

Original Research Article

Additional head of biceps brachii: a cadaveric study

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ABSTRACT

Background: The biceps brachii is an important muscle of anterior compartment of arm. It shows frequent anatomic variability due to presence of supernumerary heads. Knowledge of the existence of the third head of biceps brachii is important for surgeons. Keeping this in mind a study was planned to see the incidence of additional head of biceps brachii in sample Indian population and to compare it with other racial groups.

Methods: The study was carried out on 30 cadaveric upper limbs. The upper limbs were dissected and studied for the presence of additional head of biceps brachii. The attachment and nerve supply of the additional head was carefully observed, recorded and documented.

Results: Out of 30 limbs which were dissected, additional head of biceps brachii was found only in two limbs. In both the cases the additional head was present only on the right side and arose from the anterior surface of humerus, superomedial to the origin of brachialis. The additional head fused with the common bulk of the muscle and was inserted into the radial tuberosity and bicipital aponeurosis. The extra heads of biceps brachii muscle received branches from musculocutaneous nerve.

Conclusions: Biceps brachii is one of the commonest muscles showing variations. The additional head is not only of academic importance, but its knowledge also helps clinicians in managing fractures of humerus and nerve entrapment.

Keywords: Additional head, Biceps brachii muscle, Cadaver, Variant

INTRODUCTION

The biceps brachii is an important muscle of anterior compartment of arm. It is a powerful supinator and flexor of the forearm. There are two heads of biceps brachii. The long head takes origin from the supraglenoid tubercle of the scapula at the apex of glenoid cavity. The short head originates from the coracoid apex of scapula along with coracobrachialis. Both these heads fuse distally ending in a flattened tendon and get inserted on the rough posterior part of the radial tuberosity. The tendon has a broad medial expansion, bicipital aponeurosis which fuses with the deep fascia over the origin of flexor muscles of the forearm. The muscle is supplied by musculocutaneous nerve and the arterial supply is by the

brachial artery.¹ Biceps brachii is a muscle which shows frequent anatomic variability due to presence of supernumerary heads.^{2,3} The presence of this additional head can cause a change in the surrounding architecture and can be mistaken for mass in imaging. Knowledge of the existence of the third head of biceps brachii will enhance pre-operative evaluation, facilitate surgical intervention within the arm and improve postoperative outcomes.

Additional head of this muscle is reported in 10% cases arising from the superomedial part of brachialis but not much data is available about the occurrence of additional head in North Indian population.¹ Keeping this in mind a study was planned to see the incidence of additional head

of biceps brachii in sample Indian population and to compare it with other racial groups.

METHODS

A study was planned to look for the additional head of biceps brachii muscle. The study was carried out on 30 formalin fixed cadaveric upper limbs in the department of Anatomy, Dayanand Medical college and hospital.

Inclusion criteria

- All the dissections were done on the cadavers which were voluntarily donated in the department of anatomy over a period of two years. The cadavers were carefully selected and dissected over a period of six months (September 2019- February 2020).

Exclusion criteria

- Any cadaver with upper limb deformity or showing any pathology were excluded from the study. Any limb showing fracture of shoulder or elbow where the origin of biceps was not clearly seen were also not studied. The cadavers showing fracture of humerus where the anatomy of the region may have been altered were also excluded from the study.

The upper limbs were dissected by giving a longitudinal midline incision on the anterior aspect of limb extending from tip of acromion process to 3cm below the elbow joint. There were horizontal incisions given proximal and distal to this vertical incision. Skin, superficial fascia and fat were carefully removed.

The biceps muscle was then exposed from origin to insertion. Nerves in the region were also dissected. In few cases, the incisions were also extended to study the muscle in detail. The biceps brachii was then carefully studied for the presence of any additional head. The origin of the additional head and its insertion were carefully observed. The attachment and nerve supply of the additional head was recorded, documented and photographed.

RESULTS

Out of 30 limbs which were dissected, additional head of biceps brachii was found only in two limbs (6.67%). In both the cases the additional head was present only on the right side. The head arose from the anterior surface of humerus and was superomedial to the origin of brachialis (Figure 1) in both the limbs.

The additional head fused with the common bulk of the muscle (Figure 2) and was inserted into the radial tuberosity and bicipital aponeurosis. The extra heads of biceps brachii muscle received branches from musculocutaneous nerve (Figure 3) which passed between the short head and the extra head to supply it.



Figure 1: The origin of 3rd head of biceps brachii muscle.



Figure 2: The common insertion.



Figure 3: Nerve supplying the 3rd head of biceps brachii muscle.

DISCUSSION

Biceps brachii shows presence of multiple heads with 9-22% of people having additional heads.³ Though presence of third head is frequently seen but four, five, or even seven heads have been reported.⁴ In the present study, out of 30 upper limbs dissected, two upper limbs (6.67%) showed the extra belly of biceps brachii taking origin from the anterior surface of humerus just above the origin of brachialis muscle. The findings were consistent with the study done by Henry Gray, according to whom third head of biceps occurs in 10% of cases and it arose from upper and medial side of brachialis.¹ In another study, incidence of supernumerary heads of biceps in Indians was 7.1% which was consistent with this study (6.67%).⁵ The prevalence of extra heads of biceps brachii in different population being 8% in Chinese, 10% in Europeans, 12% in Africans, and 18% in Japanese.³

In a study done by Cheema and Singla it was found that the additional head originated from the humerus near the insertion of coracobrachialis and merged with the muscle belly.⁶ In this study, also authors got the similar results, extra head just merging with the muscle belly.

Kumar et al, observed that the anomalous third head arose from the 'V' shaped insertion of the deltoid muscle on the humerus and it fused with the common belly of the muscle.⁷ In this study, authors didn't get any such finding but the additional head did fuse with the muscle belly before forming the flattened tendon and getting inserted into the radial tuberosity. The bicipital aponeurosis and its attachment to the deep fascia was also there in both the cases. Avadhani and Chakravarthi also found Biceps Brachii with three heads in 16.67% of cases.⁸

Nasr and Hussein found that the incidence of third head was 7% and it arose from the anteromedial aspect of humerus, between the coracobrachialis insertion and the brachialis origin in 6% and from middle of the medial border of humerus in 3%.⁹ These findings are again consistent with this results. However, their study showed predominance on left side (7%) in contrast to present study where both the limbs showing additional head were of right side.⁹

A study reported biceps brachii to be arising from the tendon of the pectoralis major, the deltoid, the articular capsule, or the crest of the greater tubercle.¹⁰ According to this study the additional head was taking origin from humerus and also from the medial intermuscular septum. In the present study origin was from the humerus but there was no attachment to the intermuscular septum and it coincides with the studies of Asvat et al, Rodriguez-Niedenfuhr et al, and Kosugi et al.^{4,11,12} Rodriguez-Niedenfuhr et al, also classified the additional heads according to their attachment to humerus into superior, inferomedial and inferolateral type.⁴ The most common type being the attachment on the inferomedial side between the attachment of coracobrachialis and

brachialis. In the present study also, the attachment was on the inferomedial side of humerus which was the most common type of attachment. In most of the studies, the extra belly fused with the main muscle belly and got inserted into the radial tuberosity as seen in the present study. Bryce in a study showed that the extra head was also attached distally to the coronoid process of ulna which was not the case in the present study.²

The extra head was supplied mainly by the musculocutaneous nerve as in the present study but a study by Al-Kushi AG documented that extra head was supplied by the median nerve.¹³

Embryological rationale

Different patterns of attachment of biceps brachii and occurrence of variation in form of multiple heads has been explained by Testut.¹⁴ According to whom embryologically, distal portion of brachialis muscle was attached to radius instead of ulna which presented as additional head. Lokanatham S and Subhadra Devi V had another explanation and said that a portion of brachialis gets separated from the main muscle when it gets pierced by musculocutaneous nerve which is seen as additional head.¹⁵

According to some it is believed that incidence of additional head was due to functional adaptation in individuals who do strenuous physical activity and hence male preponderance and increased incidence on right side.¹⁶ Another explanation of the additional head of biceps brachii is that it is remnant of the long head of the coracobrachialis, an ancestral hominoid condition as studied by Sonntag.¹⁷ This is the most plausible explanation in this case as extra head arose from the insertional area of the coracobrachialis. The knowledge of accessory heads of biceps is important for surgeons. According to Swieter MG and Carmichael SW, in case of fracture of humerus the additional head may cause unusual displacement of fracture fragments and is to be taken in account while doing surgical intervention.¹⁸ This accessory head can even compress the neurovascular bundle. Knowledge of supernumerary head is also important for anesthetists in giving selective nerve blocks.

Biceps brachii is used by plastic surgeons in flap surgery so they need to have thorough knowledge of the additional head and its innervation to prevent any iatrogenic injury.^{19,20} In imaging, the extra head can be mistaken for a soft tissue tumour and thus the importance of the knowledge of anatomy and variation of biceps brachii is important for radiologist also.²¹

CONCLUSION

Biceps brachii is one of the commonest muscles showing variations. It has been observed that presence of extra head of biceps brachii may go completely unnoticed and

may be clinically silent until discovered after trauma on imaging or during surgical intervention. By having thorough pre-operative knowledge of this extra head surgeon can avoid operative complications. The extra head of biceps brachii can cause non-union or mal union of fracture humerus and can also compress median nerve. Thus, awareness of the morphological variants of biceps muscle helps in better pre-operative evaluation, safe surgical intervention within the arm and better postoperative results. Hence, this study will be useful to surgeons, orthopedic surgeons, anesthetists, neurologists, radiologists and anatomists.

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