THE PHYLOGENETIC SIGNIFICANCE OF THE
CHONDRO-EPITROCHLEARIS MUSCLE AND ITS
ACCOMPANYING PECTORAL ABNORMALITIES

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The chondro-epitrochlearis muscle is an anomalous slip detached from the ventral edge of the pectoralis major, running down the medial side of the arm to insert on to the medial epicondyle. The muscle is somewhat variable in form but the following example, discovered by students in the course of dissection may be considered fairly typical.

The cadaver was that of an 80-year old white man. The chondro-epitrochlearis begins as the inferiormost fibres of the left pectoralis major, about 5 cm. from its origin along the costal cartilages. These fibres separate from the inferior edge of the pectoralis as a rounded fasciculus about 6 mm. thick. Proximally, this fascicle is bound to the pectoralis by a fascial sheet. As the pectoralis major crosses the axilla, the fascicle curves away from the parent muscle and runs down the humerus parallel to the biceps to a point about 7.5 cm. from the condyles. Here the muscular fibres end and the fascicle continues as a tendon to insert on the epicondyle (Fig. 1).

The muscular fascicle as it curves away from the pectoralis is joined by a tendon from the under surface of that muscle, derived from fibres of the pectoral fascia. This chondro-epitrochlearis tendon runs superiorly through the pectoral fascia, crossing most of the fascial fibres which run toward the insertion of the pectoralis. The chondro-epitrochlearis tendon, gradually decreasing in size, continues beyond the upper edge of the pectoralis major as a longitudinal bundle of connective tissue fibres in the brachial fascia to attach to the joint capsule superficial to the tendon of origin of the long head of the biceps. A few fibres from that tendon join the chondro-epitrochlearis tendon (Fig. 1).

The insertion of the pectoralis major is abnormal. Normally, the fibres originating from the lower part of the sternum and the costal cartilages pass under the more cranially originating fibres to insert higher (more proximally) on the humerus (Fig. 2). In this specimen the most cranial fibres, those of the clavicular division, insert most proximally on the humerus. The lower sternal fibres pass under the upper sternal ones to insert on the humerus deep to the latter and the clavicular fibres, while the costal fibres insert at the lower edge of those from the clavicle (Fig. 1). Thus, the usual untwisted insertion of the pectoralis has been partially straightened out.

This untwisting of the pectoralis major insertion is regularly found when a chondro-epitrochlearis muscle is present. Eisler (1912, p. 464), reviewed the reports of thirteen authors who described chondro-epitrochlearis and stated that all of these authors reported that the normal twisting of the pectoralis major insertion was missing.
Fig. 1. Chondro-epitrochlearis muscle. Note aberrant pectoral insertion, and small long head of the biceps. From a damaged specimen, partially restored.

Fig. 2. Diagramatic representation of the insertion of the human pectoralis major. The cranial extension of the insertion of the costal fibres (X') has been slightly exaggerated (after Ashley, 1952).
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Previous attempts to explain the phylogenetic significance of the chondro-epitrochlearis do not seem to have taken the accompanying disturbance of the pectoral insertion into account, although Tischendorf (1949) noted that the insertion of the pectoralis was untwisted when a pectoralis IV (chondro-epitrochlearis, and epigastric slips) was present.

**DISCUSSION**

Testut (1884), and subsequent authors, ascribed the name ‘chondro-epitrochlearis’ to Wood (1868). He himself attributed the name to Duvernoy (1855) but no muscle of that name appears in the work cited. As a matter of fact, there is no evidence in any of Wood’s papers (1864, 1865, 1866, 1868) that he ever saw a true chondro-epitrochlearis muscle. What he did see and describe were ‘epigastric slips’, i.e. detached slips from the inferior border of the pectoralis major that insert on the humerus at the same level as the pectoralis. These slips, he said, were the equivalent of the chondro-epitrochlearis of apes and monkeys. Apparently Wood (1868, p. 491), regarded this ‘chondro-epitrochlearis’ as the equivalent of the abdomino-or xiphihumeralis of quadrupeds, a muscle now considered part of the pectoralis minor (Howell, 1937a).

Perrin (1871) advanced the explanation that the chondro-epitrochlearis is homologous with the ‘extensor plicae alaris’ of birds. This latter is really two muscles, called by modern students of avian myology the ‘tensores patagii longus and brevis’ (compare Owen, 1866 and Fisher, 1946). The muscles serve to tighten the patagium, the fold of skin at the leading edge of the wing and are, of course, found only in birds. Perrin’s suggested homology was accepted by Testut (1884). It is extremely improbable. The tensores patagii are innervated by fibres from the posterior divisions of the brachial plexus and are thus part of the dorsal (extensor) muscle mass (Fisher, 1946 and Howell, 1937b). The chondro-epitrochlearis, being part of the pectoralis major, is innervated by fibres from the anterior division (Bryce 1899, Tischendorf 1949) and is derived from the ventral (flexor) muscle mass.

According to Steinbach (1922), Ruge (1914) believed that the chondro-epitrochlearis is homologous to the panniculus carnosus of most mammals. This idea cannot be disproved but it does not explain why the insertion of the muscle should shift from the undersurface of the skin to the medial epicondyle. Steinbach’s own explanation is far more obvious and likely.

In most mammals, the pectoralis major inserts much farther down the humerus than it does in primates. An insertion as far down as the medial epicondyle is not uncommon (Fig. 3) and indeed, the insertion may extend to the deep fascia of the forearm (Steinbach, 1922, p. 504). The chondro-epitrochlearis is merely an atavistic anomaly demonstrating the extent of the insertion in ancestral forms.

In quadrupeds the pectoralis minor, or profundus, inserts largely on to the upper end of the humerus. When the insertion of this muscle migrated to the tip of the coracoid process in primates, a part of the pectoralis major, or superficialis, moved its insertion to the region formerly occupied by the minor. The pectoralis major fibres that inserted most distally (Figs. 2 and 3, X’) in quadrupeds, have, in primates, migrated up the humerus deep to the fibres that had inserted most proximally.
(Figs. 2 and 8, X). The migrant, \(X'\) fibres now reach the area formerly inserted upon by the pectoralis minor, high up on the humeral shaft, passing under the \(X\) fibres to reach the new high insertion. This migration has produced the characteristic twisted insertion of the pectoralis major in the primates (Harris 1939).

This author found progressively less twisting of the pectoralis major insertion in more and more primitive primates, and no twisting in most other orders of mammals. The partially untwisted insertion of the pectoralis major found with a chondroepitrochlearis is obviously reminiscent of the primitive quadrupedal insertion.

![Diagram showing pectoralis muscles](image)

Fig. 3. Pectoralis muscles of the guinea pig (Cavia). The parts labelled \(A\) and \(B\) are the equivalents of the human pectoralis major, crossing the biceps to insert between it and the brachialis. \(C\) is the pectoralis minor. \(D\) probably does not exist in man. Compare positions of \(X\) and \(X'\) in Figs. 2 and 3.

The presence of a chondro-epitrochlearis and the absence of the pectoral tendon twist are not independent related events, but two aspects of the same event. The chondro-epitrochlearis consists of the caudalmost fibres of the pectoralis major inserting at their original site. These are the same fibres that normally (in man) curve under the rest of the muscle to insert high on the humerus. Obviously, they cannot insert at both these positions at once. A chondro-epitrochlearis must, therefore, invariably be accompanied by an untwisted pectoralis major insertion.

**SUMMARY**

The chondro-epitrochlearis is an atavistic anomaly duplicating the far distal insertion of the pectoralis major in quadrupeds. When this anomaly is present, the normal twisted insertion of the pectoralis major is always more or less straightened
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out. This is explained by the fact that the chondro-epitrochlearis is derived from the original inferior edge of the pectoralis major. Fibres from this region in man normally twist under the rest of the muscle to insert high on the humerus. If these fibres are attached to the medial epicondyle they cannot insert high up on the humerus to produce the usual twisted insertion.

I wish to thank Messrs John Schoentag, Eugene Mitchell and Jay Milne for preserving this anomaly for me on the cadaver they were dissecting, at some inconvenience to themselves.

REFERENCES


