The Quantified Human Adductor Brevis - A Dimorphic Perspective on the Muscle with Variations.

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ABSTRACT

Background: Adequate anatomical knowledge of quantification characteristics with the possible variations of Adductor brevis is required for the proper performance of surgeries and reconstructions. Sports and groin injuries are common in adductor muscles. Adductor brevis is the shortest of the three adductor muscles. Surprisingly, quantification characteristics for populations are lacking. The present study quantifies the human Adductor brevis muscle in a North Indian population. It also describes variations observed for the muscle during the study. Methods: The morphometry of adductor brevis was studied in 50 inferior extremities obtained from 25 phenol embalmed adult North Indian cadavers with known age and sex. A measurement of the length and width of aponeurosis and length of fleshy part of muscle was undertaken. Results: The mean estimates for various morphological features of adductor brevis were standardized for North Indians. The variations from the norm were observed and recorded. Rare variations like a well formed additional adductor brevis muscle having separate origin and insertion and an adductor brevis divided into two parts were observed and described. The reconstructive procedures should be performed taking into account the local population profile and variations. Conclusion: The results will aid the clinician in choosing appropriate morphometric criterion during reconstructive procedures. This will lead to better functional and aesthetic outcomes in restorative surgeries.

Keywords: Hand hygiene, operation theatre, OT staff, health care associated infection.

INTRODUCTION

Adductor brevis is an important member of the adductor family occupying the medial compartment of the thigh executing the function of adduction and medial rotation. Deviations from normal anatomy are unusual and rarely reported. Adequate anatomical knowledge of quantification characteristics with the possible variations of Adductor brevis is required for the proper performance of surgeries and reconstructions. Variation is the first and most fundamental evolutionary factor. In fact if there would have been no variation, no change could have ever occurred and evolution would have not been possible. Those variations that cannot be inherited have no part in the evolution of a species, as they concern only the individual not race. Variations may have important influences on predisposition to illness, symptomatology, clinical examination, investigation and patient management including surgery. Recognition of variations enables clinicians to distinguish features which merit further investigations or treatment from those that do not. The present pioneer quantified study provides the morphometric criterion for the muscle and describes the rare variations observed.

MATERIALS AND METHODS

50 inferior extremities from 25 phenol embalmed adult cadavers obtained from the Department of Anatomy, Government Medical College, Amritsar, Punjab, India comprised the material for this study. The cadavers were labelled from 1 to 25 with suffix R (Right) or L (Left). The muscles of medial compartment of the thigh were exposed and their origin and insertion were traced on the bones of hip, thigh and leg as per the dissection steps provided by Cunningham’s Manual of Practical Anatomy. Each measurement was taken using a standard measuring tape and after sometime reconfirmed by using an unbraided silk thread. The points were marked on silk thread and measurement reconfirmed by determining distance between two points on stretched thread using measuring tape. The origin of Adductor brevis from the inferior ramus of pubis was traced. Its insertion into the femur was noted. The length of fleshy part of muscle was measured [Figure 1]. The length of aponeurosis was measured on the linea aspera from the point where fleshy fibers ceased [Figure 2]. The width of aponeurosis was taken transversely from the linea aspera [Figure 3]. The muscle was divided close to its origin and then turned laterally. The posterior branch of obturator nerve was traced behind the muscle. Any variation, if present was noted and photographs taken.

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Table 1: Mean values and standard deviation of various parameters of Adductor Brevis.

<table>
<thead>
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<th>Serial No</th>
<th>Parameters</th>
<th>Mean Values</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fleshy part</td>
<td>13.50</td>
<td>0.96</td>
</tr>
<tr>
<td>2</td>
<td>Length of the aponeurosis</td>
<td>7.20</td>
<td>0.92</td>
</tr>
<tr>
<td>3</td>
<td>Width of the aponeurosis</td>
<td>2.69</td>
<td>0.52</td>
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Table 2: Mean values and standard deviation of various parameters of Adductor Brevis in males.

<table>
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<th>Standard Deviation</th>
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<td>13.57</td>
<td>0.91</td>
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<tr>
<td>2</td>
<td>Length of the aponeurosis</td>
<td>7.25</td>
<td>0.89</td>
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<td>3</td>
<td>Width of the aponeurosis</td>
<td>2.67</td>
<td>0.37</td>
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Table 3: Mean values and standard deviation of various parameters of Adductor Brevis in females.

<table>
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<tbody>
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<td>Fleshy part</td>
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<td>1.070825</td>
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<tr>
<td>2</td>
<td>Length of the aponeurosis</td>
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<td>1.201041</td>
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<tr>
<td>3</td>
<td>Width of the aponeurosis</td>
<td>2.925</td>
<td>0.125831</td>
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The present study is the pioneer study in which various measurements have been taken. These measurements provide baseline data and reference values for further similar studies.

RESULTS & DISCUSSION

Adductor Brevis is the smallest and shortest (hence the name brevis, meaning short in Latin) of the three short adductor muscles. Groin strains are common injuries to the adductor muscles, which occur without a thorough warm-up or in individuals with chronically tight or weak adductor muscles. Groin and adductor injuries are also common in sports that require flexibility in hip outward (abduction) movements such as hockey players.\[3\]

The main function of the adductor brevis is to pull the thigh medially.\[4\] The adductor brevis and the rest of the adductor muscle group is also used to stabilize left to right movements of the trunk, when standing on both feet, or to balance when standing on a moving surface. The adductor muscle group is used pressing the thighs together to ride a horse, and kicking with the inside of the foot in soccer or swimming. Last, they contribute to flexion of the thigh when running or against resistance (squats, jumping, etc).

It is somewhat triangular in form, and arises by a narrow origin from the outer surfaces of the superior and inferior rami of the pubis, between the gracilis and obturator externus fibers, passing backward, lateral ward, and downward, are inserted, by an aponeurosis, into the line leading from the lesser
trochanter to the linea aspera and into the upper part of the linea aspera, immediately behind the pectineus and upper part of the adductor longus.

In our study, we observed observed a supernumerary muscle [Figure 4], in between the adductor brevis and adductor magnus in one left limb. We also observed a variation wherein the adductor brevis is divided into two parts in one left adductor region [Figure 5], out of 50 cadaveric thighs. The division persisted down to the insertion. The two variations are described below.

(a) Supernumerary muscle between the adductor brevis and adductor magnus:

Truly anomalous muscles of the adductor compartment of thigh are apparently very rare. In one male left thigh, a supernumerary muscle was found between the adductor brevis and the adductor magnus. The characteristic features of this muscle were:

Origin: This muscle arose from the upper part of the inferior ramus of the pubis, ran obliquely downwards and laterally, distally it become aponeurotic.

Insertion: The aponeurosis was attached to the posterior side of the base of lesser trochanter. The muscle resembled a scalene quadrangle and was smaller than the adductor brevis.

Nerve supply: The nerve supply of the muscle was not found in this case.

Relations: The anterior surface of the muscle was covered with adductor brevis. The posterior surface of muscle was related to the posterior division of obturator nerve and the adductor magnus muscle.

A supernumerary muscle located between the adductors brevis and minimus in humans has been reported as an anomalous muscle belonging to the adductor brevis by several authors.[5-9] However, they provided no fundamental basis for investigating the true nature of this muscle. The division of adductor brevis into more or less two completely separate fascicule near insertion is described to be normal.[10] Duplication of the origin of the adductor brevis sometimes occur.[11] According to Standring adductor brevis often has two or three separate parts,[12] may be integrated into adductor magnus. Ochiltree reported a case in which the adductor brevis divided into two quite separate insertions into the linea aspera but he did not describe it as a separate muscle.[13] In this case the muscle is inserted the posterior side of the base of lesser trochanter. So the insertion is different from that of the regular adductor brevis muscle.

Furthermore, only few authors gave descriptions of its nerve supply.[6,9,14,15] According to these authors, the muscle is supplied by the posterior branch of the obturator nerve. Nakamura et al reported a supernumerary muscle between the adductor brevis and adductor minimus in humans. Chopra et al reported a supernumerary muscle in the adductor compartment of thigh between adductor brevis and adductor magnus.[17]

During evolution, by the process of subdivision, fusion, migration and splitting, the original muscle mass within the limb gave rise to new muscle.[18] In urodeles (amphibia) and reptiles the number of muscles in the adductor compartment is two viz. pubotibialis and adductor femoris whereas the number has increased to three in mammals viz. adductor longus, brevis and magnus.[19] The musculature of the limb develops from myogenic precursor cells derived from ventral dermomyotome of somites in response to molecular signals from the nearby tissue. As the long bones form, myoblasts aggregate and form a large muscle mass in each limb bud. In general this muscle mass separates into dorsal and ventral components. Small changes in the extracellular environment of myoblast are believed to induce local fusion of some cells, and
thus creates a gap that further divides the muscle mass and that is how, these blocks of muscle anlagen undergo spatiotemporal sequence of divisions and subdivisions as the limb lengthens, leading to formation of individual muscles.[12]

From the above discussion it appears that this supernumerary muscle could be an additional adductor brevis muscle, which might have been formed due to abnormal splitting of original muscle anlagen. To the best of our knowledge, such well-formed additional adductor brevis muscle having separate origin and insertion is very rare.

If such supernumerary muscle is present it may add to the strength of adductor muscles. Orthopedic surgeons and radiologists should be aware of the presence of such variation in the adductor compartment of thigh. If present, it can be used for surgical reconstructions.[10]

(b) Adductor Brevis divided into two parts
Out of 50 cadaveric thighs, in 1 left adductor region of an adult female cadaver it was observed that adductor brevis is divided into two parts.

Origin: Adductor brevis arose from the outer surfaces of the inferior pubic ramus between the gracilis and obturator externus.

Insertion: The fibres passed backward, laterally and downwards displaying a linear aponeurotic insertion from the lesser trochanter to the linea aspera.

As the fibres passed backwards, laterally and downwards, the muscle was divided into two parts. The division persisted down to the insertion.

Nerve Supply: Anterior division of obturator nerve
Ochiltree found that after a course of about 2.5 cm,[13] the Adductor brevis was divided into a proximal and a distal portion, both of which were innervated from the obturator nerve. The division persisted down to the insertion, which was normal, except that the distal fasciculus extended to the middle of the linea aspera.

CONCLUSION

The present pioneer study provides quantifiable morphometric reference range for adductor brevis muscle. It also provides insight into the rare variations associated with the muscle. A thorough knowledge of muscle morphology and variations is imperative for achieving successful surgical outcomes in sports and groin injuries to the muscle.

REFERENCES


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