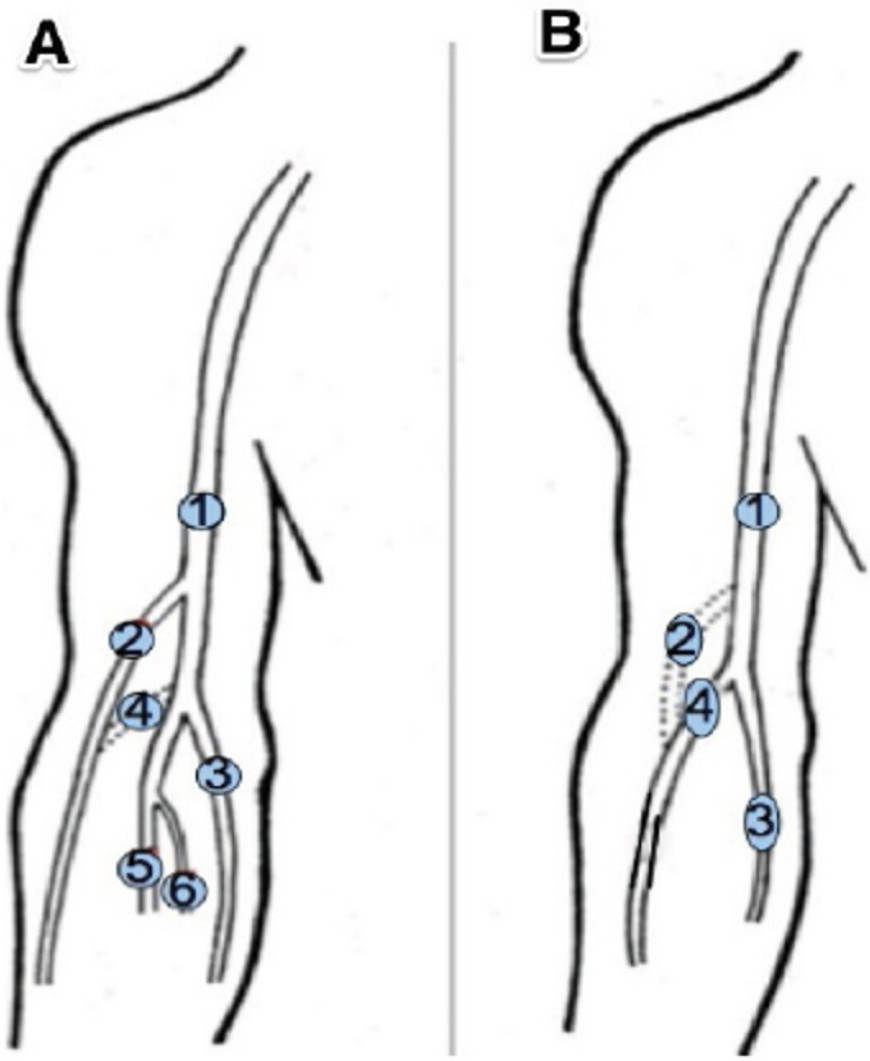

Figure 4. Schematic diagram of development of the brachial artery showing the normal pattern (B) and variant as seen in our case (A). 1, brachial artery; 2, radial artery—initial connection; 3, ulnar artery; 4, radial artery—final connection; 5, anterior interosseous artery; and 6, median artery [6].

4. Conclusion

Implication of this anatomical variation is that its influence, especially on the conduct of clinical or surgical procedures like arteriography images, could have serious implications in orthopedic, plastic, and vascular surgeries. Additionally, its effect on blood pressure measurement, which is normally measured in the arm in the brachial artery.

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