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Anatomy of the deep brachial artery — general overview (cadaveric study) — discussion on terminology

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Abstract: There are only very few studies on the anatomy of the deep brachial artery — DBA (*arteria profunda brachii*), both regarding its course, branching pattern and contribution to the cubital rete. Most of the textbooks are based on data which remain unchanged for years. The aim of this article was to summarize the current knowledge on this vessel, based on the anatomical and clinical studies and other sources available including also own cadaveric study. We tried to present also some controversies regarded to the nomenclature of the branches of the DBA.

Key words: deep brachial artery, course, anatomical variation, nomenclature.

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Introduction

The deep brachial artery (DBA) is one of the major branches of the brachial artery. Its course and regular branching pattern has been described years ago and is presented unchanged even in the most outstanding textbooks [1]. Moreover, current national textbooks dealing with anatomical nomenclature [2, 3], still present unchanged patterns.

Numerous studies have been undertaken to elicit variations of different vessels in the human body [4]. Interestingly, not too many articles deal with the philosophy of normality and variability in anatomy [5].

There are only very few modern studies dealing with the anatomy of DBA. Therefore, trying to fill this gap we have prepared an overview presenting more contemporary information. Most of the contemporary studies deal with potential application of the terminal branches of DBA used for creation of the musculo-cutaneous flaps necessary for different plastic surgery procedures.

Most of the textbooks describe DBA as a single branch of the brachial artery arising medially from the posterior aspect of the vessel, slightly below the level of the teres major muscle. The artery usually goes in company with the radial nerve on the posterior surface of the humerus, between the medial and long heads of the triceps brachii within so called triangular interval [6]. During its course it gives off the muscular branches, and sometimes the nutrient artery of the humerus [7]. Next it descends to the posterior aspect of the elbow joint. It divides at various levels into terminal radial and middle collateral arteries. The radial collateral artery, being a direct continuation of the DBA, runs along the radial nerve, pierces the lateral intermuscular septum, and goes anterior to the lateral epicondyle of the humerus between brachialis and brachioradialis muscles. It joins the radial recurrent artery.

The middle collateral artery (MCA) runs posterior to the mentioned septum and epicondyle. It is usually a larger terminal vessel of DBA. It lies between the brachialis and the lateral head of triceps brachii muscle. Next it descends between the lateral head of the triceps brachii and the brachioradialis muscles. It pierces the deep fascia and becomes a cutaneous vessel [8–12]. It may also remain under the fascia to join the interosseous recurrent artery posterior to the lateral epicondyle of the humerus. The MCA gives off perforating arteries (fasciocutaneous perforators) and continues as a small branch that goes in company with the nerve to anconeus muscle. As already mentioned in the references [8–12] MCA and its cutaneous branches (perforators) may serve as anatomical background for raising the lateral arm flap for different reconstruction procedures. Last decades brought to attention blood supply of the medial head of triceps brachii and its application to performing so called medial triceps free flap [13].

The radial collateral artery (RCA) is a direct continuation of the DBA, which accompanies the radial nerve. Together with the nerve it pierces the lateral intermuscular septum of the arm, and runs between the brachialis and brachioradialis muscles, in front of the lateral epicondyle of the humerus. It joins usually with the radial recurrent artery, supplying mentioned muscles, the radial nerve. Similar to the MCA the RCA gives off several fasciocutaneous perforators which play important role in the plastic surgery.

The DBA may originate also together with the posterior circumflex humeral artery or from the axillary artery at different levels [14, 15]. It may arise as a double vessel [16]. Apart from the normal regular branches the DBA may be incidentally the source of the internal thoracic artery [17].

Material and Methods

The study was based on the review of the literature and dissection study of the human cadavers remaining in the collection of the Department of Anatomy Jagiellonian University Medical College. All donors signed donation certificate for which we are very thankful [18]. 20 upper limbs were carefully dissected during routine anatomical dissections. Dissection of the cadavers was performed by three independent teams conducted by experienced supervisors, members of the staff of the Department of Anatomy, Jagiellonian University Medical College. The origin of the DBA was shown and next gentle anatomical dissection was applied in each case. Lateral and long heads of triceps brachii muscle were sectioned to visualize the minute branches of the artery. We have studied only these limbs which did not show macroscopically any signs of pathologies with special respect to the vascular system. After exposition of the branches of DBA, they were covered with acrylic emulsion (Liquitex R, Binney and Smith, USA) [19] to distinguish basic main ramifications and possibly trace the structures supplied.

Results

Variations of the course and branching pattern of different blood vessels in the human body gained the interest of many anatomists for decades [4]. In our material studied few abnormalities were present, as expected. DBA descended through the triangular interval permanently together with the radial nerve (Fig. 1), however in one case we found the high bifurcation of the DBA into the middle and the radial collateral arteries (Fig. 2).

After rising from the brachial artery DBA gave off in all specimens studied a strong branch that ascended toward the deltoid muscle — a deltoid ramus. In fact it seemed that DBA looked similar to the “V”: lower arm of the “V” was a proper DBA.

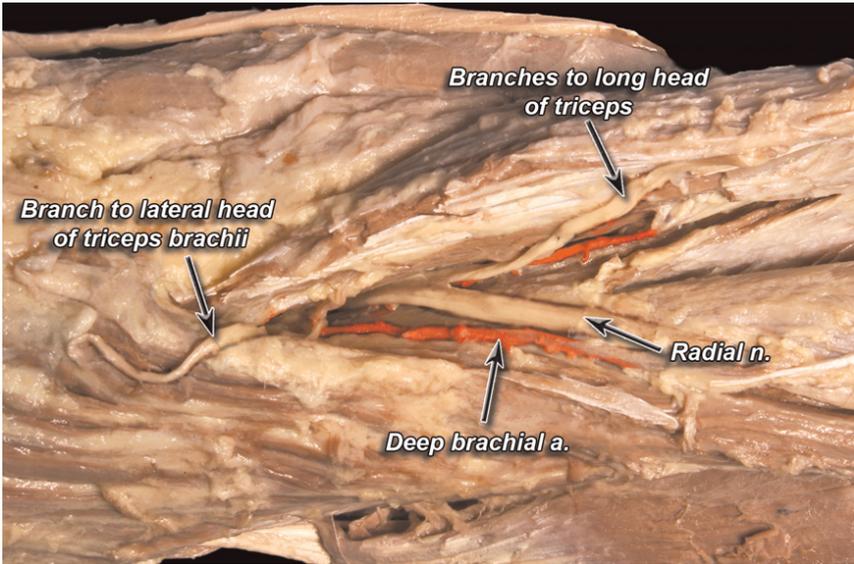


Fig. 1.

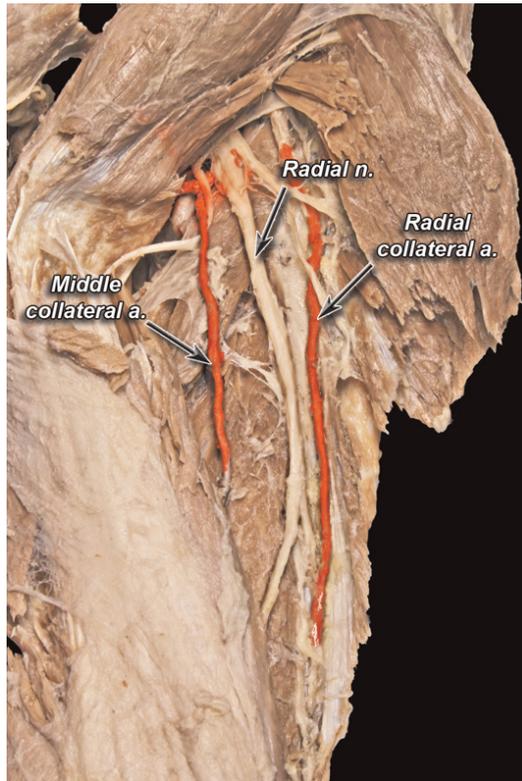


Fig. 2.

During the trip of the DBA through the triangular interval we could see branches of both structures to the heads of triceps brachii muscle. Thorough dissection of the long head of triceps brachii muscle followed by its sectioning enabled visualization of the branches that pierced the muscle and turned into fasciocutaneous perforators (Fig. 3) that originated from the radial collateral artery.

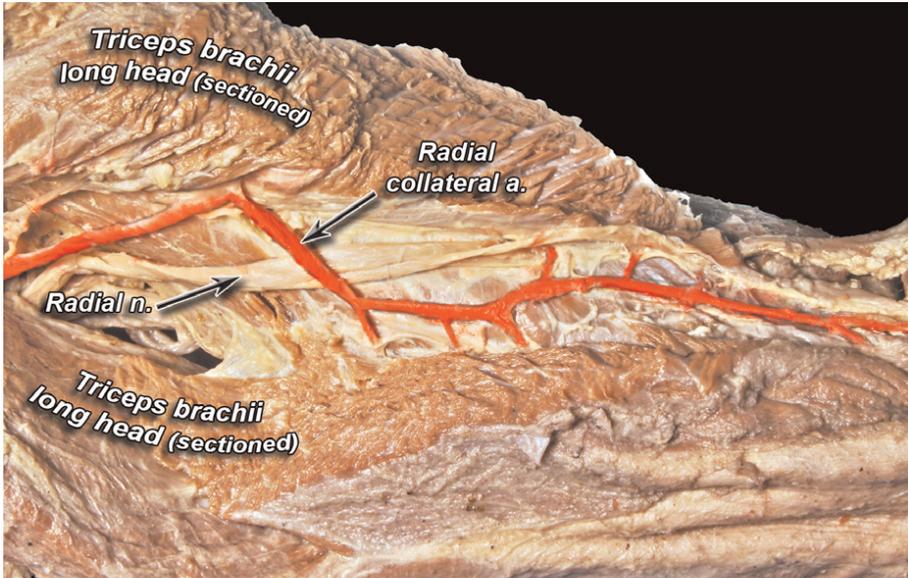


Fig. 3.

Regular subdivision of the DBA into the radial and middle collateral arteries was seen in all of the limbs studied (Fig. 4 and 5).

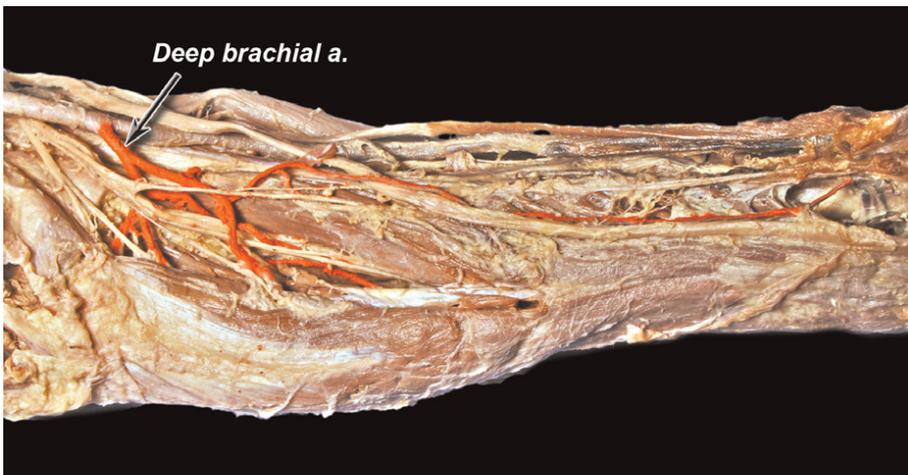


Fig. 4.

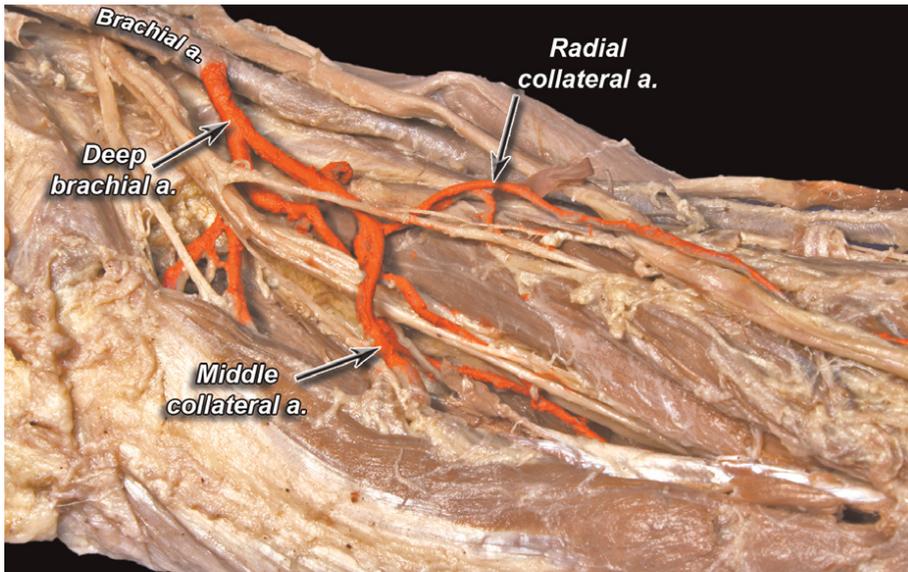


Fig. 5.

Discussion

The nomenclature regarded to the ramification of the DBA is not consistent. There is a lack of proper naming of different branches. The sources [2, 3] mention the following branches of DBA:

- Deltoid branch
- Nutrient artery/-ies (of the humerus)
- Middle collateral artery
- Radial collateral artery

Definitely there is a lack of proper classification of the muscular branches which supply the heads of triceps brachii. Besides, significantly important are fasciocutaneous perforators used in the plastic and reconstructive surgical procedures.

The DBA seemingly arises from the inner and back part of the brachial artery [20]. Numerous variations of the origin of DBA have been described in the literature: Panagouli *et al.* [21] observed during a random dissection a case of a high origin of the superficial ulnar artery arising from the right axillary artery while in the left arm the second portion of the axillary artery gave rise to two trunks. One of those trunks gave rise to the anterior humeral circumflex artery and continued as DBA. Similar observation was made by Clarke *et al.* [22]. Yücel in 1999 studied the case of common origin of DBA and superior ulnar collateral arteries from the third portion of the axillary artery [23]. Aastha *et al.* dissected DBA which arose in common with the anterior and posterior humeral circumflex arteries from the third division of the axillary artery [15]. Cavdar *et al.* [24] observed subdivision of the axillary artery into two

stems: deep and superficial brachial artery of which the DBA gave off anterior, posterior circumflex humeral and the subscapular arteries.

Tubbs *et al.* [6] made interesting clinically applicable observation on the course of the radial nerve and DBA through the triangular interval of the posterior aspect of the arm. Surgical approaches to the radial nerve within this region require careful dissection. This area gained attention of the operating surgeons mostly for using motor branches of the radial nerve for nerve transfers. They found also a communication between the DBA and posterior humeral circumflex artery.

The knowledge on the DBA, its course and branching pattern is necessary in rare cases of the treatment of the aneurysm of the DBA [25].

Interesting observation was made on the blood supply of the triceps brachii muscle necessary for evaluation of the muscle behaviour and strength [26].

It comes to our attention that DBA may also originate from the subscapular artery [27].

Variations of the arterial system in humans is not uncommon [4, 27]. It is mainly caused by inappropriate blood vessel formation during embryogenesis. It is widely known that blood vessels penetrate into the growing limb bud at stage 12. In the beginning the capillary plexus ingrows the limb primordium forming marginal veins (primordia of the cephalic and basilic venous system) and the axial artery which is responsible for blood supply of the growing limb and terminal plexus in the future hand. The axial artery is next turned into the axillary, brachial, common and anterior interosseous and the median arteries [28]. The axillary and the brachial arteries begin their development at stages 16 and 17 — that is probably why some variations may occur in the meantime [29, 30]. The frequency of all variations in the arterial system of the upper limb may reach even 20% [29]. The knowledge on them is essential for the vascular and plastic surgeons, radiologists and other Health professionalists, mostly for accurate evaluation in the operation field but also for proper diagnosis, treatment, and interpretation of the images.

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Conflict of interest

None declared.

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