ISSN 2250-3153

Study of Variations in the Origin of Biceps Brachii Muscle in Kerala

Dr. Amar Jayanthi. A[*], Dr. M.A. Elezy[**]

[*] Additional professor of Anatomy, Government medical college, Thrissur
[**] Professor of Anatomy, Karuna Medical College, Palakad, Kerala, India

***Abstract*- Background and aim**: Many variations of upper limb muscles are known. Biceps brachii is a double headed muscle in the human body. Most common variation is the third head, but four, five or more heads have been reported. The purpose of this study is to observe the frequency of variations of biceps brachii muscle with respect to accessory heads of origin in a population of central kerala. **Materials and Methods**: In this study 240 arms from 70 adult Kerala cadavers of both sexes and 50 foetuses from the Anatomy department of Thrissur government medical college were studied. Biceps brachii muscles were examined for their attachments, number of heads of origin, level of fusion of muscle bellies, innervations and contribution to the formation of aponeurosis. Data collected were analysed quantitatively and qualitatively using epi info soft ware. **Results**: Supernumerary heads of biceps brachii were observed in 10.8% of cases. Where biceps had three heads of origin, 15.2% were males and 2.5% females. Accessory heads were more on left side 6.7% and 5% on right side. Bilateral triple heads were observed in one case. In most of the muscles the main bulk is formed in the upper third of arm. **Conclusion** These supernumerary heads might be significant in production of strong flexion and supination of forearm. They may cause compression of neurovascular structures because of their close relation to the brachial artery and median nerve. Variant biceps brachii may confuse a surgeon and may cause iatrogenic injuries. The surgeons and traumatologists have to be aware of such variations.

Index Terms- Biceps brachii, Accessory head, Variations, Injuries, Compression.

I. INTRODUCTION

Upper limb muscles presents with a wide range of variations in the form of accessory muscles, accessory heads of origin or ectopic site of origin. Occasionally accessory muscles develop and some are clinically significant[1]. Biceps brachii muscle of arm is an efficient supinator and flexor of forearm, having two heads of origin, one from supra glenoid tubercle and the other from coracoid process of scapula. The two heads join to form a single belly to be inserted to the radial tuberosity. The reported morphological variations of biceps brachii muscle include absence of short head, two heads remain separate for the entire length of muscle, the muscle split for 3/4th of its course, doubled long head, presence of super numerary or accessory heads[2.] Though several variations are reported the most common variation is in the number of heads of origin ranging from three to seven, usually three heads. The third head that is found most frequently arise from the interval between the insertion of coracobrachialis and origin of brachialis from the anterior surface of humerus[3]. Several authors reported gender and racial differences in the presence of 3rd head of biceps, Chinese 8%, European White 10%, African Black 12%, Japanese 18%, South African blacks 20.55%, South African whites 8.35% and Colombian 37.5%[4]. Incidence of biceps anomaly in Indians is 7.1% [5]. Biceps brachii shows a variability of 8 to 12 % of arms with gender difference more in males. The incidence was higher in the right arm[2]. Little has been reported regarding the incidence of anatomical variations of biceps brachii in keralites. This study describes the various developmental anomalies that affect biceps like accessory heads, formation of muscle belly, insertion and innervation of the powerful and essential muscle of arm in Keralites.

II. MATERIALS AND METHODS

The study was carried out in the department of Anatomy, Government Medical College, Thrissur from August 2006 to September 2011. It comprises of 70 adult human cadavers of both sexes and 50 fetuses of gestational age group from 28 weeks to full term obtained from Obstetrics and Gynaecology department of the same institution. Intra Uterine Dead fetuses were collected after prior approval from institutional ethical committee. A total of 120 specimens of which 80 were males and 40 were females. Biceps brachii muscle was examined for their attachments, the number of heads of origin, the level of fusion of muscle bellies, innervation and contribution to the formation of aponeurosis. Deviation from the normal pattern were studied in detail, sketched and photographed. Data collected were entered in Microsoft excel and analysed quantitatively and qualitatively using epi info soft ware.

III. RESULTS

During the study period of 5 years a total of 120 specimens were examined. The male female ratio is 80:40. The study revealed that 10.8 % of cases biceps showed three heads of origin. Bilateral triple head was observed in one case. 6.7% had anomaly on the left side and 5% on the right side. There is no statistically significant difference in the side in unilateral cases (P= 0.581). Accessory head was found to be more in males (15.2%) than in females(2.5%).

Of the 120 right limbs, 48.3% the long and short heads united to form the main bulk of the muscle in the upper third of arm, followed by 38.3%, where fusion occurred in the middle of

arm and in 13.3% cases the two heads remained separate through out its length and united just before forming the tendon in the cubital fossa. On the left side 56.7% fused in the upper third of arm, 35.8% in middle third and 7.5 % cases the fusion occurred in lower one third of arms. This difference is not statistically significant (P= 0.239).

Biceps received its innervation from musculocutaneous nerve in 80 % of cases. In 20.8% of cases musculocutaneous nerve was found to be variable, either absent or shows deviation in its course or was connected to median nerve in the arm. Musculocutaneous nerve was absent in 2.5% of cadavers with equal preponderance of the side (P= 0.687). In cases where musculocutaneous nerve was absent innervation was received through median nerve.

The tendon of biceps brachii inserted normaly in all the cases. Contribution to aponeurosis and its attachment to the posterior border of ulna could not be traced in all cases hence statistical analysis was not done.

IV. DISCUSSION

Biceps brachii muscle is most variable in terms of number and morphology of its heads of origin. Previous studies shows the incidence of accessory heads of biceps to be rare in Indian population. It is found to be 2% in Indians according to Vollala[6], 5% in South Indians as reported by Lokanadham [7], 3.7% in Srilankan population as reported by Ilayperuma[8] and 7.1to 18.3 % according to Vinnakota[5]. The standard anatomy text book by Susan Standring gives the incidence of biceps anomaly to be 10 % which concurs with the observations of this study and also with Bergman et al in white Europeans[9].

Of the reported variations like absence of short head, doubled long head additional origins from the articular capsule of the glenohumeral joint and tuberosities of the humerus, a bifurcated tendon, and the presence of multiple heads with origins from the coracoid process[10]. and heads of more than three, in this study we observed 3rd head from greater tuberosity of humerus in one case(figure.1), doubled long head in another and the muscle bellies joining just before tendon formation in one case(figure 2). Rodriguez-Niedenfuhr et al, classified the supernumerary heads from humerus based on origin and location into superior, inferomedial and inferolateral types[4]. The most common type of third head is described as the inferomedial type that arises from the anterior surface of humerus between the insertion of coracobrachialis and origin of brachialis(Figure 3). Gray's anatomy describes the incidence of infero medial type as 10%. In the present study the accessory head observed to be 10.8% subjects supports the observations of Johnson in grays anatomy. In human, where long head of coracobrachialis is absent, the third head of biceps brachii which arises in continuity with the insertion of coracobrachialis may represent a remnant of long head of coracobrachialis the ancestral hominoid condition, as reported by Rodriguez – Niedenfuhr[4].

In this study bilateral triple head is seen in one case out of the 120 bodies, though Kousuki etal reported it to be asymmetrical. The two heads of biceps brachii fuse to form the main bulk of muscle at variable levels but commonly at about the junction of middle and lower one third of arm[10]. In the present study the fusion of two bellies occurred mostly in upper third of arm on both sides.

The three muscles of front of arm are innervated by musculocutaneous nerve carrying fibers from ventral rami of 5th,6th and 7th cervical rootlets. It is presumed that development of biceps brachii muscle is likely to influence the course and branching pattern of musculocutaneous nerve[11].

Variations in the course and distribution of musculocutaneous nerve have been reported as 22% by Chitra[12], which is close to our finding of 20.8% where the nerve is found to be anomalous.

Several authors found a male preponderance of accessory head and the incidence was higher in the right arm, suspecting a functional adaptation in people who show excessive physical activity. The result of the present study having a male preponderance of 15.2% is in agreement with the findings of previous authors namely Bergman etal, Asvat etal but more on left side (6.7%). This difference in gender as well as side is found to be non significant.(P= 0.581). Studies by Khaledpour and Rai Ranade reported the prevalence in males to be 31.2% and 4.81% respectively[4].

Muscles of front of arm develop from myogenic precursor cells that arise from ventral dermomyotome of somites. Molecular changes occurring in these precursor cells induce muscle development. Muscle regulatory genes like Pax 3 and Myf 5are activated and transcription factors like Myo D, myogenin and myogenic regulatory factors are expressed. Further growth of muscle occurs by fusion of myoblasts and myotubes and later are invested by connective tissue[13]. Variation of muscle patterns may be a result of altered signaling or stimulus between mesenchymal cells. Different views exist for the presence of supernumerary heads of biceps brachii especially the inferomedial type. One school of thought is that these accessory heads of biceps may be due to the musculocutaneous nerve that pierces biceps and cause a longitudinal splitting of myotubules which get a covering of connective tissue and becomes a separate belly.

The accessory head may or may not give extra strength to the muscle but these heads become relevant during surgical intervention of the arm especially after humeral fracture, where they may or may not cause displacement of fracture fragments of humerus. Because of its close relation with median nerve and brachial artery neurovascular symptoms have been reported due to compression. Accessory heads without an intervening artery or nerve are useful for flap surgery as they would be expandable than the two main heads.

Embryological studies by Testut, described the variation as a portion of brachialis muscle where its distal insertion has been translocated from ulna to the radius. This supports the hypothesis of functional adaptation[5]. Lokanatham suggested that presence of supernumerary medial heads was due to the musculocutaneous nerve piercing the brachialis muscle and producing a supernumerary separate head.

V. CONCLUSION

Muscle actions may be predicted from a knowledge of their attachments. Most muscles play a role in some movement and a knowledge of this is of considerable importance in the diagnosis

of muscle paralysis, an essential element in determining the presence, site and degree of injury to nerves. The data collected in the present study may help surgeons during surgical procedures and management of disorders of upper limb.

ACKNOWLEDGEMENT

We specially wish to thank ***Dr. Razim A.E***, lecturer in Anatomy for the invaluable support and coordinated work to organize this case study.

REFERENCES

[1] Keith L Moore and T V N Persuad, The Muscular System. The Developing Human Clinically Oriented Embryology; 7th edition Elsevier, 406

[2] Akhilandeswari B Supernumerary head of biceps brachii. International Journal of Anatomical variations 2010; 3: 214-215.

[3] Anjali aggarwal, Harjeet Kaur, Daizy Sahni, Adity a Aggarwal. Four-headed biceps brachii muscle with variant course of musculocutaneous nerve: anatomical and clinical insight. International Journal of Anatomical variations 2009; 2: 127 – 128.

[4] Rai R, Ranade A V, Prabhu L V et al. Third head of biceps brachii in an Indian population. Singapore Med J. 2007; 48 (10): 929 – 931.

[5] Vinnakota Sunitha, Bhattom Narasingarao. Bilateral three headed biceps brachii – A case report. People's Journal of Scientific Research. 2011 July vol 4 (2), 53-54.

[6] Vollala VR, Nagabhooshana S, Bhat SM, Potu BK, Rakesh V. Multiple accessory structures in the upper limb of a single cadaver – case report. Singapore Med J 2008; 49 (9) e 256.

[7] Lokanadham S and Subhadra Devi V. Unusual presentation of supernumerary head of biceps brachii muscle in South Indian population. World Journal of medical Sciences. 2011; 6 (3): 115 -120.

[8] Ilayperuma I, Nanayakkara G & Palahepitiya N. Incidence of humeral head of biceps brachii muscle - Anatomical insight. Int J Morphol 2011; 29(1):221-225.

[9] David Johnson. Susan Standring. Grays anatomy 39th edition; 2005: Elsivier 835 – 55.

[10] Text book of Anatomy Hollinshead p352, edition, publisher.

[11] Hitendra Kumar, Srijit Das, Gayatri Rath. An anatomical insight into the third head of biceps brachii muscle – clinical study. Bratisl Lek Listy. 2008; 109 (2) 76 – 78.

[12] Chitra.R. Various types of inter communication between musculocutaneous nerve and median nerves: Annals of Indian Academy of Neurology 2007; Vol 10: 100 – 104.

[13] Keith L Moore and Persuad T V N, The Muscular System. The Developing Human Clinically Oriented Embryology. 2009; 8th edition: p358 -62. Elsevier.

AUTHORS

First Author – **Dr. Amar Jayanthi. A Date of birth** : 19.05.1960. **Qualification**: MBBS1987, MS (Anatomy) 1997, University of Kerala.Senior Residency in Obstetrics and Gynaecology 1989, Foundation course in Palliative Medicine 2006. **Extra curricular activity**: Served the community through National Service Scheme as student volunteer, under Kerala University from 1976 to 1985 and as Programme officer of National Service Scheme under Calicut university from 1999 to 2002. **Awards**: best paper award for embryology in 58th National Conference of Anatomical Society of India at Dr. Dy Patil Medical College, PUNE in 2011. **Member** of Anatomical Society of India, Society of Clinical Anatomists and Indian Medical Association. **Publications** : one in National Journal, Presented papers and chaired sessions in national conferences., e-mail ID jayanthiamar@yahoo.co.in, mobile no. 9447698881

Second Author – Author name, qualifications, associated institute (if any) and email address. Dr. M.A. Elezy, BSC, MBBS, MD(Anatomy), Former professor and head of the department ofanatomy, Government medical college, thrissur, e-mail ID elezyma@gmail.com, mobile: 9445169063

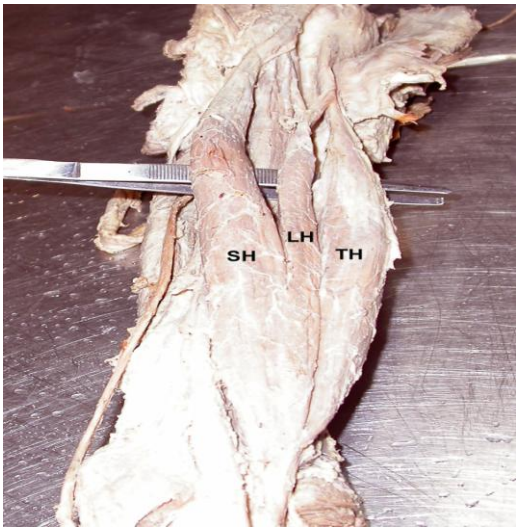

Fig 1. Photograph of left arm of an adult male having three heads for biceps brachii. Third head arising from the greater tuberosity of humerus and joining the main mass of muscle in the lower part of arm before forming tendon. Abbreviations: SH: Short head of biceps brachii, LH: Long head of biceps brachii, TH: Third head of biceps brachii.

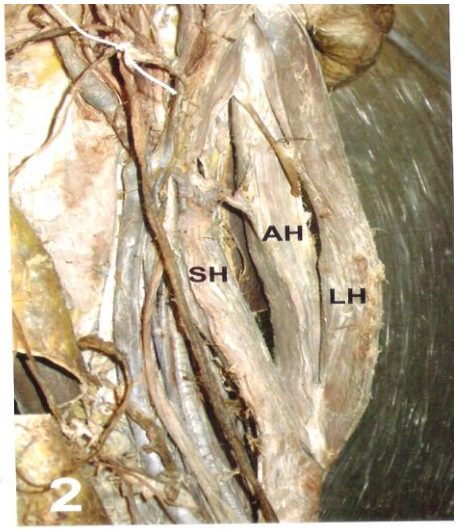

Figure 2. Photograph of left arm of an adult showing three heads of biceps brachii joining with each other to form the tendon. Abbreviations: SH: short head of biceps, LH: long head of biceps and AH: Accessory head of biceps.

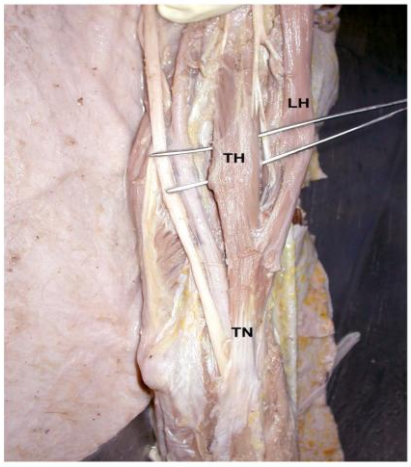

Figure 3. Photograph of inferomedial type of third head of biceps brachii. Abbreviations: LH: long head of biceps and TH: Third head of biceps, TN: Tendon of biceps brachii.