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**ANATOMICAL STUDIES ON THE MUSCLES OF THE
LATERAL AND MEDIAL ASPECT OF THE
THIGH OF THE ONE-HUMPED CAMEL
(CAMELUS DROMEDARIUS)
(With 4 Figs.)**

By

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دراسات تشريحية على عضلات الوجه الوحشي والانسي
للفخذ في الجمل وحيد السنام

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أجري هذا البحث علي عدد أربعة أرجل جمل خلفية لدراسة عضلات الفخذ واخذت مقاييسات العضلات علي الأرجل وهي في حالة طازجة من الجزر وتم دراسة منشأ واندغام العضلات علي عينات محفوظة في الفورمالين ١٠ ولقد وجد الآن العضلة موترة للفاغفة العربية يمكن رؤيتها من علي الوجهين الانسي والوحشي للفخذ ولأن منشأها من عند الشاخصة الفخذية اللحني لها له أربعة زوايا تلك وتحتضن الجزء العلوي من عضلة المستقيمة الفخذية وحافة هذه العضلة الأمامية وجد أنها مغطاة بلفافة مرنة تصل بين منشأ العضلة واندغامها في عظمة الرضفة كما أن العضلة الكفلية الوسطي تتكون من جزئين ، جزء سطحي يحتوي علي جزء آخر خلفي صغير وهو العظمة الكثرية وجزء عميق وهو لاصفر من السطحي ويسمي العضلة الكفلية الاضافية ووجد أن العضلة الكفلية الفائرة توجد تحت العضلة السابقة فسوق السطح الكفلي لعظمة الحوض . ومن عضلات الوجه الانسي للفخذ العضلة الخياطية التي لها منشأ مزدوج يمر من بين هذا المنشأ عضلة حرقفية قطنية والأوعية الدموية الفخذية ، العضلة العقريية في أقوي عضلة لمجموعة العضلات الأنسية وتتكون من جزء صغير أمامي هي عضلة العقربة الصغري وجزء كبير خلفي هي العقربة الكبرى . العضلة الرباعية الفخذية مثلثية الشكل في القطاع العرضي والعضلة السادة الخارجة قعوية الشكل أما العضلة السادة الداخلة تشبه المروحة أما العضلة التوأمية الفخذية في الجمل مثلثة الشكل منقسمة لجزئين الأمامي والخلفي والجزء الخلفي منها متلحم تماما مع وتر اندغام العضلة السادة الداخلية قبل اندغام العضلة السادة الداخلية قبل اندغامها مباشرة

SUMMARY

The lateral and medial muscles of the thigh were studied on the pelvic limb of the camel, from the lateral aspect muscles is the M.tensor fascia

latae which can be observed from both sides, medial and lateral beside cranially also attached by its origin to the tuber coxae, its fleshy part is quadriangular in shape infolding the proximal part of the rectus femoris, its cranial border covered by a thick elastic sheet of fascia from the origin till its insertion in the patella. The M.gluteus medius consists of two parts, superficial and deep one, the superficial part has a small caudal part called M.piriformis. The deep part of the M.gluteus medius is smaller than the superficial one and called M.gluteus accessorus. The M.gluteus profundus is the deepest muscle of gluteal region.

The medial muscles of the thigh included the M.sartorius which has a divided origin from which the iliopsoas muscle passes through it together with the femoral blood vessels.

The M.pectineus is fusiform shape its tail flattened cranio caudally. The M.adductor is the most powerful from the medial group it consists of cranial small part M.adductor minor and large caudal one M.adductor major. The M.quadratus femoris is triangular in its cross section. The M.obturator externus is funnel shape attached to the obturator foramen externally the M.obturator internus is fan shape closing the obturator foramen on its pelvic surface. The M.Gemelli is triangular shape has cranial and caudal parts the tendon of the caudal part is completely fused with the tendon of M.obturator internus.

INTRODUCTION

The camel as an animal walking for a long period DENIS (1970), GUATHIER and DAGG (1962) and EL-SHARABY (1990) and the pelvic limb musculature has a dynamic direction in all domestic animals, so it result in the forward movement as what observed by DAGG (1974) as well as SABER and AHMED (1987) in camel on the other hand FRAGUIER (1955) in camel mentioned that the thoracic limb has the main force of the forward movement.

These different opinions leads to carrying out the present investigation for the studying of the origin, insertion shape and length of the lateral and medial muscles of the thigh which will facilitate the studying of the locomotion in the camel. Also the lack of any study on the musculature of the pelvic limb in the literatures except in textbooks since LESBRE (1903) and recently by SMUTS and BEZUIDENHOUT (1987) in camel also, neccesitates the carrying out of this work.

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MATERIAL and METHODS

The samples of the present work consists of four pelvic limbs of normal healthy, adult, different ages and of both sexes one humped camel. These samples were collected from the slaughter house of Koom Hammada, Behera Governorate, three of them were used fresh as it is and dissected for description and taking all the measurements in this fresh state, then the samples were preserved in the deep freez. One of the samples were injected by 10% formaline through the abdominal aorta, then dissected to help in determination the areas of origin and insertion in the deep dissection.

The nomenclature used in the present work were adopted according to that mentioned in the Nomina Anatomica Veterinaria (1983).

RESULTS**a) Lateral muscles of the thigh:****1 - M. Tensor fascia latae (1, 2, 3, 4/1):**

It is the most cranial muscle of the thigh and can be observed medially and laterally. Proximally it originates from the craniolateral aspect of the tuber coxae by a very short tendinous part while medially it originates by a long tendon (10 cm) from the iliac fascia. Laterally it is attached to the intermuscular septum between this muscle and the gluteal part of the gluteobiceps muscle for about 20 cm.

The belly of this muscle is quadriangular in shape, infolding the proximal part of the recuts femoris muscle. The cranioproximal angle attached to the tuber coxae, its thickness about 3 cm. The lateral angle is the thickest one about 4 cm, which is attached with the distal part of the intermuscular septum of the gluteobiceps and this muscle. The medial angle is thin about 2 cm, where it is attached to the distal part of the iliac fascia. The last angle is the craniodistal one which has the thinnest thickness (1/2 CM), attached to the aponeurosis of this muscle.

The direction of the muscle fibres is cranioventrally and is covered by an elastic sheet of fascia extends from the tuber coxae toward the insertion of this muscle. The length of the fleshy part of the muscle is about 25 cm, and it has four borders length, the dorsomedial 10 cm, dorsolateral 20 cm, ventromedial 15 cm and ventrolateral border 13 cm.

The insertion of the tensor fascia lata muscle takes place by a long aponeurosis of about 30 cm, which is consists of the apponeurosis covered by the fascia lata which contain a clear elastic fibers. The insertion of this muscle in the proximal border of

the patella and the fascia lata in the medial and lateral aspect of the stifle together with the aponeurosis of Mm. Gracilis, sartorius and gluteobiceps.

2 - M. gluteus medius (1, 2/2):

It is the largest and widest muscle in the gluteal region of the camel, where it is attached along the arch of the wing of the ilium with its iliac crest. It consists of two parts superficial and deep. The superficial part is triangular in shape, originates from the iliac crest and gluteal surface of the ilium to be inserted in the summit of the greater trochanter. A small part of this muscle which is attached in the caudal part of the greater trochanter is called M. Piriformis (2/3). The deep part of this muscle the M. gluteus accessorius is smaller than superficial one and has a glisseming fascia (2/4) covering it, to be attached in the cranialateral part of the greater trochanter.

3 - M. gluteus profundus (2/5):

It is the deepest muscle in the gluteal region, undercover of the gluteus medius. The muscle originates from the dorsal surface of the wing of the ilium, ischiatic spine and sacrotuberal ligament to be inserted in the cranial aspect of the greater trochanter just caudodorsal to the tendon of M. gluteus accessorius.

b) Medial muscles of the thigh:

1 - M. sartorius (3, 4/6):

The origin of this muscle is divided into two heads, cranial (3/8) and caudal one (3/7). The cranial, head which its length is about 10 cm, is attached to the iliac fascia together with the medial part of the tensor fascia lata. The caudal head originates from the psoas tubercle together with the tendon of insertion of the psoas minor muscle, its length about 13 cm. Both the cranial and caudal heads unite together nearly at the level of the proximal third of the thigh, inbetween these two heads the iliopsoas muscles passes toward its insertion together also with the femoral blood vessels and nerve.

The belly is some what cord-like in shape with a triangular cross section, its length is about 25 cm, its cranial border attached with the fascia lata while the caudal border attached to the cranial part of the gracilis muscle. This muscle tapered distally where it is attached to a long and narrow aponeurosis its length about 12 cm, to be inserted in the medial epicondyle of the femur in common with the cranial part of gracilis muscle insertion.

2 - M. pectineus (3, 4/9):

It is a fusiform in shape, its length is about 20 cm, and about 7 cm thickness but the belly circumference is about 24 cm. This muscle originates by a very short tendon from the ventral aspect of the pectin of the pubis and the prepubic tendon.

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The tendon of insertion is also very short and attached to the caudal surface of the femur just under the level of the teres minor tuberosity and extends in a distalward direction together with the tendon of adductor muscle toward the medial supracondyloid tuberosity, the tail of this muscle is flattened craniocaudally.

3 - M.adductor (3, 4/10):

It is the most powerful muscle in the caudomedial aspect of the thigh. It consists of two parts; cranial small part (M.adductor minor) and large caudal part (M.adductor major). It has a triangular shape, the base of this triangle is located proximally where it represents the origin of this muscle.

The adductor minor (4/11) is present caudally to the pectineus muscle (18 cm length, 6 cm width and 1.5 cm thickness), it originates from the ventral part of the pectin of the pubis, it is directed caudoventrally, and is partially separated from the adductor major specially from the lateral aspect of this muscle and fused in the medial aspect.

The adductor major which is the largest part, its length is about 35 cm, at its middle the width is 15 cm, while the thickness also at the middle is 7 cm. It originates from the ischiatic symphysis and ischial tubula ventrally as well as the symphyceal ligament, it is directed cranioventrally with its apex to be inserted in the caudal surface of the femur (lateral to the insertion of the pectineus muscle and attached together, and its line of insertion of the femur extends distally till reaches the lateral supracondyloid tuberosity. The lateral border of the adductor major muscle is attached to the aponeurosis of the vastus lateralis muscle distally, while this border proximally attached with the intermuscular septum between it and quadratus femoris.

4 - M.quadratus femoris (4/12):

It is a strap like muscle, its length about 15 cm, has 4 cm width and 3 cm thickness, it has a triangular shape in cross section. It originates from the caudolateral part of the tabula of the ischium and directed cranioventrally toward the femur to be insert in the caudal surface of the femur proximal third of the femur at the level of the minor trochanter.

5 - M.obturator externus (3, 4/13):

It is a funnel shaped muscle the base of this funnel represents the fleshy origin from the ventral surface of the pubis and ischium which is surrounding the obturator foromen, the cranial part of this muscle covering the hip joint. The apex of the funnel gives the tendon of insertion which is directed to be attached in the trochanteric fossa. The ventrical length of this muscle is about 15 cm.

6 - M.obturator internus (3, 4/14):

It is a fan shaped muscle, it originates by a very thin aponeurosis covers the pelvic surface of the body of the ilium, the cranial border of the obturator foramen (caudal border of the pubic bone), the medial border of the obturator foramen also, and caudally by its thick fleshy part to the pelvic surface of the ischium. The tendon of insertion of this muscle passes from the pelvic cavity through the lesser ischiatic foramen, resting on a subtendinous bursa of about 3 cm in diameter, the tendon continues its course for about 10 cm, has 0.6 cm thickness undercover the caudal part of the M.gemelli and the ischiatic nerve crossing it also. This muscle inserted in the trochanteric fossa of the femer.

7 - Mm.Gemelli (2/15, 16):

These muscles are together, triangular in shape, consist of two parts, cranial 2/15 and caudal 2/16 one, which is divided dorsally by the tendon of M.obturator internus, it originate from the ischiatic tuberosity and the lateral border of the lesser ischiatic notch. The caudal part has 5 cm thickness and 10 cm length, while the cranial part has 3 cm thickness and 8 cm length. The tendon of insertion is directed toward the trochanteric fassa together with the tendons of Mm.obturator externus and internus. The tendon of the caudal part of the Mm.gemelli observed as completely fused with the tendon of M.obturator internus.

DISCUSSION

The M.tensor fascia lata which can be observed medially and laterally on the thigh of the present work, originates from the tuber coxae cranially and laterally while medially it is attached by a long tendon to the iliac fascia, the same results observed by SMUTS and BEZUIDENHOUT (1987) and SABER and AHMED (1987) in the camel but they did not mentioned the attachment of this muscle to the iliac fascia.

The results of the present work shows that the fleshy part of the M.tensor fascia lata is quadriangular attached ventrally by a long aponeurosis covered by a thick elastic sheet to be the proximal end of the patella together with the aponeurosis of Mm.Gracilis, sartorius and gluteobiceps as that mentioned by SABER and AHMED (1987) and SABER and BOLBOL (1982) in camel, but the former did not mention the presence of the thick elastic layer on the aponeurosis, while SMUTS and BEZUIDENHOUT (1987) in the camel observed this elastic layer and added that the insertion in the patella and tibial tuberosity, medial femoral fascia on the femoral epicondyle, RAGHAVAN and KACHROO (1964) in ox mentioned that the insertion of this muscle indirectly to the patella through the fascia lata and the lateral patellar ligament. The present work proved that this muscle has similar structure to that mentioned by MAY (1970) in

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sheep, whereas MCLEOD (1960) GETTY (1975) and NICKEL, SCHUMMER and SEIFERLE (1986) in ruminants recorded that this muscle is strong in ox and unlike that in other species it does not form an aponeurosis in the distal half of the thigh, unlike that observed in the present work. BRADLEY (1946) in horse mentioned that the M.tensor fascia latae originates beside the tuber coxal from the lateral border of the ilium and inserted in the patella, lateral ligament and tibial crest. MILLER CHRISTENSEN and EVANS (1964) in dog observed this muscle has three clear slips the results which could be observed in the present work.

The division of M.gluteus medius in the camel into superficial and deep parts were also observed by SMUTS and BEZUIDENHOUT (1987) and SABER and AHMED (1987) in camel. On the other hand RAGHAVAN and KACHROO (1964) in ox, MAY (1970) in sheep, GETTY (1975) and NUCKEL, et al. (1986) in ruminants mentioned that its origin extends on the lumbar part of the Milongisimus dorsi. The origin of the M.gluteus profundus in the present work is similar to that ilium, observed by SMUTS and BEZUIDENHOUT (1987) and SABER and AHMED (1987) in the camel, as well as BRADLEY (1946) in horse and MILLER, et al. (1964) in dog. On the other hand this muscle as mentioned by RAGHAVAN and KACHROO (1964), GETTY (1975) and NICKEL, et al. (1986) in ruminant as well as MAY (1970) in sheep is well developed fan-shaped and its insertion in the neck of the femur while in the present work in the greater trochanter.

The medial muscles of the thigh including the M.sartorius which observed in the present work has divided origin, cranial and caudal part the belly is long inserted in the medial epicondyle of femur with the gracilis aponeurosis.

The origin and insertion of the sartorius and gracilis mentioned by SMUTS and BEZUIDENHOUT (1987) in the camel. RAGHAVAN and KACHROO (1964) in ox, GETTY (1975) and NICKEL, et al. (1986) in ruminants as well as MAY (1970) in sheep are similar to that of the present work. BRADLEY (1946) in horse mentioned that the origin is not divided and inserted in the medial patellar ligament, while MILLER, et al. (1964) in dog stated that this muscle is flat and extends in two peculiar straplike strands as cranial and caudal bellies the results which were not observed in the present work.

The origin & insertion of the M.pectineus in the present work are similar to that mentioned by SMUTS and BEZUIDENHOUT (1987) in camel.

RAGHAVAN and KACHRO (1964) in ox, GETTY (1975) and NICKEL, et al. (1986) in ruminants as well as MAY (1970) in sheep and MILLER, et al. (1964) in dog observed similar results about the origin of the muscle described in the present work, but the insertion is different from the camel as it attached to the caudal surface of the femur and the medial epicondyle of the femur.

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BRADLEY (1946) in horse added that this muscle originates also from the accessory ligament and the insertion only on the femur close to the nutrient foramen of it.

The M.adductor described in the present work is the powerful muscle of the medial group of thigh and its length is about 35 cm. SABER and AHMED (1987) in the camel recorded the length of this muscle to the bones in camel.

MILLER, et al. (1964) in dog recorded that this muscle represented by two separable muscles M.adductor longus (small) and M.adductor magnus (large) et brevis but in the present work the belly is single.

The M.quadratus femoris in the present is has strap like, originates from the ischiatic tabular and is inserted on the caudal surface of femur at the level of minor trochanter, however, SMUTS and BEZUIDENHOUR (1987) in camel mentioned that its insertion at the level of major trochanter. However, RAGHAVAN and KACHROO (1964) in ox, and NICKEL, et al. (1986) in ruminants as well as MILLER, et al. (1964) in dog mentioned the same origin as in the present work while the first author observed that its insertion in the upper part of trochanter minor, whereas the latter two authors recorded that the insertion of this well developed muscle specially in ox is located distal to the trochanteric fossa. MAY (1970) in sheep mentioned that the origin of this muscle in the lateral surface of ischium and inserted in the trochanteric ridge, the results which were not observed in this work.

The M.obturator externus is funnel shape, originates from external margin of obturator foramen and inserted in the trochanteric fossa, which is similar to the records of SMUTS and BEZUIDENHOUR (1987) in the camel, RAGHAVAN and KACHROO (1964) in ox, MAY (1970) in sheep, BRADLEY (1946) in horse and MILLER, et al. (1964) in dog. On the other hand GETTY (1975) and NICKEL, et al. (1986) in ox mentioned that this muscle consists of two parts extra pelvic part which is similar to that of the present work and other animals, and intrapelvic part.

The M.obturator internus is fan shape originates from the pelvic surface of ilium, ischium and obturator foramen, and is inserted in the trochanteric fossa through its passage on the lesser ischiatic foramen, as what observed in this work and by SMUTS and BEZUIDENHOUT (1987) in the camel, RAGHAVAN and KACHROO (1964) in ox and MAY (1970) in sheep, while the latter two authors observed that the tendon of insertion emerge through the obturator foramen. Also BRADLEY (1946) in horse and MILLER, et al. (1964) in dog showed a similar results as in the present work. On the other hand GETTY (1975) and NICKEL, et al. (1986) in ruminants stated that this muscle is absent.

The Mm.Gemelli of the present work are well developed, triangular shape consist of two parts cranial and caudal part divided dorsally by the tendon of M.obturator

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internus. The origin and insertion of this muscle are similar to that mentioned by SMUTS and BEZUIDENHOUT (1987) in the camel who added that the caudal part takes origin also from the sacrotuberal ligament the results which could not be observed in this work.

MAY (1970) in sheep, GETTY (1975) and NICKEL, *et al.* (1986) in ruminants observed somewhat, similar results to the present work, but described it as an undivided muscle, on the other hand RAGHAVAN and KACHROO (1964) in ox recorded that this muscle has three fleshy parts, while MILLER, *et al.* (1964) in dog and BRADLEY (1946) in horse stated that this muscle consists of two parts the latter added that these two parts are superficial and deep stratum, the results which were not proved by the present work as the two parts are cranial and caudal one.

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LEGENDS

- Fig. 1:** Diagram showing the lateral aspect of the thigh of the right pelvic limb, the Mm.gluteobiceps, semitendinosus and semimembranosus are cutted.
- Fig. 2:** diagram showing the lateral aspect of the thigh of the righ pelvic limb. the Mm.gluteobiceps, semitendinosus and semimembranosus are cutted and the M.gluteus medius is reflected.
- Fig. 3:** Diagram showing the medial aspect of the thigh of the right pelvic limb, the Mm.gracilis and semimembranosus are cutted.
- Fig. 4:** diagram showing the medial aspectof the thigh of the right pelvic limb, the Mm. gracilis, semimembranosus and adductor.

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| a) greater trochanter of femur. | b) broad sacrotuberal ligament. |
| c) ischiatic tuberosity. | d) iliac crest. |
| e) femur. | f) tibia. |
| g) patella. | h) tibial tuberosity. |
| i) tendon of insertion of M.psoas minor. | j) pelvic symphysis. |
| 1- M.tensor fascia lata. | 2 - M.gluteus medius. |
| 3- M.gluteus piriformis. | 4 - M.gluteus accessorius. |
| 5- M.gluteus profundus. | 6 - M.sartorius. |
| 7- Caudal part of 6. | 8 - Cranial part of 6. |
| 9- M.pectineus. | 10- M.adductor major. |
| 11- M.adductor minor. | 12- M.quadratus femoris. |
| 13- M.obturator externus. | 14- M.obturator internus. |
| 15- Cranial part of M.Gemelli. | 16- Caudal part of M.Gemelli. |
| 17- M.gluteobiceps (cutted). | 18- M.semitendinosus (cutted). |
| 19- M.semimembranosus (cutted). | 20- M.vastus lateralis. |
| 21- M.poploteus. | 22- M.flexor digitorum longus. |
| 23- M.extensor digitorum lateralis. | 24- M.peroneus longus. |
| 25- M.psoas major (cutted). | 26- M.iliacus (cutted). |
| 27- M.tibialis cranialis. | 28- M.vastus medialis. |

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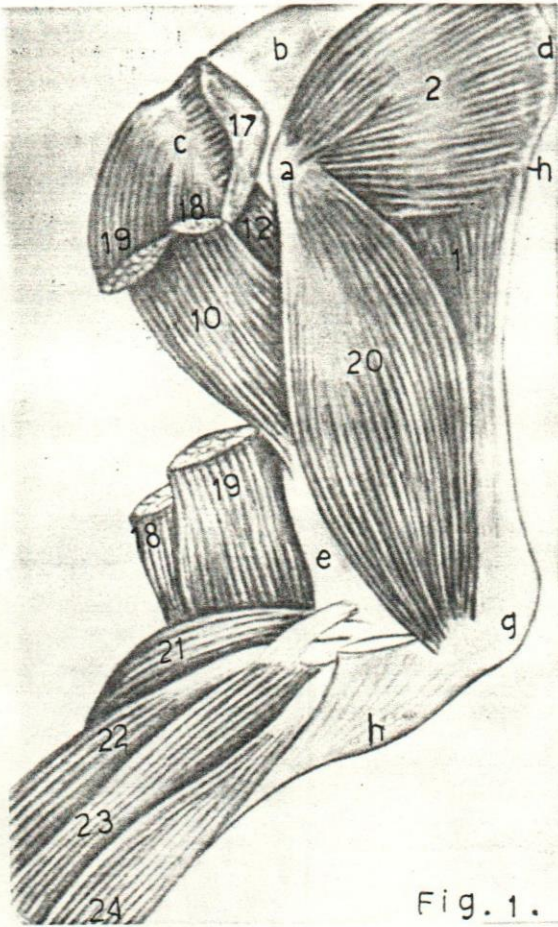


Fig. 1.



Fig. 2.

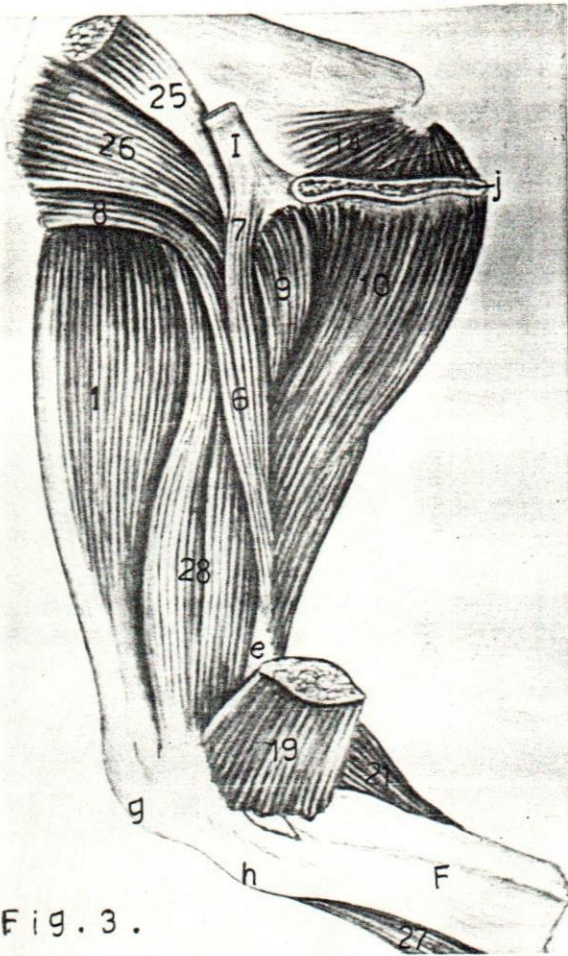


Fig. 3.

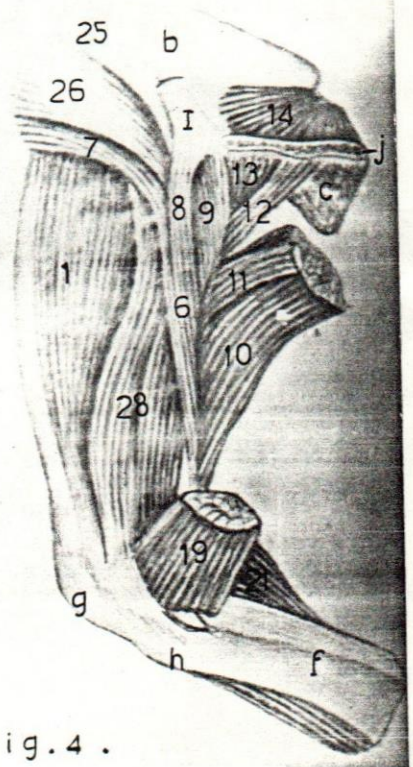


Fig. 4 .