Resumen por el autor, Paul H. Stevenson.

Sobre un músculo digástrico anómalo en el muslo de un chino.

En el presente trabajo se da a conocer una observación sobre la presencia de dos vientres musculares supernumerarios unidos con los músculos biceps y piriforme del fémur, respectivamente, y contínuos entre sí mediante un tendón intermediario asociado con la fascia que se extiende sobre el gran trocánter. Las relaciones de los músculos con las estructuras vecinas, así como las relaciones que presentan entre sí, indican la existencia de una sola anomalía del desarrollo, la cual produce un músculo de forma digástrica, en vez de dos músculos aberrantes separados que se reúnen después de su llegada a un punto común anormal. El autor revisa las relaciones embriológicas tempranas de la región, y aquellos estados de la diferenciación de los esbozos musculares tempranos que tienen importancia en la anomalía descrita son objeto de discusión. En adición a la anomalía objeto del presente trabajo el autor enumera otras siete anomalías observadas en los músculos apendiculares y en los nervios del mismo sujeto.

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ON AN ANOMALOUS DIGASTRIC MUSCLE IN THE THIGH OF A CHINESE

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ONE FIGURE

Failure to find in the literature any citation of the following variations in the musculature of the lower extremity suggests the value of placing the present case on record. From the standpoint of ontogeny, the relations found present a picture of such unusual interest that a brief discussion of the developmental factors concerned is also included in this report.

DESCRIPTION

The anomalies to be described represent the most important of several observed during the dissection of a male Chinese, age 39. An enumeration of the other abnormalities observed in this same body is appended at the end of this report.

Lying beneath the long head of the biceps femoris and roughly bisecting the angle between that and the short head, there was discovered a third distinct, though smaller head to this muscle. The fibers of this supernumerary muscle slip, which measured approximately 15 cm. in length and from 3 to 5 cm. in diameter, converged proximally into a small tendon which passed out of sight in the earlier stages of the dissection between the peroneal and tibial divisions of the sciatic nerve (fig. 1). At the same time there was observed a smaller cord-like tendon emerging from beneath the lower border of the gluteus maximus above and passing distomedially toward the deeper structures of this region of the posterior thigh. Although the course of this latter tendon formed a distinct angle with that of the tendon arising immediately from the supernumerary head of the biceps, yet

manipulation and subsequent dissection proved their continuity one with the other. In brief, the tendon of this anomalous muscle, continuing proximally from the distodorsal position of

Fig. 1 A semidiagrammatic drawing of the posterior musculature of the thigh in which the anomalous digastric muscle appeared, showing the relations of the two muscle bellies to the piriformis and the biceps, respectively, as well as the relation of the intervening tendon to the peroneal division of the sciatic nerve and to the greater trochanter.

the muscle below, passed dorsoventrally around the medial side of the peroneal nerve and, after becoming loosely associated with the fibrous tissue investing the divided sciatic nerve, changed its course from a slightly medial to a slightly lateral direction (fig. 1).

Upon reflecting the gluteus maximus muscle and tracing the proximal portion of this anomalous tendon to its origin, it was observed to be associated with the capsule of the bursa lying between the gluteus maximus and the greater trochanter (*b. trochanterica m. glutei maximi*).

Careful dissection of the origin of the above tendon and examination of the relation of its fibers to those of the superficial layer of the bursa capsule revealed the fact that the tendon did not end there. Although sending out several diverging strands of fibers which became intimately incorporated in the capsular connective tissue, the tendon itself remained more or less distinct from the structure of the capsule and continued across it as a conspicuous though slightly flattened band (fig. 1).

The subsequent course of the tendon after leaving the surface of the bursa capsule at its proximomedial border was directed strongly medialward. The tendon now ran roughly parallel to the lower border of the piriformis muscle, being separated from the latter by a well-defined space of from 1.5 to 2 cm. above as well as by an interval corresponding to the thickness of the dorsal margin of the greater trochanter ventrally. In the case of the left side this tendon remained a fibrous cord throughout the rest of its course. On the right side, however, the tendon served as the attachment of a small muscle slip, from 1 to 3 cm. wide and approximately 10 cm. long, which passed ventral to the peroneal nerve and then between this and the tibial nerve as these emerged as separate nerve trunks from the pelvis, thereby duplicating in respect to the peroneal nerve the relations of the distal portion of the tendon below the capsule (*v. supra*). This proximal muscle slip continued medially to its origin on the anterior aspect of the third and fourth sacral vertebrae and from the dorsolateral surface of the sacrospinous ligament.

These two aberrant muscle slips were innervated by a twig from the tibial and a small branch of the anterior division of the second sacral nerve, respectively.

DISCUSSION

The embryological interpretation of the anomalous condition just described is not at once obvious. A brief discussion of some of the more relevant factors involved may therefore be considered not out of place.

In the first place, it may readily be suggested that we are dealing simply with two aberrant muscle slips—arising from two well-defined muscle entities, viz., the biceps femoris and piriformis muscles, known in each case not infrequently to give rise to supernumerary slips—whose tendons have secondarily become associated with each other in the connective tissue overlying the greater trochanter as described above. Testut,⁹ Schaef-fer,⁸ Frohse and Fränkel,⁵ LeDouble,⁷ and others have not only reported original cases, but have compiled long lists of supernumerary heads and aberrant slips observed in connection with the biceps femoris. To them the reader is referred for a detailed enumeration of these cases. When these reports are closely analyzed, however, and due allowance made for differences in terminology and interpretations, it is found that the range in variation in the origin and insertion of such slips is not wide. Testut (l.c., p. 993) summarizes the eight or nine distinctive types reported in the literature up to 1911 as follows:

“Le muscle biceps peut être renforcé par des faisceaux surnuméraires, provenant suivant les cas: 1° du condyle externe (Gruber); 2° de la partie supérieure de la ligne âpre (Meckel); 3° de la ligne rugueuse qui réunit le grand trochanter à la ligne âpre (Giacomini); 4° du fascia lata (Henle); 5° du vaste externe; 6° du grand adducteur.—J’ai observé chez un nègre (Dissection d’un Boschiman, in Arch. du Muséum, 1885), un faisceau surnuméraire, de forme triangulaire, qui partait du coccyx pour aller grossir la masse commune du biceps et du demi-tendineux.—Turner a signalé (Jour. of Anat. and Phys., 1872), sous le nom de tensor fasciae poplitealis, un petit faisceau musculaire qui se rendait du biceps à l’aponévrose poplitée.—Des faisceaux plus singuliers encore, se rendant du biceps au tendon d’Achille et au calcanéum, ont été observés par Kelch (Beitr. z. path. Anat., 1813), par Gruber (Beobacht. aus d. menschl. u. vergl. Anatomie, Heft. II, Berlin, 1879) et par Halliburton (Jour. of Anat. and Phys., 1881).⁹

Careful reading of the original of as many of the above references as were available, not only for the particular variation reported in each, but also for the review of such supernumerary slips of the biceps femoris in general that is usually contained in these writings, failed to reveal, however, any record of such an aberrant head taking origin from the fascia (either entering into the formation of the bursa capsule or otherwise) over the greater trochanter. Of the possible exceptions to this, the cases of the Giacomini and of Henle quoted by Testut (v. supra) seem to refer in the first instance to a definite bony origin from a line on the femur between the greater trochanter and the linea aspera, evidently a slip from the short head of the biceps having an independent origin slightly proximal to the usual origin of that head on the linea aspera, and in the second instance to a more superficial fascial slip from the fascia lata to the long head of the muscle. LeDouble (l.c., p. 281) also mentions a supernumerary fascial attachment "*de la face profonde du grand fessier, à quelques centimètres de ses insertions iliaques*" which, although associated with the fascia of the deep surface of the gluteus maximus, seems to be distinct from the instance herewith reported.

The second muscle slip with which we are concerned in the present view of the anomaly is the proximal fleshy termination of this aberrant tendon. Continuing medially and proximally from the trochanter and passing ventral to the peroneal nerve and then dorsally between it and the tibial nerve trunk to its final origin from the sacrum, this muscle slip would probably be considered in such a scheme simply as a divided portion of the piriformis. Both in point of origin and in its relation to the two divisions of the sciatic nerve this muscle slip qualifies well for such a classification, and the condition, if indeed this is the condition with which we are dealing, is found frequently enough to warrant the statement that it occurs normally in about 20 per cent of all cases.⁴ Such divisions affect only the proximal portion of the muscle, however, and almost invariably reunite with the main piriformis muscle tendon to become inserted with it upon the anterior and inner portion of the upper margin of the

greater trochanter. A complete separation of such slips from the usual fibers of the piriformis at the point of their insertion, on the other hand, and a subsequent migration of their insertion from the inner aspect of the trochanter downward and outward to a position on the lateral side of the trochanter, as apparently has occurred in the present case, has never been noted in the literature as far as the writer has been able to ascertain. Upon the occurrence of a continuation of such an aberrant tendon from the piriformis with an equally aberrant tendon which has reached the same point from the biceps femoris below, the literature is similarly silent. The difficulties in the way of supplying this latter phenomenon with a logical developmental background are obvious.

The second view of the anomalous condition as observed in this case suggests that we are dealing with a single developmental anomaly resulting in a compound muscle of digastric form. The early work of Bardeen and Lewis¹ and the later studies of the former³ leave little doubt that the anlagen of such muscle aberrancies as those with which we are here dealing become differentiated as such, either during or very soon after the period of general differentiation of muscle groups within the primitive myogenous zone of the limb. Unfortunately, none of the excellent figures in the articles just referred to were drawn from an angle showing the respective anlagen of both the biceps femoris and the piriformis at the same time. A careful study of these figures of actual reconstructions of the developing nerves and muscle of the lower limbs in very early human embryos, however, gives good evidence of two facts having a direct bearing on the possible formation of the anomaly in question.

In the first place, in the still undifferentiated myogenous zone of the limb bud up to the 7- or 10-mm. stage, those concentrating areas of cells which are destined to differentiate later as the specific anlagen of the biceps and piriformis muscles lie very close together. The only structure intervening in the following stages of progressive differentiation in this region is the outgrowing sciatic nerve trunk. This means that in those cases where the sciatic nerve, either as a whole or in part, pierces the piriformis

muscle a portion of the anlage of this muscle is still less definitely separated from that of the biceps which lies immediately adjacent. Such a split-off portion of the piriformis anlage, as mentioned above, almost invariably again associates itself with the main body of the muscle to become incorporated in the common tendon of insertion, after transmitting a portion or all of the sciatic nerve through the resulting proximal hiatus. Failure to reunite with its parent anlage, however, would present the alternative possibilities either of an independent existence or of an association with a neighboring muscle anlage. Both of these fates of aberrant slips from the piriformis are apparently rare in man, but that such an association with the adjacent biceps sometimes occurs in the case of lower forms may account for the original opinion of Gegenbaur⁶ (since corrected by later observers), that the piriformis was derived from the caudofemoral muscle of urodeles—a muscle represented in many mammals by a caudofemoralis extending from the caudal vertebrae to the lateral side of the distal half of the femur.² The writer believes that the present case represents an example of such an association between a separated portion of the piriformis anlage and that of the biceps femoris in man. The picture in this case is somewhat complicated by an intervening attachment over the greater trochanter, which will be discussed below, but it is altogether probable that the case of a sacral attachment of the biceps attributed to Macalister (original reference not given) by LeDouble (l.c., p. 281) represents an uncomplicated case of such an embryonic association between these respective muscle anlages.*

The second relevant fact derived from a study of the reconstructions of early human embryos referred to above is the relations of the developing skeletal elements in the primitive scleroblastema with reference to the two muscle anlages dis-

* The sacral attachment of the biceps here under discussion must not be confused with the frequent fasciculi from the coccyx, sacrum, or sacrotuberous ligament to the long head of the biceps, giving rise to the opinion of some investigators that the long head of the biceps represents a muscle primitively arising from the sacrum or coccyx and that the sacrotuberous ligament represents a transformation of that part of the muscle originally extending between the sacrum and its present origin from the ischial tuberosity.

cussed in the preceding paragraph. These are more clearly emphasized in the further studies of Bardeen devoted entirely to the development of the human skeleton. Up until a stage of development represented by a 14-mm. embryo (embryo CXLIV, pl. III, figs. 5 and 6, Bardeen²), or considerably after the beginning of the muscle-anlage differentiation, the developing femur has maintained its primitive position in relation to the pelvis. At this time the shaft of the femur lies approximately at right angles to the body axis and extends directly into the hip-joint. Here there is no neck, merely a simple rounded head, distal and dorsal to which a slight projection marks the beginning of the greater trochanter. Thus the primitive anlage of the trochanter lies not only in direct line, but also practically in the same plane with the two muscle anlages discussed above. The possibility of a secondary association between the aberrant muscle-slip anlage herewith implied and the developing trochanter lying immediately ventral to it would be enhanced in the case in question by the tendency naturally inherent in any divided portion of the piriformis to seek an attachment on the trochanter.

By the time the development of the embryo has progressed to a stage represented by one of 20 mm. (embryo XXII, pl. IV, figs. 9 and 10, Bardeen²), the trochanter is not only clearly differentiated as such, but has also rotated lateralward from its more primitive position. This lateral rotation and subsequent shifting of the trochanteric region incident upon the progressive development of the future conformation of the proximal end of the femur, dragging with it the blastemal attachments already formed—which in the case in question would include that of the aberrant muscle anlage bridging the gap from the piriformis above to the biceps below—would account for the picture presented in adult life (fig. 1).

The writer is led to suggest this second interpretation, therefore, as the true explanation of the appearance of this muscle of digastric form in the musculature of the posterior region of the thigh of this Chinese subject. Rather than with two aberrant muscle slips arising independently from distinct and widely separated muscle entities, effecting a unique union after pursuing

courses equally unusual, it seems more probable that we are dealing with the development of a single muscle anlage, the central and later tendinous portion of which early became associated with an adjacent skeletal element whose subsequent rotation from its primitive position obscures somewhat the fact of the essential continuity of the widely separate muscle bellies.

In addition to the anomaly reported above, the following were also observed in this same subject: 1) excessive size of the peroneus tertius muscle in both legs; 2) absence of the tendon of the flexor digitorum brevis usually passing to the little toe; 3) supernumerary slip arising from the tendon of the flexor digitorum longus beneath the lacinate ligament and dividing into two tendons inserting into the lateral side of the flexor digitorum brevis and the second phalanx of the fifth toe, respectively; 4) total absence of the plantaris muscle on the left side and its reduction to a fibrous cord on the right; 5) the anterior trunk of the seventh cervical nerve joins that of the eighth to form the medial cord of the left brachial plexus, while on the right side the anterior trunk of this same nerve divides into two divisions of approximately equal size joining the lateral and medial cords of the plexus, respectively; 6) supernumerary heads of both biceps brachii arising in each case from the middle third of the medial side of the humerus; 7) a small aberrant muscle slip in the right forearm, having its origin in common with the flexor digitorum sublimis and becoming tendinous soon after its origin and passing down the arm and beneath the transverse carpal ligament as a slender tendinous cord which inserted in the palm into the tendon of the flexor digitorum profundus passing to the third finger.

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