Case Report

Trifurcation of brachial artery with variant course of radial artery: Rare observation

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Abstract

Variations in the arterial pattern of the upper limb have been observed frequently, either in the routine dissections or in clinical practice. The aim of the present study was to describe the anatomical, surgical and embryological importance of major arteries of upper limbs of human beings. The present article is the report of low division and trifurcation of brachial artery and abnormal course of radial artery (passing deep to the pronator teres muscle) found in a 45-year-old embalmed male cadaver. Knowledge of the arterial variations in the upper limb is of considerable importance during invasive and non-invasive investigative procedures or orthopedic, reconstructive, or surgical procedures.

Key words: brachial artery, radial artery, upper limb.

Introduction

The brachial artery, a continuation of the axillary artery, begins at the distal border of the tendon of teres major muscle and ends approximately 1 cm distal to the elbow joint (at the level of the neck of the radius) by dividing into radial and ulnar arteries. The artery is superficial throughout its course in the arm, lying immediately deep to the deep fascia, and is accompanied by a pair of venae comitantes. Branches of the brachial artery include profunda brachii, nutrient, superior, middle and inferior ulnar collateral, deltoid, muscular, radial and ulnar arteries (Standring, 2005). The variations of the brachial artery and its branches are common. In rare cases the brachial artery may be absent (Ciervo et al., 2001), it may divide at a higher level (Standring, 2005) or it may trifurcate (Malcic-Gurbuz et al., 2002; Yalcin et al., 2006). A case of an accessory brachial artery has also been reported (McCormack et al., 1953).

The radial and ulnar arteries form the main source of arterial supply to the forearm and hand. Normally the radial artery after its origin runs laterally superficial to the tendon of the biceps brachii, supinator, pronator teres and appears in the front of the forearm. A number of variations have been reported previously regarding the origin and course of the radial artery. The radial artery may arise from the axillary artery (Sargon & Cellik, 1994) or from the medial side of the brachial artery at a higher level than usual and may cross over the brachial artery to the lateral side superficial to the bicipital aponeurosis to enter the forearm (Sargon et al., 1996), or may run superficial to flexor muscles of the forearm and over the thenar muscles (Jurjus et al., 1986). Sometimes the radial artery may be absent (Porter & Mellow, 2001) or it may be present as two superficial arteries (Sahin & Seelig, 2000).

Case report

The present study involved the upper limb dissection of a 45-year-old male cadaver in the Department of Anatomy, Melaka Manipal Medical College, India. The dissections of upper limbs were carried out according to the instructions by Cunningham's manual of practical anatomy (Romanes, 2003). Both upper extremities (right and left) of the body were dissected. The dissections took place during 2005–06. The body was preserved by the injection of a formalin-based preservative (10% formalin) and stored at –4°C. Regarding the dissection procedure, we took the cubital fossa as the landmark. Next, we dissected the anterior compartment of the forearm and palm to see the course, distribution and termination of the radial and ulnar arteries. Before taking photographs the dissected region was rinsed with water.
The right upper extremity had anomalous brachial and radial arteries but the left upper extremity was normal. The right brachial artery began as a continuation of the axillary artery at the distal border of the tendon of the teres major muscle. It ran downwards, at first medial to the humerus and then inclined to lie in front of the bone until it appeared in the cubital fossa. It ended by dividing into radial, ulnar and common interosseous arteries very close to the apex of the cubital fossa (Fig. 1). All three arteries passed deep to the tendon of the pronator teres muscle (Fig. 1a). The radial artery passing deep to the tendon of the pronator teres muscle is not normal and has not been reported in the literature. The brachial artery also gave origin to branches that replaced the course and distribution of normal radial recurrent, anterior ulnar recurrent and posterior ulnar recurrent arteries. Further course and branching pattern of radial and ulnar arteries below the level of pronator teres were normal in the forearm and palm.

**Discussion**

The variations in the arterial pattern are due to deviations from the usual development (Fig. 2a). In the upper limb bud, usually only one trunk, the subclavian trunk, persists and it probably represents the lateral branch of the seventh intersegmental artery. The continuation of the subclavian trunk forms the axis artery of the upper limb, which is the axillary artery in the axilla and the brachial artery in the arm. In the forearm it passes deep to the flexor muscle mass and terminates as a deep plexus in the developing hand. This vessel ultimately persists as the anterior interosseous artery and the deep palmar arch. A branch from the main trunk passes dorsally between the early radius and ulna as the posterior interosseous artery, a second branch accompanies the median nerve into the hand, where it ends in a superficial capillary plexus. The radial and ulnar arteries are the latest arteries to appear in the forearm; at first the radial artery arises more proximally than the ulnar, crosses in front of the median nerve, and supplies the biceps. Later, the radial artery establishes a new connection with the main trunk at or near the level of origin of the ulnar artery. The upper portion of its original stem usually disappears. On reaching the hand, the ulnar artery links up with the superficial palmar plexus, from which the superficial palmar arch is derived. The median artery commonly loses its distal connections and is reduced to a small vessel. The radial artery passes to the dorsal surface of the hand. After giving off dorsal digital branches it traverses the first intermetacarpal space and joins the deep palmar arch (Standring, 2005).

The developmental reason for the trifurcation of the brachial artery in the present case may be due to the radial artery establishing a connection with the axis artery at the level of origin of the ulnar artery, the posterior interosseous artery arising from the axis artery just distal to the connection of the radial artery and origin of ulnar artery. The main trunk (axis artery) between radial, ulnar and posterior interosseous arteries continued as the common interosseous artery (Fig. 2b).

Trifurcation of the brachial artery is a rare occurrence. We have found only two such reports in the literature: (i) trifurcation of the brachial artery into radial, ulnar and superior ulnar collateral arteries (Malcig-Gurbuz et al., 2002); and (ii) radial, ulnar and muscular arteries (Yalcin et al., 2006). The present case is different from already published reports because the brachial artery in the present case trifurcated into radial, ulnar and common interosseous arteries.

The abnormal course of the radial artery as in the present case is of interest to clinicians, particularly surgeons and radiologists for the following reasons.