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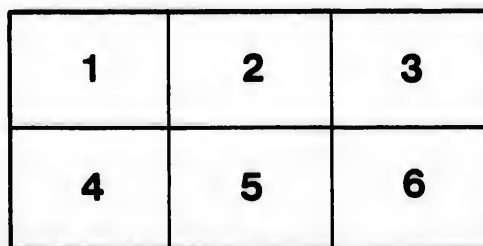
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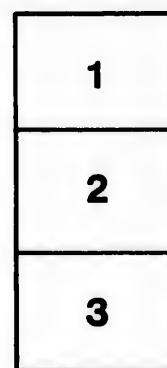
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THE *MUSCULUS STERNALIS* AND ITS OCCURRENCE
IN (HUMAN) ANENCEPHALOUS MONSTERS. By
FRANCIS J. SHEPHERD, M.D., C.M., *Professor of Anatomy*
in McGill University, Montreal. (PLATE XV.)

AT the meeting of the British Association held last summer in Montreal, Professor D. J. Cunningham, of Dublin, read a paper on "The Value of Nerve-Supply in the Determination of Muscular Anomalies," in which he stated his belief that the *musculus sternalis* belonged to the pectoral group—in fact, was an aberrant portion of the *pectoralis major*, as recently suggested by Mr Abraham, of Dublin.¹ Professor Cunningham had traced the nerve-supply² of the *musculus sternalis* in five cases, and found that it came from the internal anterior thoracic nerve, a proof he thought that it belonged to the pectoral group. He also threw out the suggestion that this might possibly be a new inspiratory muscle antagonistic to the *triangularis sterni* appearing in man (for it acted when well developed as an elevator of the ribs), and stated his impression to be that it occurred more frequently in females, as costal inspiration is more pronounced in women than in men.

In the discussion which followed, both Dr G. E. Dobson and myself held that the *musculus sternalis* was most likely a remnant of the *panniculus carnosus*. Dr Dobson considered that the *sterno-cuticularis* muscle of the hedgehog closely corresponded to the *musculus sternalis*.

Professor Cunningham also mentioned in his paper that Mr Abraham had recently found the *musculus sternalis* to occur very commonly in anencephalous monsters, as he had seen it in six out of eleven specimens examined.

Since the meeting of the British Association I have examined six anencephalous monsters which are in the museum of the Medical School of McGill University, and have found in each one a well-marked example of the *musculus sternalis*. My recent dissections of these monsters has had the effect of changing

¹ *Trans. Acad. Medicine in Ireland*, vol. i., 1883.

² *Jour. Anat. and Phys.*, January 1884.

my previous views in regard to the homology of this muscle. I have been convinced that it does not belong to the panniculus group, but very probably should be classed with the pectoral group for the following reasons:—

1. In seven out of the nine muscles found in these monsters (three had double muscles) the nerve-supply was furnished by the anterior thoracic; one of these seven, however, in addition, received a small branch from one of the intercostal. In the other two muscles, occurring in the same foetus, I was unable to satisfactorily make out the nerve-supply, but am inclined to believe it came from the anterior thoracic (Case III.).

2. In three the fibres of the abnormal muscles were continuous with those of the greater pectoral (figs. 1, 2, 6), and in one (fig. 5) the fibres pierced the greater pectoral.

3. In several the insertion of the musculus sternalis was covered by the pectoralis major, and the origin was in common with the upper sternal fibres of the pectoralis major (figs. 1, 4, 6).

4. The greater pectoral was deficient on the side on which the musculus sternalis was present in eight cases (figs. 1, 2, 3, 5, 6).

5. In one (Case VI.) the right *platysma myoides* was well developed, and passed some distance below the clavicle. It was separated from the musculus sternalis of that side by fascia and a thick layer of fat, and was on a plane quite superficial to the musculus sternalis.

In all the cases except one (fig. 3) the abnormal muscle was quite large and well developed, and had an attachment to the sternum and costal cartilages. The majority of the muscles were triangular in shape, though some were fusiform. In the last three dissected I had no difficulty in tracing the nerve-supply, as the nerve was always found passing along the interval which existed between the two portions of the greater pectoral, thence over the pectoralis minor, through the costo-coracoid membrane, to the internal anterior thoracic nerve. The nerve always entered the muscle on its deep surface. In three of the subjects the muscles were continuous with the sternal insertion of the sterno-mastoid (figs. 1, 2, 4). In two a portion of the muscle blended with the aponeurosis of the external abdominal oblique.

I do not propose in this paper to discuss all the various views that have been held in regard to the homology of the musculus sternalis, as this has already been ably done by Professor Turner¹ and others; but I might mention that Professor Bardeleben² has advanced the theory that some of these muscles belong to the sterno-mastoid, and are supplied by the intercostal nerves, whilst others should be classed with the pectoral group, because they receive their nerve-supply from the anterior thoracic. Malbranc's² observations agree with Bardeleben's, for in two living subjects he found the musculus sternalis standing out quite perceptibly under the skin.

In the first case faradisation of the intercostal nerves brought the muscle into action, but in the second it failed; but when faradisation of the thoracic nerves was employed, the muscle responded immediately.³

M. Testut⁴ holds that the musculus sternalis (pre-sternal) is in its upper part an appanage of the sterno-mastoid, and in its lower belongs to the external abdominal oblique. He says these muscles (sterno-mastoid and external abdominal oblique) are in the same muscular plane, and that the musculus sternalis is the remnant in man of the old connection which formerly existed between the two—a connection which exists in serpents.

As I said above, I feel disposed to consider the musculus sternalis as belonging to the pectoral group, and await further light to determine its proper morphological significance. In some of my cases it appeared to take the place of the absent portion of the greater pectoral, and where the muscle was well developed would act as an elevator of the ribs.

As to its occurrence in anencephalous monsters, I am unable to afford any explanation. As far as I can judge from the six specimens I have examined, it appears to be the normal condition. There seems to be great variety of origin, insertion, size, and shape of these muscles, no two being exactly alike. The fact that this muscle occurs so commonly in the brainless monsters would point rather to its being a rudiment than a new

¹ *Jour. of Anat. and Phys.*, vol. i. p. 246.

² Quoted by Testut in *Les Anomalies Musculaires chez l'homme*, 1884.

³ In Case III. in my series the muscle was supplied by both intercostal and anterior thoracic nerves.

⁴ *Les Anomalies Musculaires chez l'homme*, p. 84.

muscle appearing in man. For it is in these cases of arrest of development we should expect to find reversions, rudiments, and anomalies. On the other hand, no arrangement of any existing pectoral group resembles that found in these brainless monsters.

The proportion of female anencephalous monsters is very large in my series—five out of six are females; and as far as I can learn it is rather the exception for an anencephalous monster to be of the male sex.

The cases described in detail are as follows:—

CASE I. (fig. 1). *Female fetus, full term. Anencephalous. Musculus sternalis unilateral. Left.*

The musculus sternalis in this specimen is of large size, and arises from the fascia over the first piece of the sternum by a flat tendon, which is continuous above with the sternal origins of both sterno-mastoid muscles, and on the right side is connected with the muscular fibres of the greater pectoral arising from the manubrium. From this origin the muscle passes downwards and outwards to the left side, expanding as it descends into a large fusiform muscle, which is inserted into the whole of the fourth left costal cartilage and into the side of the sternum opposite the fifth and sixth cartilages; the innermost portion of the muscle is prolonged downwards over the lower part of the greater pectoral, and ends in the aponeurosis of the external oblique muscle of the abdomen.

The abnormal muscle lies on the sternum and costal cartilages, and has only a few of the deeper fibres of the greater pectoral beneath it. Above, on the outer edge, some muscular fibres came off from the musculus sternalis, and passing outwards form part of the greater pectoral muscle.

The nerve supplying the muscle enters its under surface about half-way down the muscle; it can be traced outwards through a cellular interval in the greater pectoral, over the pectoralis minor, to its upper border, where it pierces the costo-coracoid membrane, and joins the internal anterior thoracic nerve. As it lies between the two pectorals it gives off a branch to the lower part of the great pectoral.

CASE II. (fig. 2). *Female fetus. Anencephalous, with spina bifida of cervical and upper dorsal regions. Musculus sternalis bilateral.*

The two muscles have a common origin from the first piece of the sternum, which is continuous above with the sternal portions of both sterno-mastoid muscles. The *left* muscle, smaller than the right, consists of a flat narrow band of muscular fibres, which pass down from the common origin to be inserted into the third left costal cartilage and side of the sternum. At its insertion it is covered by the fibres of the lower segment of the greater pectoral. The *right* muscle is large and flat, and, besides the origin common to it and its fellow, is attached to the sternum opposite the second and third costal cartilages. It divides into three sets of muscular fibres—the outer inserted into the upper border of the lower segment of the pectoralis major, the middle continuous with the fibres of that muscle, and the inner inserted into the lower end of the sternum and upper part of the ensiform cartilage. On both sides a triangular portion of the greater pectoral is absent; the spaces thus left are partly covered by the abnormal muscles. This space is longer on the left than the right side. In this fetus, owing to its very friable condition, I was unable satisfactorily to trace the nerve-supply of these abnormal muscles, but am inclined to believe that the nerve-supply comes from the anterior thoracic, as on each side I traced a branch from the anterior thoracic over the lesser pectoral to the triangular interval between the two segments of the great pectoral, but there I lost it.

CASE III. (fig. 3).—*Female fetus. Anencephalous with spina bifida of cervical region. Musculus sternalis unilateral. Left side.*

In this case the abnormal muscle consists of a small fusiform slip which arises from the sternum opposite the second costal cartilage by a thin aponeurosis, passes down over the left greater pectoral a little outside the sternum, and finally expands into a broad aponeurosis, which blends with the fascia over the external abdominal oblique. It receives its nerve supply from two sources. The larger nerve, which enters the middle of the muscle, can be traced through the greater pectoral over the lesser pectoral, and through the costo-coracoid membrane to the

internal anterior thoracic. The smaller enters the muscle nearer its upper end, and can be traced through the intercostal space to the third intercostal nerve. Both nerves supply the muscle from its deep surface. This is the only case where a branch from the intercostal could be traced to the muscle itself. In several of the other cases the intercostal nerves pierced the muscle, but gave no branches to it. No portion of the greater pectoral is absent in this case.

CASE IV. (fig. 4).—*Male fœtus. Anencephalous with spina bifida of cervical region. Musculus sternalis unilateral. Left.*

The abnormal muscle in this fœtus is of large size, flat and triangular, arises by a tendon from the manubrium, in common with the upper sternal portion of the right pectoralis major and the sternal portion of the left sterno-mastoid with which its left border is continuous. As it passes down to the left it soon expands into a broad muscle which is inserted into the third costal cartilage. At its insertion it is covered by the fibres of the pectoralis major. Its inner edge is prolonged downwards over the lower portion of the last mentioned muscle. On the left side a triangular portion of the pectoralis major muscle, arising from the upper part of the sternum and costal cartilages of the second and third ribs, is wanting, the space left being partly covered by the musculus sternalis.

The nerve supplying the muscle can be seen crossing the triangular interval, and can be traced, as in the other cases, to the anterior thoracic.

CASE V. (fig. 5).—*Female fœtus. Anencephalous in spina bifida. Musculus sternalis bilateral.*

Both muscles arise in common with the upper sternal fibres of the pectoralis major from the manubrium, and diverge from each other as they descend.

The *left* muscle passes down over the sternum and left costal cartilage, and is inserted into the fourth costal cartilage near the sternum. It is a flat triangular muscle of considerable size. Continuous with its lower fibres, and running along its inner edge, is a small muscular slip which has an attachment above by a round tendon to the middle of the sternum, passes over the

lower part of the greater pectoral, and is inserted into the fascia covering that muscle. A large portion of the central part of the pectoralis major is absent, the space left, as in the other cases, being partly covered by the abnormal muscle. The nerve supplying the muscle crosses this vacant interval, and can be traced, as in the other cases, to the internal anterior thoracic.

The *right* muscle goes down and out from the common origin, and soon divides into two slips, the outer of which, after piercing some fibres of the greater pectoral, is lost in the fascia covering that muscle. The inner slip continues down immediately to the right of the sternum, and ends in a tendinous expansion which is inserted into the fascia of the lower part of the pectoral muscle. On this side also the portion of the great pectoral is deficient which arises from the second and third costal cartilages and the corresponding portion of the sternum. The nerve can be traced crossing the triangular interval, and under the upper segment of the greater pectoral to join the anterior thoracic above the lesser pectoral.

CASE VI. (fig. 6).—*Female fetus. Anencephalous with spina bifida of cervical and upper dorsal regions. Musculus sternalis bilateral.*

The muscles of the two sides have a common origin from the manubrium.

The *right* muscle, triangular in shape, is the larger. It soon becomes muscular, crosses the triangular interval caused by absence of a portion of the great pectoral, and is inserted by muscular fibres into the upper border of the lower segment of the greater pectoral, and also into the sternum opposite the fourth costal cartilage. Some of its fibres pass over the pectoral muscle and blend with it. As in the other cases, it is supplied by a branch from the internal anterior thoracic nerve, which reaches the muscle in the usual way.

The *left* muscle divides into two portions, the outer of which is the larger, flat and ribbon-shaped, passes down over the triangular interval between the upper and lower segment of the greater pectoral, and is inserted into the third costal cartilage; the inner portion has an additional origin from the second piece of the sternum. It continues down, over, and to the left side of

the sternum, developing into a fusiform-shaped muscle, which ends by dividing into two tendinous slips, one of which is inserted into the lower end of the sternum, and the other into the fascia covering the pectoralis major. The nerve-supply is, as in the other cases, furnished by a branch from the internal anterior thoracic nerve, which joins the deep surface of the muscle after pursuing the usual course across the lesser pectoral and vacant interval between the two parts of the greater pectoral. In its course a small branch is given off, which goes to the lower part of the greater pectoral.

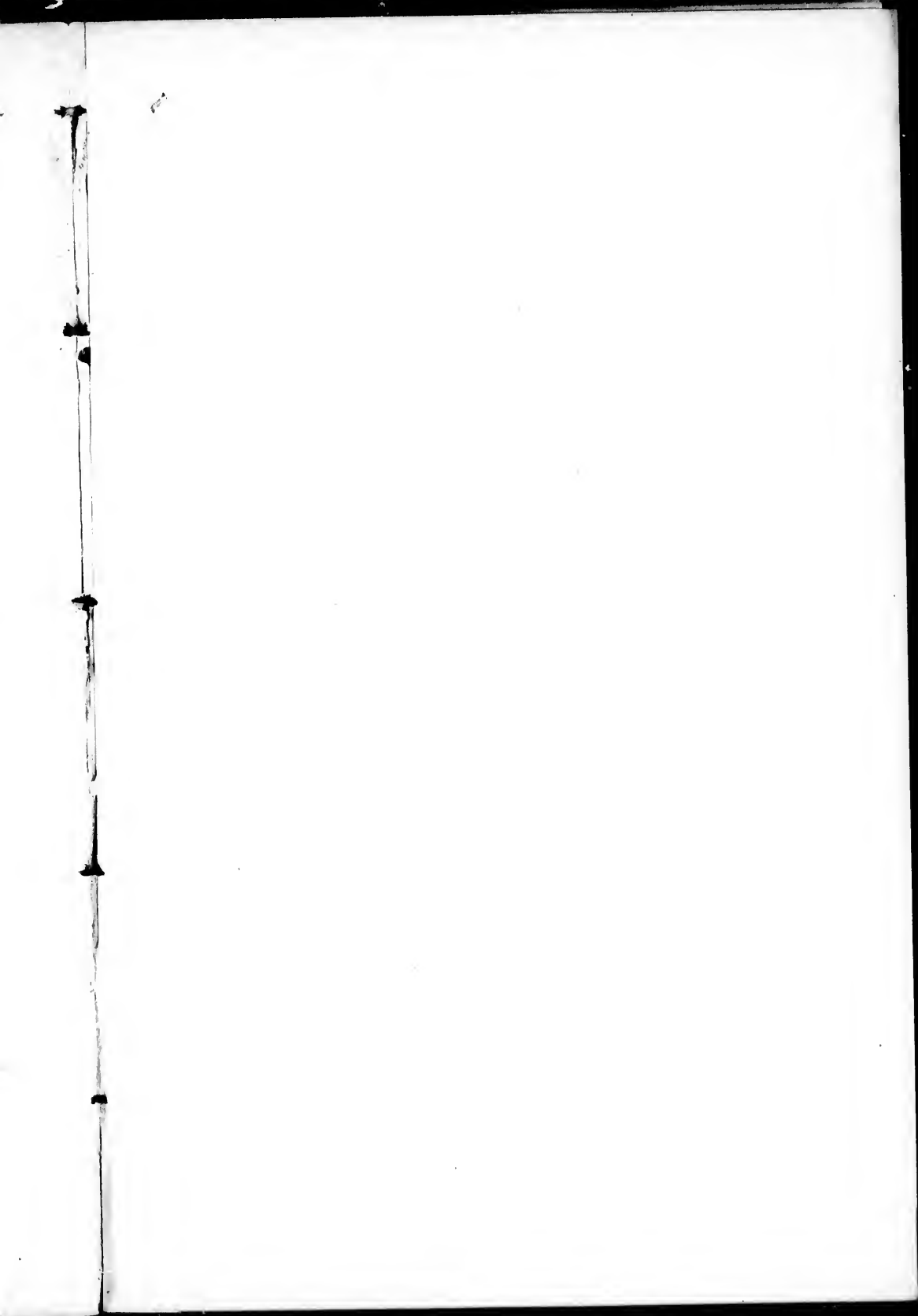
On each side there is a deficiency of the great pectoral, a triangular portion arising from the second and third costal cartilages being absent. The interval is larger on the right than the left side, and on each side is partially covered by the abnormal muscle.

In this fetus on the right side the platysma myoides is strongly developed, continues over the clavicle, and reaches for some distance below it. It is a well-developed muscle, and is separated from the musculus sternalis of that side by fascia and a thick layer of adipose tissue, so that it is on a plane quite superficial to the musculus sternalis.

Note.—I have, in adults, only seen the musculus sternalis three times¹ in three hundred subjects. Some cases, no doubt, escaped my notice, owing to the majority of the subjects having been injected through the heart, and, in consequence, the sternum having been sawn through the centre. In all the cases seen the muscle was well developed. In one case it was continuous above with the opposite sterno-mastoid, and below was attached to the cartilage of the fifth rib. In the second case it arose from the second costal cartilage, and passed down over the pectoral muscle, and ended by being inserted into the fascia covering that muscle. Some of its upper fibres intermingled with those of the platysma myoides. The subject was very thin.

In the third case the muscle was attached above and below to the fascia covering the greater pectoral. All three muscles occurred in males. Two of the muscles were on the left side and one on the right.

¹ *Annals of Anatomy and Surgery*, 1881-83.



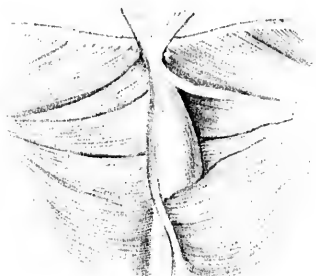


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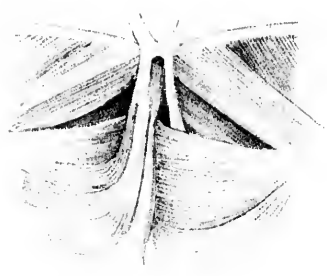


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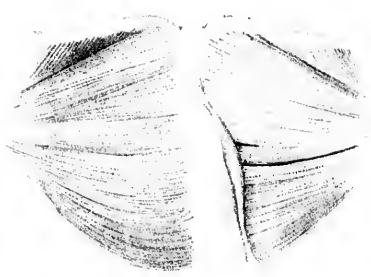


Fig. 3.



Fig. 4.



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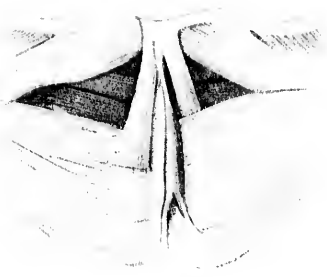


Fig. 6.

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EXPLANATION OF PLATE XV.

Fig. 1. Left musculus sternalis, arising from the first piece of sternum, and continuous with the sterno-mastoids, inserted into the fourth costal cartilage and side of sternum—a portion continuous with the left pectoral. Nerve-supply from anterior thoracic. (Female.)

Fig. 2. Double sternalis muscle, arising from manubrium, and, in common with upper fibres of great pectoral and sterno-mastoid, inserted on right side into sternum and great pectoral, on left into third costal cartilage. Sternal and costal origins of both greater pectorals defective. (Female.)

Fig. 3. A slender left musculus sternalis, arising from sternum opposite second costal cartilage, and inserted into the aponeurosis of external abdominal oblique. Supplied by a branch from anterior thoracic nerve and intercostal. (Female.)

Fig. 4. Left musculus sternalis, arising from manubrium, in common with sterno-mastoid and upper fibres of greater pectoral inserted into third costal cartilage. Nerve-supply from anterior thoracic. Left pectoralis major deficient in central part. (Male.)

Fig. 5. Double musculus sternalis, arising from manubrium, with upper fibres of greater pectoral on right side. Two slips piercing pectoral muscle, and inserted into aponeurosis covering that muscle. Muscle on left side inserted into fourth costal cartilage. Nerve-supply from anterior thoracic on both sides. (Female.)

Fig. 6. Double musculus sternalis, arising from manubrium. Right side flat muscle inserted into greater pectoral and sternum. Left side, two slips—one inserted into third costal cartilage, and other into aponeurosis of greater pectoral. Nerve-supply from anterior thoracic on both sides. Both greater pectorals defective. (Female.)

