

## A high origin of radial artery with asymmetrical vasculature of upper limbs: a case report

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### ABSTRACT

During routine dissection of upper extremity in the department, variation in formation of radial artery was observed in a male cadaver of about 55 years of age. On the left side radial artery has taken origin from 2<sup>nd</sup> part of axillary artery where as in right it has originated at its normal level. The variation in relation of median nerve with the axillary artery was also seen on the right side of the same body. These not so common phenomena are discussed in the light of embryological basis. These variations may have diagnostic, interventional and surgical significance.

**Keywords:** Radial artery, axillary artery, primitive axial artery, superficial brachial artery.

Radial artery is smaller terminal branch of brachial artery and begins in the cubital fossa about 1 cm below the bend of elbow at the level of the neck of radius. Brachial artery is continuation of axillary artery. In the hand branches of radial artery and ulnar artery contribute to the formation of superficial palmar arch.<sup>1,2</sup>

The median nerve is one of the branches of the brachial plexus, formed anterior to the axillary artery in the axilla by the union of medial and lateral roots. The median nerve descends anterior to the axillary artery and upper part of brachial artery to reach the medial aspect of the brachial artery in the distal half of the arm. It supplies most of the flexor muscles in the front of the forearm, thenar muscles, two lumbrical muscles and partly the skin of palm and fingers in the hand<sup>3</sup> (Fig. 3).

### CASE REPORT

During routine undergraduate dissection done in the department of Anatomy, M.G. Institute of Medical Sciences, Sevagram, India following features were seen in the upper limbs of a man of 55 years of age.

**Left side** (Fig. 1 and Fig. 4.)

- A high origin of radial artery from the 2<sup>nd</sup> part of axillary artery, which had bifurcated into radial and brachio-ulnar trunk in the axilla itself.
- The radial artery did not give any branch in the arm; branches of the 3<sup>rd</sup> part of the axillary artery and brachial artery were given from the brachio-ulnar trunk.
- In cubital fossa the brachio-ulnar artery gave common interosseous branch at the level of neck of radius which divided into the anterior and posterior

interosseus artery. The trunk continued as ulnar artery in its further course.

- Radial artery crossed the median nerve anteriorly from medial to lateral side in the upper part of arm and continued as definitive radial artery in the forearm passing superficial to all flexor muscles.
- Median nerve was found posterior to the radial artery but anterior to the brachio-ulnar artery.

**Right side** (Fig. 2. and Fig. 5.)

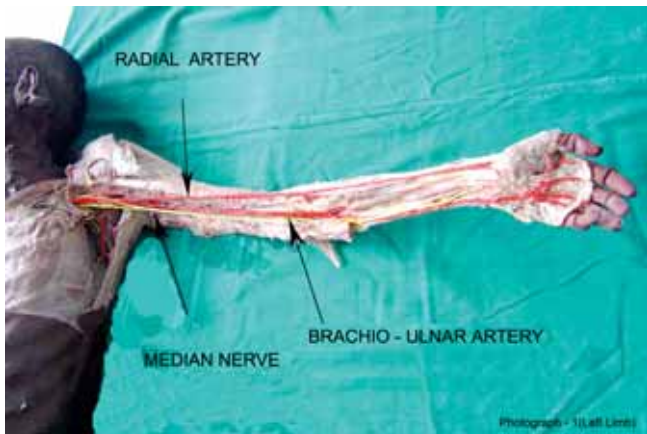
- The median nerve was formed medial to the 3<sup>rd</sup> part of axillary artery. The lateral root of median nerve crossing the vessel posteriorly joined with medial root to form median nerve, posteromedial to the 3<sup>rd</sup> part of axillary artery.
- Median nerve did not give any branch in the arm.
- The brachial artery after giving of the usual branches<sup>4</sup> divided at the cubital fossa into radial and ulnar artery.
- Rest of the distal vasculature were normal.

### DISCUSSION

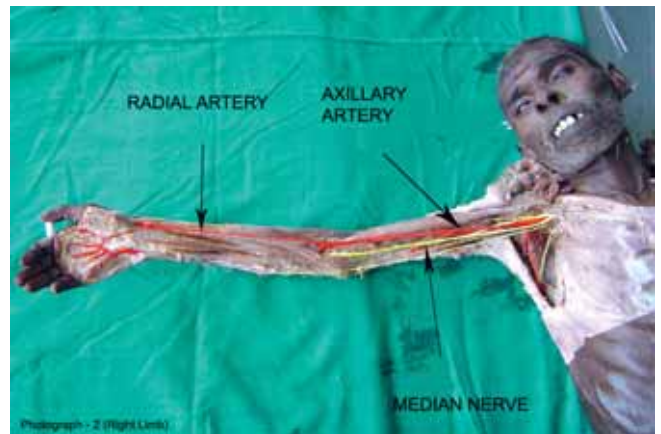
The anomalous blood vessels may be due to (i) the choice of unusual paths in the primitive vascular plexuses, (ii) the persistence of vessels normally obliterated, (iii) disappearance of vessels normally retained, (iv) incomplete development and (v) fusions or absorption of the parts usually distinct.<sup>5</sup>

Ontogenic basis of the present case can be explained if we look at the developmental stages of upper limb arteries.<sup>6</sup>

- I) The primitive axial artery of the upper limb bud represents lateral branch of 7<sup>th</sup> intersegmental artery.



**Fig. 1.** Dissected view of left arm showing high origin of radial artery and position of median nerve.



**Fig. 2.** Dissected view of right arm showing position of median nerve posterior to the 3<sup>rd</sup> part of the axillary artery.

It gives the superficial brachial artery a consistent embryonic vessel situated anterior to the cords of the brachial plexus (Fig. 6).

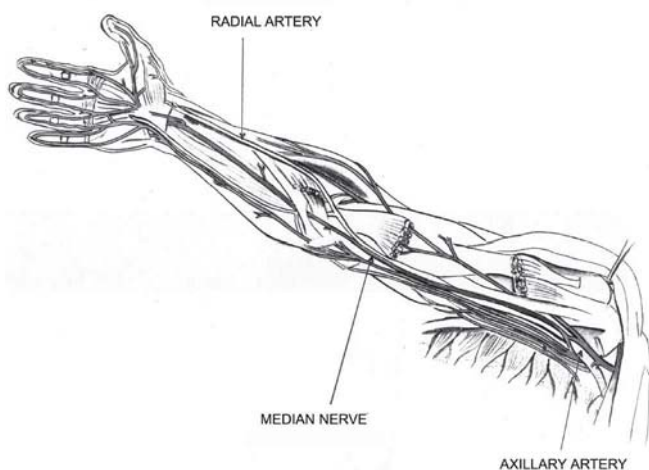
- II) The superficial brachial artery has two terminal branches above elbow joint; lateral of which continued in the forearm as a part of the definitive radial artery and medial one termed as superficial antebrachial artery.
- III) The superficial antebrachial artery divides below elbow joint into two terminal branches, median and ulnar which passes deep to flexor muscles. Each of these branches anastomoses with a corresponding branch of primitive axial artery. The preanastomotic component from primitive axial artery forms the main trunks of the median and ulnar arteries while postanastomotic part of the superficial antebrachial artery forms rest of these vessels (Fig. 6).
- IV) Gradually the primitive axial artery attains the haemodynamic predominance and persists as axillary and brachial artery.
- V) Superficial brachial artery together with the pre-anastomotic segments of its terminal branches regresses.

- VI) The radial artery has arisen more proximally than ulnar and crosses in front of median nerve (as the case here). Subsequently the lateral branch of the primitive axial artery anastomoses with the lateral terminal branch of the superficial brachial artery more distally to form the trunk of the radial artery. The lateral branch of the primitive axial artery attains the haemodynamic predominance and proximal part of superficial brachial artery along with its preanastomotic segment regresses. The postanastomotic segment of the lateral terminal branch of superficial brachial artery persists as the definitive radial artery.

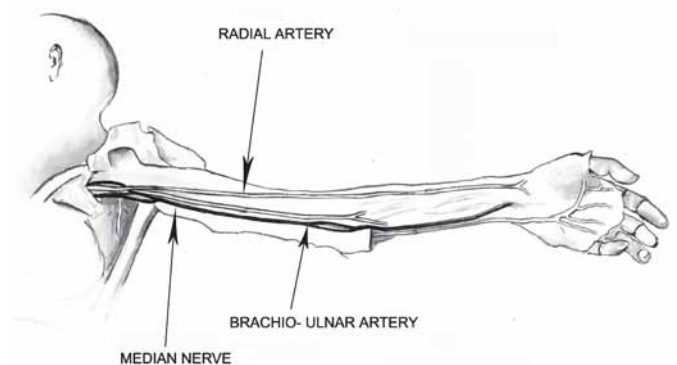
The embryological explanation of the present findings

**1) Left side**

The superficial antebrachial artery formed and crossed anterior to the brachial plexus (median nerve). Lateral communicating branch of the primitive axial artery or the anastomotic channel between it and superficial brachial artery did not form. There after the latter had attend the haemodynamic predominance and persisted as the radial artery as a branch of axillary artery high up in the upper limb.<sup>2,7</sup> It ran anterior to median nerve.



**Fig. 3.** Normal pattern of median nerve formation.



**Fig. 4.** Schematic diagram of Fig. 1

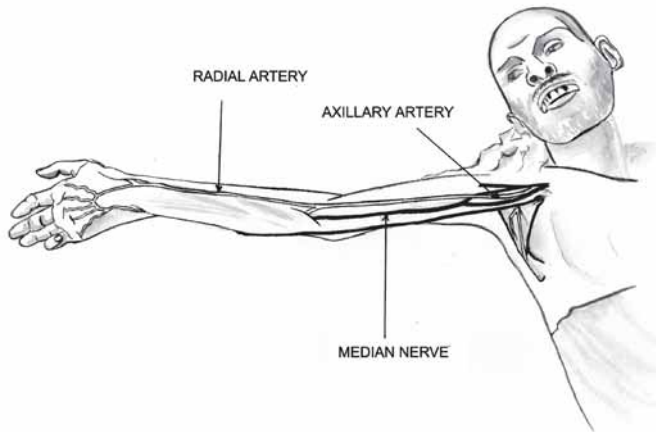


Fig. 5. Schematic diagram of Fig. 2

Rest of the upper limb vasculature development were normal.

## 2) Right side:

The distal part of the primitive axial artery had regressed after forming the anastomotic channel with the superficial brachial artery which is anterior to the cords of the brachial plexus. The latter had attained the haemodynamic predominance and persisted as the definitive brachial artery dividing into the radial and ulnar arteries as usual.

Formation of the median nerve posterior to the 3<sup>rd</sup> part of the axillary artery confirms the haemodynamic predominance and persistence of the superficial brachial artery as axillary and brachial artery.<sup>8</sup>

## CLINICAL IMPLICATIONS:

The knowledge of such variation is important for the diagnostic, interventional and surgical procedures. It may cause misinterpretation of angiographic images. Accidental puncture of superficially placed arteries may occur while attempting venipuncture, susceptible to damage in orthopedic and plastic surgery operations.<sup>9</sup>

Anomalous origin of the radial artery may cause the failure of the radial approach of the coronary angiography<sup>10</sup> and in the reconstructive surgery of the upper limb it can be ligated or cut considering it as a vein leading to disorder in circulation of the hand.<sup>11</sup>

When the superficial brachial artery persists it is more vulnerable to the accidental injuries,<sup>12</sup> it can be easily mistaken as a vein and intravenous injections into it can be disastrous.<sup>13</sup>

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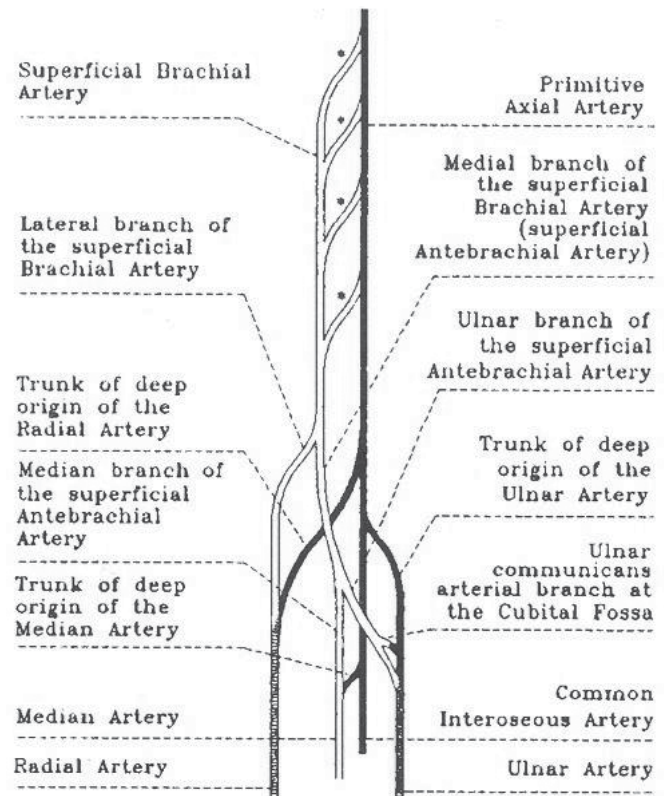


Fig. 6. Schematic diagram of formation of the arteries of arm and forearm in fetal life.

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