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The Avian Fascia Pectoralis: Anatomy and Functional Implications

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With 2 Figures

Abstract

This paper presents a description of a heretofore unrecognized avian Fascia pectoralis, and offers a hypothesis that it functions to increase M. pectoralis volume by increasing the total area available for muscle origin.

Key words: Fascia, M. pectoralis

1. Introduction

The existence and importance of connective tissue (other than ligaments) in functional morphological studies is only recently being acknowledged (see HOMBERGER and MEYERS 1989), although it has long been of importance to veterinary and medical studies (see, for example, BANKS [1986], MILLER et al. [1964], ROMANES [1981]). HOMBERGER and MEYERS (1989) described numerous fasciae within the lingual apparatus of the chicken, and show the mechanical relevance of these connective tissue structures to the functioning of that system.

The avian shoulder girdle has been the subject of many anatomical studies (see GEORGE and BERGER [1966], RAIKOW [1985] for a review). More often than not, muscles and bones are emphasized in these works, although occasionally ligaments have been included (see SY 1936). Least mentioned (and hardly ever described) are fasciae, sheets of organized connective tissue which are usually removed to expose the orientation of muscle fibers.

2. Materials and Methods

Portions of the myology attaching to the pectoral girdle were examined in 14 specimens of the Domestic Pigeon (Columba livia), 3 specimens of the European Starling (Sturnus vulgaris), and 1 specimen each of American Robin (Turdus migratorius), Great-horned Owl (Bubo virginianus), and House Sparrow (Passer domesticus). Both fresh and preserved specimens were examined.

In one preserved starling, the connective tissue associated with M. pectoralis was digested with sodium hypochlorite (as per LOEB and GANS 1986), to determine if it was a site of muscle fiber origin (fascia) or tendinous fibers of the muscle proper (aponeurosis); see BANKS (1986), HOMBERGER and MEYERS (1989).

Nomenclature is from Nomina Anatomica Avium (BAUMEL 1979; VANDEN BERGE 1979) whenever possible.
3. Observations

Examination of M. pectoralis revealed the existence of a fascia over the ventro-medial surface of the muscle in all specimens examined (Fig. 1). The connective tissue initially appeared to be superficial tendinous fibers, but after digestion with sodium hypochlorite (as per LOEB and GANS 1986), it became apparent that this was a fascia (not an aponeurosis) and that the ventro-medial fibers of M. pectoralis arise from its dorsal surface (Figs. 1, 2C).

The Fascia pectoralis (named here for the first time) lies laterally to the carina sterni (sternal keel), to which it is anchored. It extends laterally from the carina about 5 mm in the starling and 10 mm in the pigeon (Fig. 1). The lateral border of the Fascia pectoralis is anchored to the epimysium of M. pectoralis and runs roughly parallel to the carina throughout the mid-part of M. pectoralis. Cranially and caudally, the Fascia pectoralis curves laterally (Fig. 1). The Fascia pectoralis is very thin and arising fascicles of M. pectoralis are visible through it (Fig. 1). Very little variation was observed within the species examined.

4. Discussion

Based on my observations, I suggest that the origin of M. pectoralis from the Fascia pectoralis provides an increase in the area available for muscle attachment beyond that which could be accomodated by the sternal keel alone (Fig. 2A, C). Since the force a muscle can exert is partly a result of its physiological cross-sectional area (GANS 1982), the extension of the origin of M. pectoralis onto a fascia may be a means of increasing overall muscle volume (and cross-sectional area), and thus force. The narrow width of the Fascia pectoralis may represent a compromise between maintaining the movement of the muscle (some stretch being inherent).

An analogous situation involving M. temporalis fascia (Fascia temporalis) extended (FURBRINGER 1969). The Fascia temporalis, in addition to that provided by the extensor, provides a site for muscle attachment as the muscle contracts out.

This is presumably the case for Fascia pectoralis. A survey of the literature indicates that studies have overlooked the association of this fascia. FURBRINGER (1969) described fascia along the ventro-medial surface of M. anser (Herring), and listed various musculature of Murre (Uria aalge) as being attached from the anterior 2/3 of the sternum (FURBRINGER 1984) also referred to a midventral fascia, which fibers of M. pectoralis are continuous and some gulls (FURBRINGER 1902; GEORGANTOPOULOS 1982).

Fig. 2. Diagrammatic cross-sections of M. pectoralis origins. A. From sternal keel alone. B. From keel and midventral raphe (after description of Vanden Berge [1975]). C. From keel and Fascia pectoralis. c coracoid; f Fascia pectoralis; h humerus; p M. pectoralis; r raphe; st sternum; su M. supracoracoideus.

compromise between maximizing the area for muscle attachment and minimizing the movement of the muscle’s fascial origin towards the insertion on the humerus (some stretch being inherent in connective tissue).

An analogous situation to the avian Fascia pectoralis has been reported involving M. temporalis of the opossum (Didelphis marsupialis), in which a fascia (Fascia temporalis) extends from the sagittal crest of the skull (Hiiemae and Jenkins 1969). The Fascia temporalis provides an additional area for fiber attachment in addition to that provided by the sagittal crest. The flexible connective tissue provides a site for muscle origin, but in contrast to bone, accommodates bulging as the muscle contracts (Hiiemae and Jenkins 1969).

This is presumably the first description and functional interpretation of the Fascia pectoralis. A survey of the avian morphology literature indicates that most studies have overlooked this structure. A few authors, however, have mentioned this fascia. Fürbringer (1902) illustrated and labelled (his Figure 206) a fascia along the ventro-medial surface of M. pectoralis of the Greylag Goose (Anser anser), and listed various species and taxa which possess this fascia. Stettenheim (1959) illustrated and indicated part of the origin of M. pectoralis of the Common Murre (Uria aalge) as being from the dorsal surface of an “aponeurosis” arising from the anterior 2/3 of the ventral border of the sternal keel. Zusi and Bentz (1984) also referred to a ventral, superficial “aponeurosis” that arises from the ventral edge of the sternal keel in a hummingbird (Eulampis jugularis), from which fibers of M. pectoralis take origin. In some species (loons, grebes, ducks, tinamous, and some gallinaceous birds), the left and right Mm. pectoralis arise from a midventral raphe extending ventrally from the sternal carina [(Fig. 2B); (Fürbringer 1902; George and Berger 1966; Raikow 1985; Vanden Berge 1975)].
1975)]. Although no functional interpretation was provided for this construction either, the raphe does represent an alternative means by which to increase the volume of M. pectoralis.

This study offers an example of functionally-neglected connective tissue structure and suggests a testable hypothesis of its function.

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