

GROSS ANATOMICAL STUDY OF PECTORAL GIRDLE OF SMALL INDIAN KITE (*MILVUS MIGRANS GOVINDA*)

Aarti Sharma¹ and S. C. Dubal²

Department of Anatomy and Histology, College of Veterinary Science and Animal Husbandry
Anand Agricultural University, Anand-388 110, Gujarat, India

ABSTRACT

Received Revised on: 21.09.2017

Accepted on: 21.02.2018

The skeleton of the pectoral girdle consisted of scapula, coracoid and clavicle as other birds. The scapula was a short, pneumatic and sword shaped as domestic fowl but, coracoid and clavicle had peculiar unique characteristic. The coracoid had hook like proximal extremity, a small foramen and scapular process. Clavicles were flat, which formed 'U' shaped furculum with rudimentary Hypocleidium.

Key words: Clavicle, coracoid, Pariah kite, pectoral girdle, scapula, small Indian kite

Introduction

The small Indian kite (*Milvus migrans govinda*) is a medium sized bird of prey or diurnal raptors. This species is recognized for its yellow cere (gap between two nostrils), yellow gape, long black talons and pale yellow legs. It was formerly known as Pariah kite. Population of raptors is declining worldwide and many species are threatened with extinction and scarification of small Indian kite is common for some mythological taboos, bones can be used as the evidence even after biological decomposition of a carcass. The present study showed the pectoral girdle of small Indian kite can be identified easily by observing peculiar gross structure of bones. The gross anatomy of bones of pectoral girdle of Small Indian kites was meagre in the available literature. Hence the research work was carried out on the pectoral girdle of the small Indian kites.

Materials and Methods

The present study was conducted on the six adult kites (*Milvus migrans govinda*) irrespective of sex. The carcasses were collected from the cadavers presented to the Bodakdev (Wildlife Care Centre) and Namoh Namoh Parivar, Ahmedabad with the permission of Chief Wildlife Warden, Gandhinagar, Gujarat. The carcasses were collected, biologically macerated, cleaned and finally bones were completely sun-dried. Bones were observed grossly, classified and bone-specific characteristics like trochanters, condyles, projections, depressions, crest, foramens, grooves, ridges, etc. were studied and noted.

The nomenclature has been adopted as per the description given by Nickel *et al.* (1977) and Baumel and Witmer (1993). The gross photography of an individual bone with various views, showing characteristics features were recorded.

Results and Discussion

The pectoral girdle of the Small Indian kite had three pairs of bones namely scapula, coracoid and clavicle (Fig.1) same as observed by Getty (1975) In the fowl, Nickle *et al.* (1977), King and McLelland (1984) and Beaufrère (2009) in fowl, pigeon and goose, Tomar *et al.* (2010) in the Pariah kite, Ghosh (2012) in the fowl and Indu *et al.* (2012) in the Green-winged macaw and the peahen.

Scapula

The scapula was a short, less curved, pneumatic and latero-medially flattened bone of the pectoral girdle, which resembled like a sword with sharp borders. It was located lateral and parallel to the vertebral column and its caudal extremity extended to about the cranio-lateral border of the ilium. The widest part of the scapula was about a quarter near the caudal extremity, known as blade of scapula (Fig. 2A). For the description, the scapula had two surfaces, two borders and two extremities. Similar findings were reported in fowl by Getty (1975) and King and McLelland (1984).

The costal (medial) surface was convex and smooth and it was in contact with the lateral surface of the ribs. The lateral surface was concave and tilted slight dorsally. Furthermore, it had a less developed scapular spine, which began near the caudal extremity (Fig. 2B). The dorsal border was convex and presented a sharp downward bend caudally while the ventral border was concave and less sharp than the dorsal border (Fig. 2A). The cranial (articular extremity) was thick and transversely wide, which was composed of an articular concavity laterally and an acromion process medially. The acromion process had an articular surface for the clavicle to form syndesmotomic scapulo-clavicular joint. The lateral articular surface, which with the articular surface of the coracoid completed the glenoid cavity for the head of the humerus. The coracoid process was in the form of a convex protuberance,

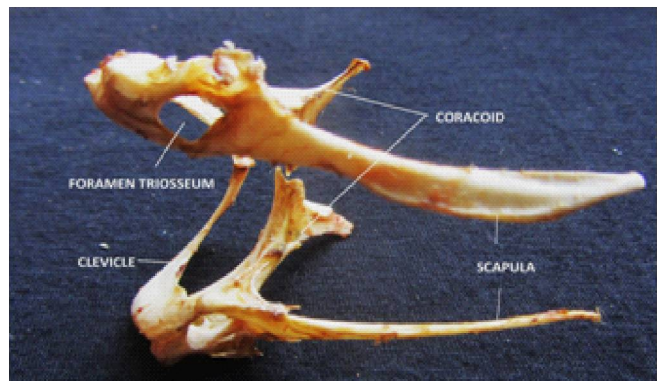


Fig. 1: Skeleton of the pectoral girdle, showing three pair of bones, forming foramen triosseum.

¹M.V.Sc Scholar and corresponding author, email: aartisharmavet@gmail.com

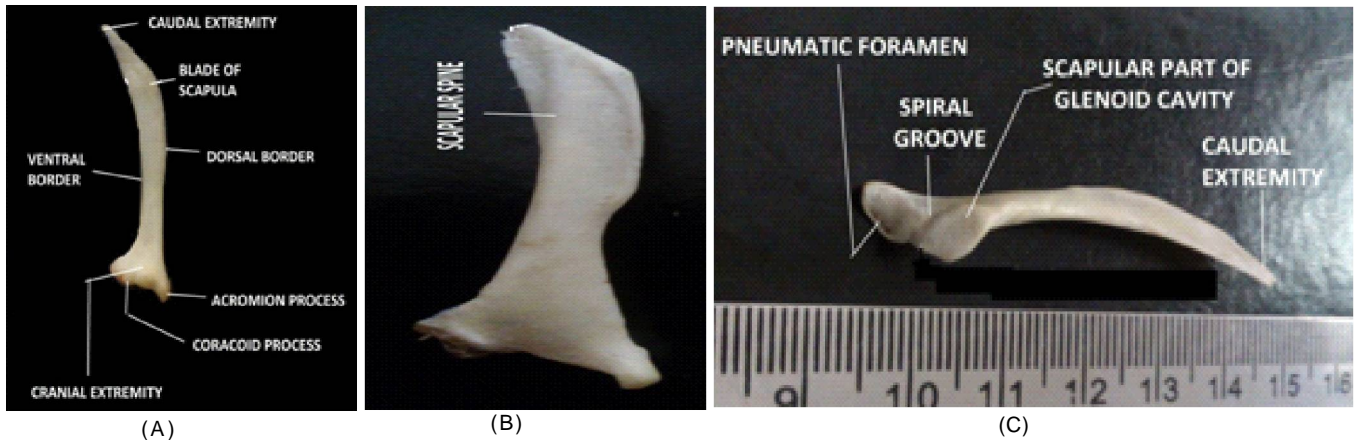


Fig. 2: The scapula of the Small Indian kite showing different structures of scapula (A) Medial surface (B) Lateral surface (C) Ventral view.

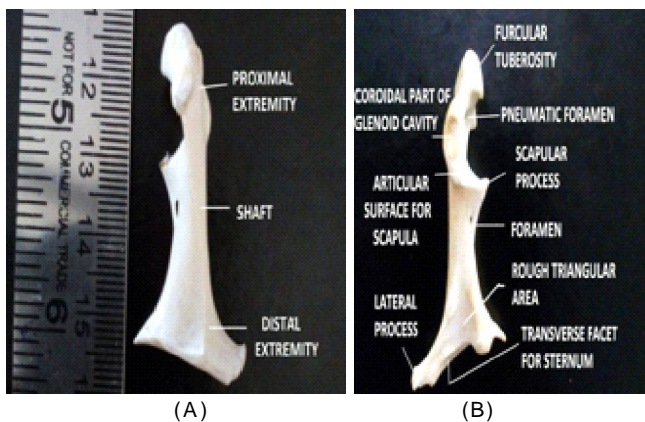


Fig. 3: The left coracoid of the Small Indian kite (A) Ventral view (B) Dorsal view

which separated by a shallow curved groove to acromion process and articulates with the coracoid to form the scapulo-coracoid joint. The acromion process had a pneumatic foramen (Fig. 2C).

The caudal extremity was narrow, pointed and non-articular end of scapula that reached up to the cranio-lateral border of the ilium. Similar findings were reported in pigeon, fowl, duck and goose by Nickle *et al.* (1977) and in Pariah kite by Tomar *et al.* (2010). The present observations are also similar to the observations of Indu *et al.* (2012) in Green-winged macaw and peahen except in shape of the coracoid process, which was flat in Green-winged macaw whereas, in kite it was a convex protuberance as in peahen. This difference in the shape of the coracoid process might be due to the contact with the well-developed scapular process in the coracoid of the Green-winged macaw, which was absent in the peahen and less developed in the Small Indian kite.

Coracoid

The coracoid was the strongest and the shortest bone of the pectoral girdle. It was directed obliquely caudo-ventrally and with distal extremity slightly mediad. It had two expanded extremities and a shaft (Fig. 3A). The proximal extremity was relatively hook-like and consisted of three distinct articular surfaces. The most proximal hook shaped process called as furcular tuberosity, had an articular surface on its medial aspect

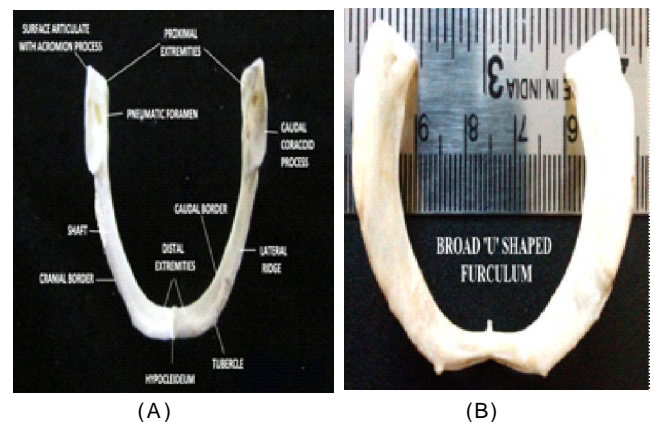


Fig. 4: The clavicle of the Small Indian kite (A) Caudal view (B) Cranial view

for the articulation with the articular surface of the clavicle to form syndesmotomic claviculo-coracoid joint. Furthermore, a larger and caudally directed concave articular surface completed the glenoid cavity with the help of the glenoid articular surface of the scapula (Fig. 3B). The caudo-medial smaller pointed scapular process was for the articulation with the scapula to form the scapulo-coracoid joint. Below the furcular tuberosity, there was a pneumatic foramen.

The distal extremity was spatula shaped, transversely wider than the proximal extremity and had a long transverse articular surface for the articulation with the sternum. There was a process laterally. The shaft was short and stout and compressed latero-medially. Near the distal extremity, there was a triangular rough area (Fig. 3B). Furthermore, a small foramen was present on the proximal one-third part of caudo-medial border of the bone below the scapular process (Fig. 3B). The width of the distal extremity was about twice the width of the proximal extremity.

The scapular process was also reported by Indu *et al.* (2012) in the Green-winged macaw and a tiny through and through perforation was reported by Tomar *et al.* (2010) in the Pariah kite. However, in contrary to the present finding, the presence of the scapular process was not described by Tomar *et al.* (2010) in the Pariah kite. The other general observations were similar to those reported by Getty (1975) in the fowl, Nickle *et al.* (1977) and King and McLelland (1984) in different birds,

Tomar *et al.* (2010) in the Pariah kite, Ghosh (2012) in the fowl and Indu *et al.* (2012) in the Green-winged macaw.

The present study showed that there are species variations in the structure of the coracoid. The scapular process and foramen were absent in the peahen and the domestic fowl but it were present in the Green-winged macaw. Furthermore, the shaft of the coracoid was more rounded and long in the fowl and the peahen than the kite. The variations in the morphology of the coracoid might be due to variation in the species of birds and flight habit.

Clavicle

It was a flat and the most cranial bone of the pectoral girdle, which directed vertically. For the description, it had a shaft and two extremities (Fig. 4A). The shaft was latero-medially flattened and strongly curved. For the description, the shaft had two surfaces and two borders. The cranial border was thick, blunt and strongly convex while the caudal border was thin, sharp and strongly concave. Furthermore, the cranial border below the middle had a small tubercle. The lateral surface had a longitudinal line near the cranial border, which originated near the caudal coracoid process, which terminated at the distal extremity. The medial surface was smooth and concave in both the directions (Fig. 4A).

The proximal extremity was broader than the distal extremity. Its cranial border was thick and rounded off while the caudal border was thin and sharp. The junction of the borders was pointed, which with the acromion process complete the foramen triosseum (syndesmotoc union). Furthermore, it had an articular surface for the coracoid, a caudal coracoid process which served for the syndesmotoc union with the furculum tuberosity of the coracoid (Fig 4A). The distal extremity was narrow and fused with the opposite bone and formed a broad and short 'U' shaped furculum (Fig. 4B). The junction was in the form of latero-medially flattened protuberance, situated caudally known as hypocleideum, which was not prominent in *Milvus migrans govinda* (Fig. 4A). The present study showed that there was species variation in the shape of the clavicles, the furculum and the hypocleideum. Getty (1975), Nickle *et al.* (1977), King and McLelland (1984) and Ghosh (2012) in the fowl and Indu *et al.* (2012) in the peahen observed thin rod shaped clavicles, which formed 'V' shaped furculum with prominent hypocleideum, as a sagittal bony plate while the Pariah kite had flat clavicles, which formed 'U' shaped furculum with rudimentary Hypocleidium. Nickle *et al.* (1977) in the pigeon reported narrow 'U' shaped furculum with less developed hypocleideum known as thoracic process. Indu *et al.* (2012) in the Green-winged macaw also reported narrow 'U' shaped furculum but hypocleideum was absent. Getty (1975) in the goose, Nickle *et al.* (1977) in the goose and the duck reported 'U' shaped furculum without hypocleideum. The difference in the shape of furcula and hypocleideum may be due to different flight habit in the mesozoic birds and Hui (2002) in different birds.

Broad and short 'U' shaped furculum of the Pariah kite indicated their soaring gliding flying habit as described by Hui (2002) in different birds. The lateral ridge was also reported by Nickle *et al.* (1977) in the goose and the duck. However, in contrary to the present finding, the presence of the tubercle on the cranial border, caudal coracoid process and lateral ridge were not described by Tomar *et al.* (2010) in Pariah kite. The other general observations are similar to those reported by Getty (1975) in the fowl, Nickle *et al.* (1977), King and McLelland (1984) and Beaufrière (2009) in different birds, Tomar *et al.* (2010) in the Pariah kite, Ghosh (2012) in the fowl and Indu *et al.* (2012) in the Green-winged macaw and the peahen.

Foramen triosseum

The foramen triosseum was almost spherical in shape, which was syndesmotoc union between the proximal extremities of all three bones of the pectoral girdle, namely acromion process of the scapula with the pointed end of clavicle medially, the furcular tuberosity of coracoid with the clavicle cranially and the coracoid with the scapula caudally (Fig. 1). The present observations are in accordance with the observations of Getty (1975) in the fowl, Nickle *et al.* (1977), King and McLelland (1984) and Beaufrière (2009) in different birds, Tomar *et al.* (2010) in the Pariah kite, Ghosh (2012) in the fowl and Indu *et al.* (2012) in the Green-winged macaw and the peahen.

References

- Baumel JJ and Witmer LM (1993) Handbook of avian anatomy: Nomina Anatomica Avium. 2nd ed. Publications of the Nuttall ornithological club, No. 23, Cambridge.
- Beaufrière H (2009) A review of biomechanic and aerodynamic considerations of the avian thoracic limb. *J. Avian Med. Surg.* **23**(3): 173-185.
- Getty R (1975) Sisson and Grossman's the Anatomy of the Domestic Animals. Vol II, 5th ed. W. B. Saunders Company, Philadelphia. pp. Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, R.S. Pura-181 102, Jammu and Kashmir, India 2095.
- Ghosh RK (2012) Osteology In: Primitive Veterinary Anatomy. 5th ed. Current Books International, Kolkata, pp. 16 and 81.
- Hui CA (2002) Avian furcula morphology may indicate relationships of flight requirements among birds. *J. Morphol.* **251**: 284-293.
- Indu VR, Lucy KM, Sreeranjini AR, Maya S, Ashok N and Syam KV (2012) A comparative study on the pectoral girdle of green-winged macaw and peahen. *J. Vet. Anim. Sci.* **43**: 56-58.
- King AS and McLelland J (1984) Birds: Their structure and function. 2nd ed. Bailliere Tindall, London, pp. 59-60.
- Nickle R, Schummer A and Seiferle E (1977) Anatomy of the domestic birds. 1st ed., Berlin, Hamburg, Verlag Paul Parey, pp. 14-15.
- Tomar MPS, Vaish R, Rajput N and Shrivastav AB (2010) Gross morphometrical studies on pectoral girdle of Pariah kite (*Milvus migrans*). *Journal of Animal and Veterinary Advances*, **9** (19): 2482-2484.