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دراسة مورفولوجية لعضلات المفصل الكتفي

في الذئب

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تم في هذا البحث دراسة منشأ وتركيب واندغام وكذلك الفعل الممكن لكل عضلة من عضلات مفصل الكتف في الذئب . هذا وقد نوقشت النتائج مع مثيلاتها في الكلب والقط ووجد أن هذه العضلات تتميز :

- العضلة فوق الشوكية ، الدالية المبرومة الصغرى والغرابية العضدية تتغمد بألياف عضلية وأخرى وتريية.
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- المفصلة العضدية.
- هذا وقد تم ايضاح النتائج بأربعة أشكال توضيحية.

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**MORPHOLOGICAL STUDY ON THE MUSCLES
OF THE SHOULDER JOINT OF THE WOLF**
(*Canis lupus L. 1758*)
(With 4 Figures)

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SUMMARY

The origin, insertion, gross structure, and the possible action of the muscles of the shoulder joint have been described. The obtained results show differences in the anatomy of the shoulder musculature of wolf and dog. These differences are characterized in wolf by: (1) the muscular and tendinous insertion of the Mm. supraspinatus, deltoideus, teres minor, and coracobrachialis, (2) the wide, long aponeurosis from the entire caudal border of the scapula as the origin of the M. teres minor, (3) the wide insertion of the M. coracobrachialis, and (4) the presence of a well developed M. articularis humeri. The results are illustrated by four diagrams.

INTRODUCTION

Various types of wolves are found in zoos throughout the world. In order to do any type of surgical procedure in or around the joints, a veterinarian should have a thorough knowledge of the anatomy of the muscles in the area. For this reason, it is worthwhile studying the anatomy of the shoulder muscles of wolf. Furthermore, such a study facilitates a comparison of the shoulder muscles of wolf, dog, and cat. Although the anatomy of the shoulder of dog (BRADLEY 1927, EVANS and CHRISTENSEN 1979) and cat (CROUCH 1969) has been extensively studied, no information is available on the anatomy of these muscles in wolf. An account is given in this study of the muscles of the shoulder joint of wolf (*Canis lupus L. 1758*).

MATERIAL and METHODS

This study was carried out on five left and five right thoracic limbs. The adult wolves which had recently died were perfused with 10% formaline solution through the common carotid artery. After three days, the limbs were isolated and preserved in the same solution. In addition, two fresh thoracic limbs from one recently died wolf were used. The muscles of the shoulder were dissected and the obtained results were compared with those of the dog and cat. The anatomical nomenclature used here conforms to the *Nomina Anatomica Veterinaria* (1983).

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RESULTS

The muscles of the shoulder joint can be classified according to their position, relative to the shoulder joint, into lateral, medial, cranial and caudal muscle groups.

I. LATERAL SHOULDER MUSCLES :

This muscle group is comprised of four muscles: supraspinatus, infraspinatus, deltoideus and teres minor.

1- M. supraspinatus :

The supraspinatus muscle (1/1; 2/3) arises from the supraspinous fossa, the spine of the scapula and the distal half of the cranial border of the scapula. The muscle runs along the cranial surface of the shoulder and so covers the tendons of origin of the Mm. biceps brachii and coracobrachialis. It inserts on the edge of the major tubercle of the humerus. In addition, some fibers blend with the tendon of insertion of the deep pectoral muscle (2/3').

Structure :

The muscle originates by small tendons and is covered by a thick aponeurosis, which spring from the spine of the scapula. It is thin (16 mm) near its origin, becoming thicker (22 mm) distally. The insertion of the muscle (4/1) is approximately 5,5 cm in length and consists of a superficial muscular layer, approximately 3 mm thick, and a deep fibrous layer, approximately 2 mm thick.

Action :

The muscle extends the shoulder joint and helps in bearing the weight of the body.

2- M. infraspinatus :

The infraspinatus muscle (1/2) originates from the infraspinous fossa, the spine of the scapula and the aponeurosis of origin of the M. deltoideus.

It ends on the Facies m. infrasinati at the proximal end of the humerus.

Its tendon of insertion is separated from the major tubercle of the humerus by Bursa subtendinae m. infrasinati, which reaches approximately 1,5 cm in diameter.

Structure :

The muscle is covered laterally by a heavy aponeurosis, from which many fibers arise and by means of which the M. deltoideus is attached to the spine of the scapula. The muscle has a thickness of approximately 18 mm and its fibers extend cranioventrally. A bursa of 1 cm diameter is present between the muscle and the infraglenoid tubercle. The tendon of insertion (4/2) is strong, measures approximately 4,5 cm in length and has its own sheath, which is connected cranial to the Facies m. infrasinati by a fibrous band of approximately 5 mm in width.

Action :

The M. infraspinatus flexes the shoulder joint, abducts and rotates the arm laterally. It also acts as lateral collateral ligament of the shoulder joint.

3- M. deltoideus :

This muscle consists of two portions, Pars scapularis and Pars acromialis.

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A. Pars scapularis :

The scapular portion of the M. deltoideus (1/3) originates from the spine of the scapula and ends on the deltoid tuberosity.

Structure :

The origin of the scapular portion is an aponeurosis, which covers the M. infraspinatus. The aponeurosis has a width of approximately 15 mm dorsally, tapering to approximately 9 mm ventrally. The muscle is about 3 cm wide and 6 mm thick. Its muscular fibers run cranio-ventrally. The muscle inserts as a tendinous slip, which passes deep to the acromial portion.

B. Pars acromialis :

The acromial portion of the M. deltoideus (1/4) originates from the acromion and inserts on the deltoid tuberosity.

Structure :

The origin of the muscle is purely muscular and from 2 to 5 cm in length. The belly of the muscle is flat and covered by a strong, fibrous sheet on its dorsal half. It measures about 13 mm in thickness and its fibers run craniodistally. Its insertion is partially muscular and approximately 5 cm in length.

Action :

The muscle is a flexor of the shoulder joint and participates in abducting the limb.

4- M. teres minor :

The teres minor muscle (4/3) originates from the caudal border of the scapula and inserts on the teres minor tuberosity and the area proximal to it.

Structure :

The muscle arises from the entire caudal border of the scapula with a long aponeurosis. This aponeurosis, which is narrow (5 mm) dorsally and wide (13 mm) ventrally, lies on the long head of the M. triceps brachii. In one case, the distal portion of the aponeurosis received fine fibers from the long head of the M. triceps brachii, arising from the infraglenoid tubercle.

The muscular belly is ellipsoid in shape, approximately 5,5 cm in length and surrounded by a delicate fibrous sheet. The insertion consists of tendinous and muscular portions. The tendinous portion is approximately 1 cm long, 5 mm wide and attaches to the teres minor tuberosity. The muscular insertion is also approximately 5 mm wide and ends proximal to the teres minor tuberosity.

Action :

The muscle is a flexor of the shoulder joint.

II. MEDIAL SHOULDER MUSCLES :

The Mm. subscapularis and coracobrachialis cover the medial aspect of the shoulder joint, while the M. articularis humeri lies on its caudomedial aspect.

1- M. subscapularis :

The subscapular muscle (2/4) arises from the subscapular fossa and caudal border of the scapula. It ends on the minor tubercle of the humerus and the shoulder joint capsule.

Structure :

The M. subscapularis is covered by a tendinous sheet, from which 5 to 6 fibrous bands extend into the substance of the muscle, dividing it into 4 to 5 portions. It converges to the caudal border of the scapula, reaching a thickness of 11 mm. It inserts with a flat tendon, lying on the medial aspect of the shoulder joint capsule. This tendon measures approximately 2,5 cm in width, and 1,5 cm in length. From its cranial border a narrow band of about 5 mm wide runs cranioventrally with a slight lateral inclination to end onto that part of the shoulder joint capsule, which reflects on the tendon of origin of the M. biceps brachii.

Action :

This muscle adducts the limb and extends the shoulder joint. During flexion of the joint, it helps in maintaining the flexion, also acting as its medial collateral ligament.

2- M. coracobrachialis :

The muscle (2/5; 3/2) takes origin from the coracoid process of the scapula. It inserts on the crest of the minor tubercle and the medial aspect of the humerus caudodistal to the teres major tuberosity.

Structure :

The tendon of origin, approximately 3,1 cm in length and surrounded by a tendon sheath, runs caudoventrally across the medial aspect of the shoulder joint capsule and the tendon of insertion of the M. subscapularis.

The muscular belly is fusiform and measures about 11 mm in thickness at its middle portion. A muscular bundle, approximately 4 mm wide and 5 mm thick extends from the caudal aspect of the muscle and joins the medial head of the M. triceps brachii. In two cases, however, this bundle went to the M. brachialis. The insertion consists of a muscular and a fibrous portion. The muscular portion reaches approximately 2 cm in length and inserts on the crest of the minor tubercle. The fibrous portion inserts as a tendon, approximately 3 cm long and 3 mm wide, which runs distally along the medial face of the humerus deep to the tendon of insertion of the Mm. teres major and latissimus dorsi.

Action :

The M. coracobrachialis flexes the shoulder joint.

3- M. articularis humeri :

This muscle (2/6; 3/3) originates from the scapula above the caudal portion of the lip of the glenoid cavity and inserts on the caudal portion of the minor tubercle of the humerus and the shoulder joint capsule.

Structure :

The origin is fibrous and measures approximately 5 mm in length and 3 mm in width. The muscle reaches a length of 3 cm and is approximately 2 mm thick. Macroscopically, the muscle is partially fibrous, partially muscular. Its fibers extend craniodistally on the caudomedial aspect of the shoulder joint, ending on the minor tubercle. Some fibers blend into the caudal aspect of the shoulder joint capsule.

Action :

The muscles helps in the flexion of the shoulder joint and tenses the joint capsule during flexion.

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III- CRANIAL SHOULDER MUSCLE :

The *M. biceps rachii* lies on the cranial aspect of the shoulder and brachium.

M. biceps brachii :

This muscle (2/4; 3/4) extends from the supraglenoid tubercle to the radial and ulnar tuberosities.

Structure :

The tendon of origin is round and measures approximately 4 cm in length. It crosses the shoulder joint craniomedially to the intertubercular groove. In doing so, the tendon is enveloped by the joint capsule, so that the capsule actually forms a tendon sheath. The tendon is held in place by a strong transverse band extending between the cranial portions of the major and minor tubercles. The belly of the muscle is approximately 12 mm in thickness and 2,5 cm in width. Except for its distal fifth, the muscle is covered by two extensive fibrous sheets. A fibrous fold is present within the interior of the muscle but does not reach the tendon of origin. The muscle fibers extend between the two exterior sheets and this interior fold. The insertion of the muscle consists of a tendon and aponeurosis. The tendon is approximately 5 mm in diameter and ends on the radial tuberosity, while the aponeurosis inserts on the ulnar tuberosity.

Action :

The *M. biceps brachii* extends the shoulder joint and flexes the elbow joint.

IV- CAUDAL SHOULDER MUSCLES :

The *M. teres major* and the long head of the *M. triceps brachii* lie on the caudal aspect of the shoulder joint.

1. M. teres major :

This muscle (1/5; 2/8) originates from the caudal angle and proximal third of the caudal border of the scapula, as well as the fascia of the *M. subscapularis*. It ends on the teres major tuberosity of the humerus.

Structure :

The origin of the *M. teres major* is purely muscular. The muscle measures about 12 mm in thickness and its fibers run cranioventrally. It inserts with a flat tendon (18 mm long and 15 mm wide), which fuses with the tendon of the *M. latissimus dorsi*.

Action :

The muscle flexes the shoulder joint and draws the humerus dorsally.

2. Caput longum of the M. triceps brachii :

The long head of the *M. triceps brachii* (1/7; 2/9; 3/5; 4/4) is the strongest muscle of the shoulder joint. It arises from the distal three-fourths of the caudal border, the lateral face of the caudal angle, and the infraglenoid tubercle of the scapula. It inserts on the olecranon. The Bursa subtendinea *m. tricipitis brachii* (approximately 1,5 cm in diameter) is located between the olecranon and the tendon of insertion.

Structure :

The Caput longum has muscular and tendinous origins. The muscular origin, approximately 9 cm long, arises from the caudal border of the scapula. The tendinous origin includes a long narrow band and an aponeurosis. The long narrow band springs from the lateral surface of the caudal angle of the scapula and runs between the M. infraspinatus cranially and M. teres major caudally. The aponeurosis arises from the infraglenoid tubercle and reaches a length of about 1,5 cm and a width of 1 cm. Laterally, the muscle appears as it consists of two portions. The first portion is based on the caudal border of the scapula and tapers to end on the caudolateral aspect of the second portion which is rectangular and covered by a strong tendinous sheet. The tendon of insertion is strong with about 2,5 cm length.

Action :

The long head of M. triceps rachii flexes the shoulder and extends the elbow joint.

DISCUSSION

The origin of the M. supraspinatus in wolf resembles that of cat (CROUCH 1969) and dog (SEIFERLE a. FREWEIN 1984). Its origin from the cranial border of the scapula in this study, however, is not recorded in cat or dog. On the other hand, EVANS and CHRISTENSEN (1979) stated that in dog this muscle arises from the edge of the neck of the scapula, a condition not seen in wolf. The insertion of the M. supraspinatus in wolf consists of muscular and tendinous portions. REIGHARD and JENNINGS (1929) and CROUCH (1969) described this insertion as muscular in cat, while EVANS and CHRISTENSEN (1979) reported it as a strong tendon in dog. According to the results of dog (BRADLEY 1927) the M. supraspinatus of wolf ends on the major tubercle of the humerus and with the tendon of insertion on the deep pectoral muscle.

The origin and insertion of the M. infraspinatus in wolf are similar to those of dog and cat (SISSON 1975). The Bursa subtendinae m. infraspinati in wolf is also described in dog by EVANS and CHRISTENSEN (1979). WALTER (1908) described a second bursa in dog, located between the M. infraspinatus and the acromion, which is found between the M. infraspinatus and the infraglenoid tubercle in wolf. The fibrous band connecting the sheath of the tendon of insertion of the M. infraspinatus and the area cranial to the Facies m. infraspinati in wolf are not described in dog or cat.

The origin and insertion of the M. deltoideus are similar to those of dog and cat (SISSON, 1975).

The M. teres minor arises from the entire length of the caudal border of the scapula in wolf, as in cat (CROUCH 1969). In dog, however, it springs from the distal third of the caudal border of the scapula and the infraglenoid tubercle (BRADLEY 1927, SISSON 1975).

The muscle has tendinous and muscular insertions in wolf. In cat (REIGHARD a. JENNINGS, 1929) and dog (EVANS a. CHRISTENSEN 1979) this insertion is strictly tendinous. According to SEIFERLE and FREWEIN (1984) and De LAHUNTA and HABEL 19867, the M. teres minor of dog inserts on the teres minor tuberosity in a fashion similar to that of wolf, as seen in this study. In cat, on the other hand, it is recorded as inserting on the major tubercle of the humerus (HORSBURGH a. HEATH 1938; CROUCH 1969).

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The origin and insertion of the *M. subscapularis* resemble those of cat (McCLURE *et al.* 1973) and dog (HABEL 1981). However, the attachment of its fibers onto the shoulder joint capsule in wolf is not recorded in the available literature. The strong *M. articularis humeri* of wolf resembles that of cat, as described by SISSON (1975) and SHIVELY (1983). On the other hand, this muscle is not reported in dog.

The origin of the *M. coracobrachialis* in wolf is like that of cat and dog (SISSON 1975). WALTER (1908) stated, that the tendon of its origin is surrounded by a tendon sheath in dog, as is also true in wolf. The present study shows that the muscle inserts on the medial aspect of the humerus, caudodistal to the *teres major* tuberosity, a condition not recorded in dog or cat.

The origin of the *M. biceps brachii* in wolf agrees with that of dog and cat (SISSON 1975). The shoulder joint capsule is reflected around the tendon of its origin as a sheath in wolf, similar observation being made by WALTER (1908) in dog. The muscle inserts on the radial and ulnar tuberosities in wolf as in dog (SHIVELY 1983), while its insertion in cat is limited to the radial tuberosity (REIGHARD *a.* JENNINGS 1929; McCLURE *et al.* 1973).

The origin of the *M. teres major* from the fascia of the *M. subscapularis* in wolf resembles that of dog (BRADLEY 1927) and cat (CROUCH 1969).

The long head of the *M. triceps brachii* of wolf has a wide origin, arising from the caudal angle and distal three-fourths of the caudal border of the scapula, and the infraglenoid tubercle. SISSON (1975) and EVANS and CHRISTENSEN (1979) reported its origin in dog from the infraglenoid tubercle and the distal two-thirds of the caudal border of the scapula. In cat, CROUCH (1969) stated that it originates from the glenoid border of the scapula. The Bursa subtendinea *m. tricipitis brachii* in wolf is similar to that of dog (WALTER 1908).

REFERENCES

- Bradley, O.C. (1927): *Topographical Anatomy of the Dog*. 2nd ed. Oliver and Boyd, Edinburgh, Longon.
- Crouch, J.E. (1969): *Text-Atlas of Cat Anatomy*. Lea and Febiger, Philadelphia.
- De Lahunta, A., *a.* R.E. Habel (1986): *Applied Veterinary Anatomy*. W.B. Saunders, Philadelphia.
- Evans, H.E., *a.* G.C. Christensen (1979): *Miller's Anatomy of the Dog*. 2nd ed. W.B. Saunders, Philadelphia.
- Wabel, R.E. (1981): *Applied Veterinary Anatomy*. 2nd ed. R.E. Habel, Ithaca, N.Y.
- Horsburgh, D.B., *a.* I.P. Heath (1938): *Atlas of Cat Anatomy*. 2nd ed. Humphrey Hilford Oxford Univ. Press, London.
- McClure, R.C., M.J. Dallmann *a.* P.G. Garrett (1973): *Cat Anatomy, text and dissection guide*. Lea and Febiger, Philadelphia.
- Reighard, J., *a.* J.S. Jennings (1979): *Anatomy of the Cat*. 3rd ed. H. Holt and Comp., New York.
- Seiferle, E., U. J. Frewein (1984): *Bewegungsapparat* in: R. Nickel, A. Schummer *u.* E. Seiferle: *Lehrbuch der Anatomie der Haustiere*. Verlag Paul Parey, Berlin, Hamburg, Bd. 1, 5. Aufl.
- Shively, M.T. (1983): *Anatomic Comparison of Cats and Dogs*. *Vet. Med. and Small Animal Clinician*, 78 (6), 901-905.
- Sisson, S. (1975): in: R. Getty: *Sisson and Grossman's. The Anatomy of the Domestic Animals*. W.B. Saunders, Philadelphia, 5th ed., Vol. II.
- Walter, C. (1908): *Die Sehnenscheiden und Schleimbeutel der Gliedmaßen des Hundes*. Leipzig, Univ., Veterinärmed Fak., Diss.

LEGENDS**Fig. (1) Muscles of the left shoulder joint; lateral aspect.**

- | | |
|---------------------------------------|---|
| A- Acromion | B- Tuberculum majus |
| C- Humerus | |
| 1- M. supraspinatus | 2- M. infraspinatus |
| 3- Pars scapularis of M. deltoideus | 4- Pars acromialis of M. deltoideus |
| 5- M. teres major | 6- M. brachialis |
| 7- Caput longum of M. triceps brachii | 8- Caput laterale of M. triceps brachii |
| 9- M. extensor carpi radialis | 10- M. extensor digitorum communis |

Fig. (2) Muscles of the left shoulder joint; medial aspect :

- | | |
|---|--|
| A- Tuberculum majus | B- Corpus humeri |
| C- Radius | D- Ulna |
| 1- M. latissimus dorsi | 2- M. pectoralis profundus |
| 3- M. supraspinatus | 3'- Part of M. supraspinatus, that ends with M. pectoralis profundus |
| 4- M. subscapularis | 5- M. coracobrachialis |
| 6- M. articularis humeri | 7- M. biceps brachii |
| 8- M. teres major | 9- Caput longum of M. triceps brachii |
| 10- Caput mediale of M. triceps brachii | 11- A. axillaris |
| 12- V. axillaris | |

Fig. (3) Muscles of the left shoulder joint; medial aspect.

- | | |
|--|---------------------------------------|
| A- Tuberculum minus | B- Tuberculum majus |
| C- Corpus humeri | D- Radius |
| E- Ulna | |
| 1- Tendon of insertion of M. subscapularis | |
| 2- M. coracobrachialis | 3- M. articularis humeri |
| 4- M. biceps brachii | 5- Caput longum of M. triceps brachii |
| 6- Caput accessorium of M. triceps brachii | |
| 7- Caput mediale of M. triceps brachii | |

Fig. (4): Muscles of the left shoulder joint; lateral aspect.

- | | |
|---|---|
| A- Fossa supraspinata | B- Fossa infraspinata |
| C- Angulus caudalis | D- Tuberculum majus |
| E- Tuberositas deltoidea | F- Tuberositas teres minor |
| G- Corpus humeri | H- Radius |
| I- Ulna | |
| 1- Tendon of insertion of M. supraspinatus. | 2- Tendon of insertion of M. infraspinatus. |
| 3- M. teres minor | 4- Caput longum of M. triceps brachii |
| 5- Caput laterale of M. triceps brachii | 6- Caput accessorium of M. triceps brachii |
| 7- M. brachialis. | |

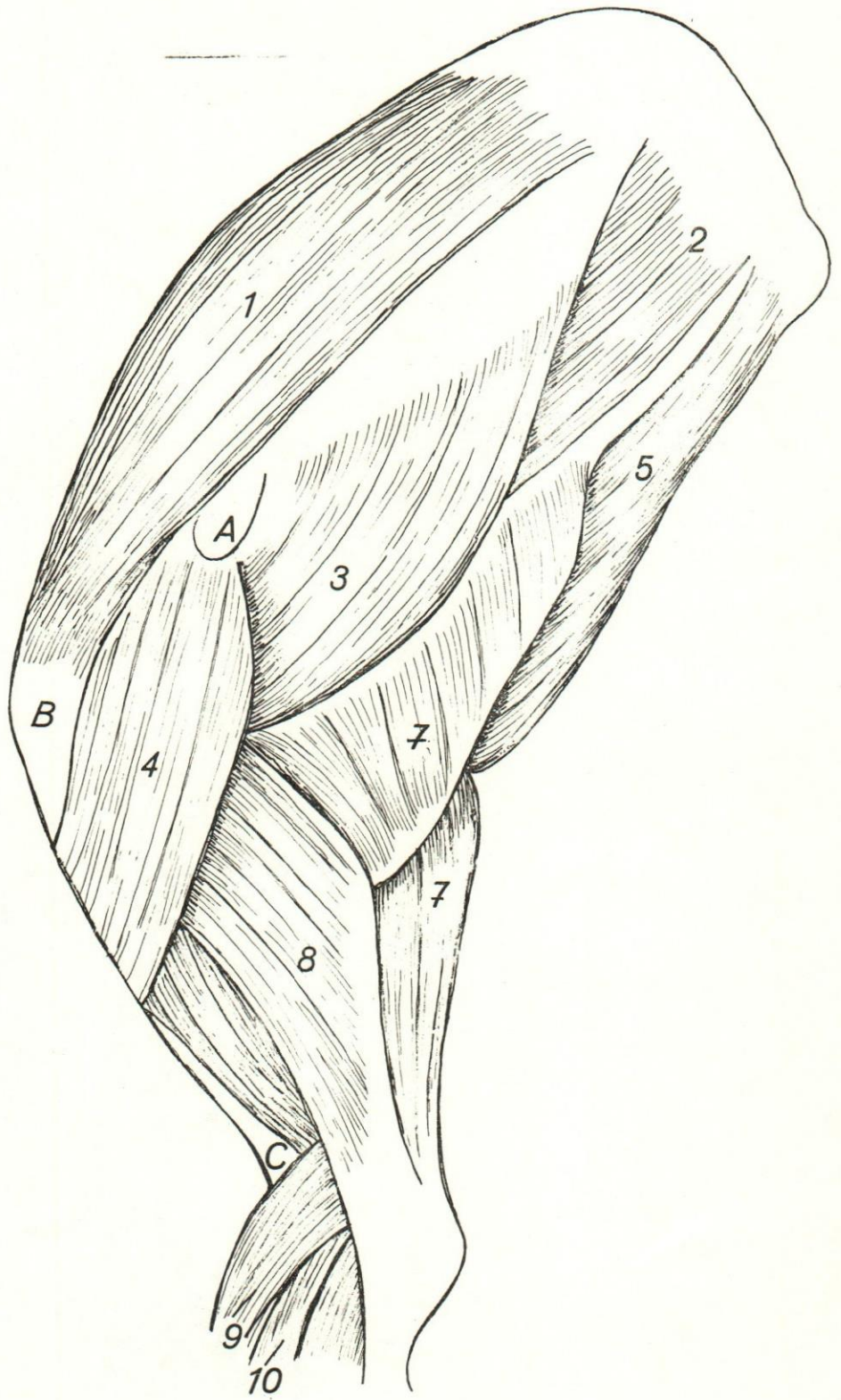


Fig.(1)



(1897)

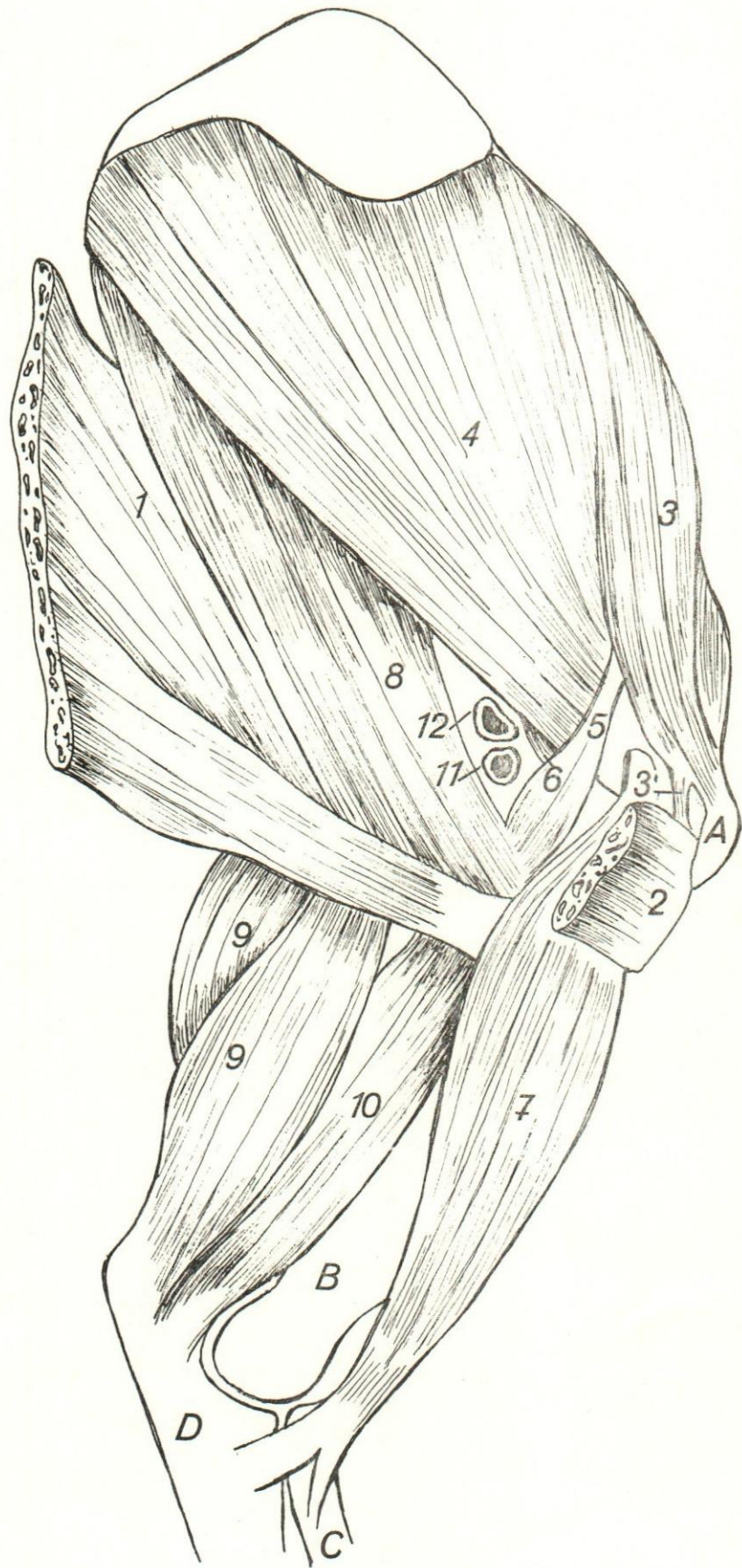


Fig.(2)



1928



Fig.(3)



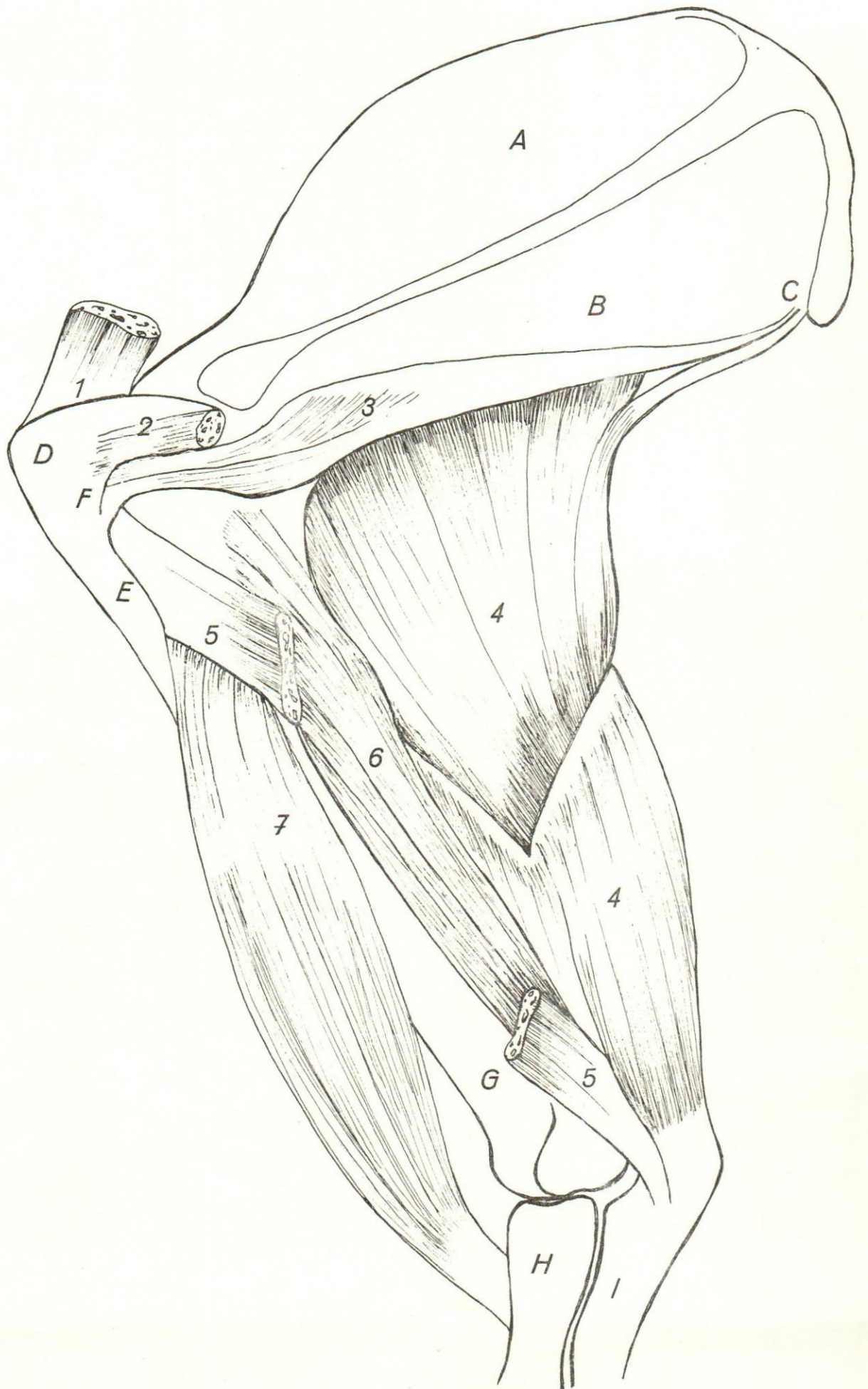


Fig.(4)

