

A Case of the Latissimus Dorsi Muscle with an Accessory Insertion into the First Rib

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An outline of the present paper was reported at the 33rd Meeting
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There was found a very rare case of variation of the latissimus dorsi muscle having an accessory insertion into the first rib in addition to the usual insertion into the crest of the lesser tubercle of the humerus.

Review was made on the true nature of the band-shaped aponeurosis forming the accessory insertion of this case and on the mechanism of formation of this variation. It was speculated that the band-shaped aponeurosis was formed upon organization into tendinous tissue of the fascia situated on the serratus anterior muscle and the upper external intercostal muscles. As for the mechanism of formation of this variation, it was considered that the band-shaped tendinous tissue upon organization of the fascia was fused with the usual insertion tendon of the latissimus dorsi muscle, and further, a muscle bundle of the latissimus dorsi muscle possibly separable anteriorly shifted to the tendinous tissue.

INTRODUCTION

A case of the latissimus dorsi muscle with an accessory insertion into the first rib in addition to the usual insertion to the crest of the lesser tubercle of the humerus was encountered while a cadaver was dissected for some purpose.

Macroscopic findings on numerous cases of the latissimus dorsi muscle in man and human fetus have been reported by Eisler (1912), Loth (1912), Nishi (1919), Wagenseil (1927, 1937), Miura (1931), Shibuya (1942), Mori (1950), Yonekura (1954) and Mori (1964). However, there has been no description of such a variation of the latissimus dorsi muscle as the case found by the present author. Consequently, the variation found by the author may be a very rare case.

In view of the above, detailed findings of the variation in this case are reported hereunder together with discussion on the mechanism of its formation.

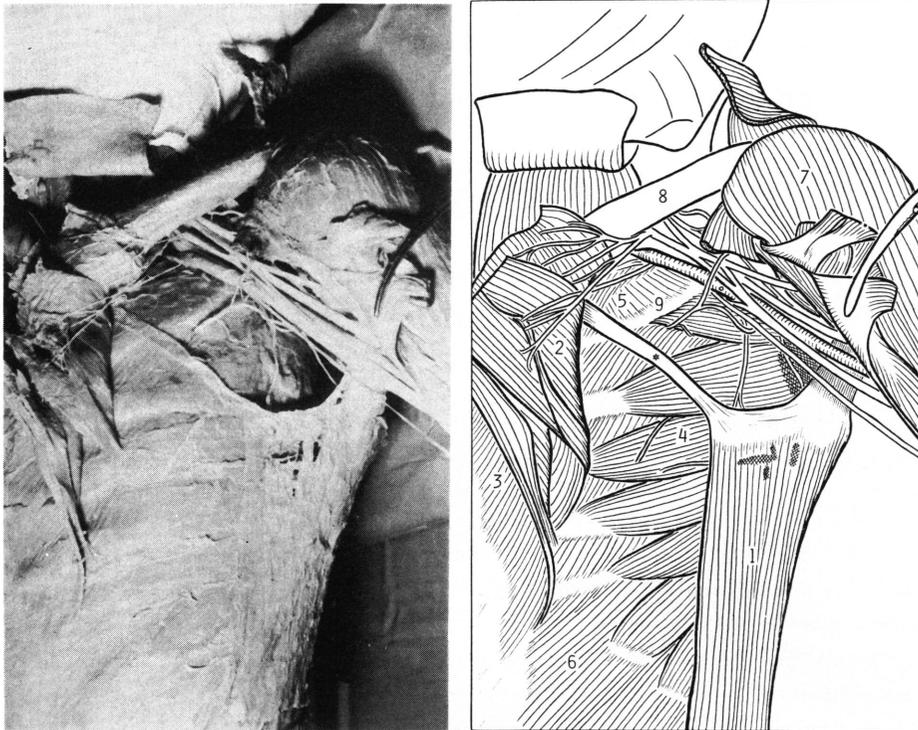


Fig. 1. Ventrolateral view
 asterisk: band-shaped aponeurosis, 1: latissimus dorsi muscle, 2: pectoralis minor muscle, 3: pectoralis major muscle, 4: serratus anterior muscle, 5: external intercostal muscle, 6: external oblique abdomina muscle, 7: deltoid muscle, 8: clavicle, 9: second rib

The material consisted of a cadaver selected at random from among the bodies preserved at Fukuoka University School of Medicine. The body had been cadaver number 94, age 30 years, female, Japanese. The cause of death had been pulmonary tuberculosis.

FINDINGS (Fig.1)

The origin of the left latissimus dorsi muscle was the same as what is described in many textbooks of anatomy. This muscle originated from the spinous processes of the lower five thoracic and the lumbar vertebrae, from the dorsal surface of the sacrum, from posterior two-thirds of the iliac crest and from the lower three ribs. Thus there was nothing peculiar about the origin.

The muscle bundles of this muscle except those originating from the ribs converged toward the axilla, and, upon shifting to the insertion tendon, was inserted into the crest of the lesser tubercle of the humerus which is the usual insertion site of this muscle. A band-shaped aponeurosis was branched anteriorly from the lateral portion of the insertion tendon near its basal part. This aponeurosis first ran anteriorly in an arch shape reaching the level of the third intercostal space near the anterior axillary line.

After appearing at the anterior thoracic wall, it first ran between the serratus anterior muscle and the pectoralis major muscle and then craniomedially between the pectoralis minor muscle and the external intercostal muscles and inserted into the lower edge of the first rib somewhat expanding in a fan shape. The band-shaped aponeurosis measured about 9.4 cm in length and 0.6 cm in width. Of the muscle bundles of the latissimus dorsi muscle, those originating from the ribs ran almost upwards and adhered to the basal part of the band-shaped aponeurosis.

In regard to the relative position of the attachment of the band-shaped aponeurosis on the first rib and the attachment of the subclavius muscle and anterior scalene muscle on the first rib, the former was located between the latter two muscles without any adhesion of the aponeurosis with them. Moreover, connective tissue was present, though in a small quantity, between this aponeurosis and the serratus anterior muscle and the external intercostal muscles, and no adhesion was seen between this aponeurosis and these two muscles. Neither was seen any adhesion between this aponeurosis and the pectoralis major and minor muscles.

Innervation was exactly the same as what is described in many textbooks of anatomy, the latissimus dorsi muscle being innervated by the thoracodorsal nerve. The pectoral nerve and the intercostal nerves were examined thoroughly, but they were found to be unrelated to the latissimus dorsi muscle and the band-shaped aponeurosis.

DISCUSSION

Macroscopic morphological studies on many cases of the latissimus dorsi muscle in man and human fetus have been carried out by Eisler (1912), Loth (1912), Nishi (1919), Wagenseil (1927, 1937), Miura (1931), Shibuya (1942), Mori (1950), Yonekura (1954) and Mori (1964). However, these reports provide no description of such a variation of the latissimus dorsi muscle as the author's case. Consequently, the variation found by the present author may be a very rare case.

Somewhat comparable with the variation of the latissimus dorsi muscle encountered by the present author are a case of the latissimus dorsi muscle fused with the anterior supracostal muscle reported by Brettschneider (1952), a case of the subcutaneous trunci muscle inserted even to the coracoclavicular fascia and the clavicle reported by Blunt-schli (1910) and rare cases of the muscle bundle at the anterior edge of the latissimus dorsi muscle separated anteriorly reported by Böse (1904) and Eisler (1912).

In comparison of the case found by the present author with the above reports, discussion will be made hereunder on the true nature of the band-shaped aponeurosis reaching to the first rib in the variation of the latissimus dorsi muscle encountered by the author and on the mechanism of formation of the latissimus dorsi muscle with such an abnormal morphology.

1) A case of the latissimus dorsi muscle adhered to the anterior supracostal muscle reported by Brettschneider (1952) (Fig.2) much resembles in appearance with the author's

case. In his findings, a band-shaped tendon originated from the first rib, ran latero-inferiorly, and shifted to a muscle bundle at the level of the fourth rib, the muscle bundle further extending downwards and inserted into the seventh and eighth ribs. This muscle bundle was fused on its way with the anterior edge of the latissimus dorsi muscle. Moreover, the band-shaped tendon and the insertion tendon of the latissimus dorsi muscle were fused at the level of the fourth rib, forming a tendon arch. Since a gap was seen below the tendon arch between the muscle bundle originating from the first rib and inserting into the seventh and eighth ribs and the anterior edge of the latissimus dorsi muscle, and since this muscle bundle was innervated by the third to fifth intercostal nerves, it was concluded by Brettschneider that this muscle bundle was the anterior supracostal muscle being fused with the anterior edge of the latissimus dorsi muscle.

Incidentally, some discussion is required on the true nature of the human anterior supracostal muscle. This muscle rarely observed in man is a homologue with the sterno-costal muscle constantly present in mammals except monotremes and anthropoids, and further the sterno-costal muscle is homologous with the cranial portion of the obliquus externus thoraco-abdominis muscle of lower mammals, and accordingly the human anterior supracostal muscle is explained to be a phenomenon of atavistic variation (Wood; 1867, 1870, Ruge; 1892, Kohlbrügge; 1897, Cals; 1902, Forster; 1916, Cords; 1924).

According to Macalister (1872) and Livini (1905), tendinous or connective tissue-like band was found at a considerably high frequency at a site on the anterior thoracic wall where the anterior supracostal muscle might have existed, and this band was considered as a rudiment of the anterior supracostal muscle.

In view of the above reports of Macalister and Livini as well as comparative-anatomical consideration on the true nature of the anterior supracostal muscle, it is considered that the human anterior supracostal muscle degenerated or disappeared during the course of ontogeny or phylogeny, and remains in many cases as a tendinous or connective tissue-like band.

As to the mechanism of formation of the variation of the latissimus dorsi muscle

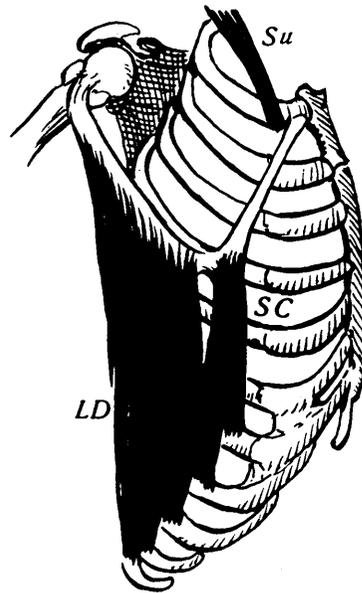


Abb. 1. Rechter Latissimus dorsi (*LD*) mit angelagertem *M. supracostalis ventralis* (*SC*). Der *M. supracostal.* erstreckt sich vom Ursprung des *M. subclavius* (*Su*) bis zur 7. und 8. Rippe.

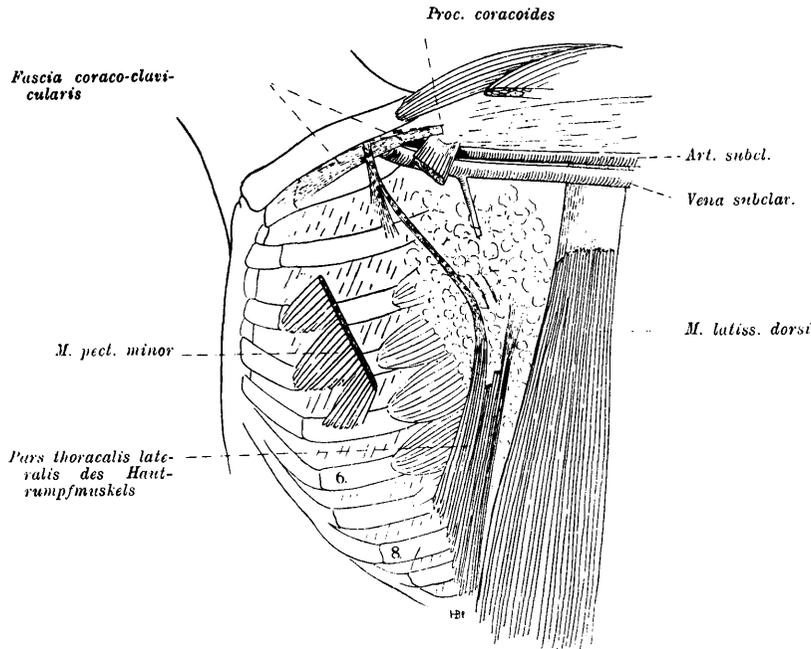
Fig. 2. This picture was copied from Brettschneider (1952).

found by the present author in reference to the case reported by Brettschneider (1952) and to the ontogeny or phylogeny of the human anterior supracostal muscle, it may be concluded that the band-shaped aponeurosis branched from the lateral portion of usual insertion tendon of the latissimus dorsi muscle in the author's case may be regarded as a tendinous rudiment of the anterior supracostal muscle and that the variation in this case was formed by secondary adhesion of the tendinous rudiment to the latissimus dorsi muscle.

However, a review on the true nature of the human anterior supracostal muscle on the basis of innervation results in another conclusion. Description on innervation of the muscle is scarce being reported only by Takeshige et al. (1968) and Kaneko et al. (1978) that the human anterior supracostal muscle is innervated by anterior twigs arising from the lateral cutaneous branches of the upper intercostal nerves. However, it has recently been confirmed by Horiguchi et al. (1980) and Yamasaki (1981) that the human anterior supracostal muscle is innervated by the twigs from the branches supplying the external intercostal muscles. Miyauchi (1981) also found three cases of the anterior supracostal muscle during dissecting practice for medical students at Medical College of Oita, and two cases of which were confirmed to be of the same findings as that of Horiguchi et al. and Yamasaki. On the basis of the confirmed pattern of nerve supply to the human anterior supracostal muscle, it is reasonable to regard that this muscle is not homologous with the sterno-costal muscle of mammals, but rather that the superficial muscle bundle of the upper external intercostal muscles was separated to be independent and extended downwards. In other words, the human anterior supracostal muscle may be regarded as progressive rather than atavistic.

This conclusion raises some questions to the reports of Macalister (1872) and Livini (1905) concerning the rudiment of the anterior supracostal muscle. The author, in dissecting practice for medical students at Medical College of Oita (25 cadavers in 1980 and 17 cadavers in 1981), carefully examined the anterior thoracic wall keeping in mind the descriptions by Macalister and Livini. Present between the upper portion of the serratus anterior muscle and upper external intercostal muscles was a fascia and the fibers constituting the fascia ran lateral-downwards. Thickening of a part of the fascia appearing like a tendinous band was observed in some bases though it varied by individuals. However, the location of the above tendinous band was quite deviated from where the anterior supracostal muscle should properly belong. According to Eisler (1901, 1912) and Kasai (1977), the nerve having innervated a muscle disappearing upon degeneration during the course of ontogeny remained at the site where the muscle disappeared upon degeneration. In observation of the fascia, the author examined very carefully the behavior of the upper intercostal nerves, but was unable to confirm any involvement of the intercostal nerves in the fascia, particularly in the tendinous band.

Consequently, it is not appropriate to regard the band-shaped aponeurosis in the variation of the latissimus dorsi muscle found by the author as a tendinous rudiment of the anterior supracostal muscle.



Pars thoracalis lateralis des Hautrumpfmuskels in Zusammenhang mit der Fascia coraco-clavicularis bei einem 40jährigen Italiener (08/111).

Fig. 3. This picture was copied from Bluntschli (1910).

2) A peculiar case of the subcutaneous trunci muscle (Fig. 3) was reported by Bluntschli (1910). When the subcutaneous trunci muscle of mammals appears in man, it is often present in view of its location as a muscular or tendinous arch of the axilla upon adhering to the latissimus dorsi muscle. Therefore, it is possible to assume some formation by fusion of Bluntschli's subcutaneous trunci muscle with the anterior edge of the latissimus dorsi muscle. This assumed formation resembles much in external appearance with the variation of the latissimus dorsi muscle found by the present author.

Bluntschli failed to provide any appropriate explanation on the band-shaped tendon reaching to the coraco-clavicular fascia of the peculiar subcutaneous trunci muscle found by him as well as to the clavicle. Ruge(1914) who described general theory on the vicissitudes of the subcutaneous trunci muscle of mammals appearing in man, cited Bluntschli's subcutaneous trunci muscle considering it as a peculiar case, but he did not provide any explanation on the band-shaped tendon, either.

The tendon reaching to the coraco-clavicular fascia and to the clavicle was located in the lower layer of the pectoralis minor muscle. In view of the relative location of this tendon against the pectoralis minor muscle, it is not appropriate to regard this tendon as part of the subcutaneous trunci muscle. If any bold speculation is allowed, this tendon might have been organized into a tendinous tissue from the fascia of the serratus anterior muscle and upper external intercostal muscles, and this tendinous tissue was

fused with the muscle bundle at the anterior edge of the subcutaneous trunci muscle, forming a peculiar case.

Consequently, the case found by the author cannot be considered to be formed by fusion of the latissimus dorsi muscle with the subcutaneous trunci muscle.

3) A case with a muscle bundle at the anterior edge of the latissimus dorsi muscle separated to be independent, running anteriorly and inserted into the fascia on the pectoral side of the axilla was reported by Böse (1904) and a similar case was also reported by Eisler (1912).

Consequently, it can be considered the muscle bundle at the anterior edge of the latissimus dorsi muscle may possibly be separated anteriorly though it may be a very rare phenomenon.

4) Concerning the mechanism whereby a variation of the latissimus dorsi muscle found by the author was formed, the following is the speculation if such is permitted though it may be a bold one. The band-shaped aponeurosis in the author's case was a fascia of the serratus anterior muscle and upper external intercostal muscles organized into a bandshaped tendinous tissue, which was adhered to the lateral portion of the insertion tendon of the latissimus dorsi muscle, while the muscle bundle at the anterior edge of the latissimus dorsi muscle possibly separable therefrom was fused with the band-shaped tendinous tissue.

SUMMARY

A very rare variation of the latissimus dorsi muscle was found on the left side of the cadaver of a 30 years old Japanese female..

A fine band-shaped aponeurosis was branched from the outside of usual insertion tendon of the latissimus dorsi muscle, formed a tendon arch in the axillary region, ran medial-upwards through the lower layer of the pectoralis major and minor muscles at the anterior thoracic wall and was inserted into the lower edge of the first rib. The muscle bundles of the latissimus dorsi muscle originating from the ribs shifted to tendon arch. It appeared that the latissimus dorsi muscle had an accessory insertion into the first rib in addition to the usual insertion. The latissimus dorsi muscle was innervated by the thoraco-dorsal nerve, but there was no involvement of the intercostal nerves and pectoral nerves in the latissimus dorsi muscle including the band-shaped aponeurosis.

Discussion was made on the true nature of the band-shaped aponeurosis and on the mechanism of formation of this variation of the latissimus dorsi muscle found in the present case.

In discussion on the true nature of the band-shaped aponeurosis, similar cases reported by previous investigators such as a case of adhesion of the latissimus dorsi muscle to the anterior supracostal muscle and a case of possibly peculiar adhesion of the latissimus dorsi muscle to the subcutaneous trunci muscle were cited. As a result of discussion on the true nature of the anterior supracostal muscle and on the frequency

of presence of a tendinous rudiment of this muscle in man as well as on vicissitudes of the subcutaneous trunci muscle in man, it was considered that the band-shaped aponeurosis forming the accessory insertion was formed upon organization into tendinous tissue of the fascia situated on the serratus anterior muscle and upper external intercostal muscles.

Furthermore, it was indicated from discussion on reports in the literature that the muscle bundle at the anterior edge of the latissimus dorsi muscle may possibly be separated anteriorly to become independent.

As to the mechanism of formation of the present variation, it was speculated that a band-shaped tendinous tissue deriving from the fascia of the serratus anterior muscle and upper external intercostal muscles adhered to the usual insertion tendon of the latissimus dorsi muscle and further a muscle bundle at the anterior edge of the latissimus dorsi muscle shifted to this band-shaped tendinous tissue.

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