GROSS ANATOMICAL STUDIES ON THE STERNUM AND CLAVICLE OF SPOT-BILLED PELICAN (PELECANUS PHILIPPENSIS)

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The sternum of Spot-billed pelican was large, broad and quadrilateral in shape. The sternal crest was small, triangular in shape and extended up to cranial half of the ventral surface only. The cranial border of the sternal crest was straight, and extended beyond the cranial border of the sternum. The hypocleidium was fused to the ventral part of the cranial border of the sternal crest permanently. The cranial border presented a deep groove in the centre and narrow grooves on either side for coracoid bones. The sternal spine extended only from the ventral edge of the groove of the cranial border. The craniolateral processes were short. The lateral borders had five articular cylinders for sternocostal bones. Numerous pneumatic foramina were present between the articular cylinders. The caudolateral processes were short. The caudal border presented a short process in the centre. The clavicles were fused to the cranial border of the sternal crest.

Key words: Spot-billed pelican, Sternum, Clavicle

Pelicans are large waterbirds, with long, straight bills and extensible throat pouches (Perrins, 1990). They belong to the order Pelecaniformes, family Pelecanidae and genus Pelecanus (Likoff, 2007). Three species of pelicans are found in India. They are Grey pelican (Pelecanus philippensis), Dalmatian pelican (Pelecanus crispus) and Rosy pelican (Pelecanus onocrotalus) (Cheeran, 2008). The sternum is a large unsegmented bone, which, forms a considerable part of the ventral body wall. It gives attachment to the flight muscles (Dyce et al., 1996). The present study of gross anatomy on sternum was undertaken because the information available is inadequate.

Four Spot-billed pelicans, brought to the Zoo Veterinary Hospital, Arignar Anna Zoological Park, Vandalur, for post-mortem examination were utilized for the present study. After post-mortem examination the specimens were biologically macerated, cleaned, dried and utilized for gross anatomical studies.

The sternum of the Spot-billed pelican was large, broad and quadrilateral in shape. It was highly concave dorsally and convex ventrally (Fig.1,2) as observed by Nickel et al. (1977) in duck and goose. But in the case of chicken, the sternum is relatively long and narrow (Dyce et al., 1996). The sternal crest was present along the midline of the ventral surface of the sternum. It was triangular in shape when viewed laterally and small and extended only up to the cranial half and caudal to this the ventral surface was free (Fig.2). It is in agreement with the observations of Kaiser (2007) in pelicans and frigate birds. In case of ratites like emu and ostrich the...
A sternal crest is absent (Sathyamoorthy and Geetha Ramesh, 2006). In the present study also it was observed that a low ridges were present on the ventral surface.

The cranial border of the sternal crest was straight and sharp (Fig.3), as in duck and goose, but it is concave in fowl and pigeons (Nickel et al., 1977). In the present study it was noticed that, the ventral border of the sternal crest was thick and triangular cranially, thin in the centre, and thicker and slightly convex caudally (Fig.2). It also extended beyond the cranial border of the sternum (Fig.3). Nickel et al. (1977) noticed that, in fowl the sternal crest does not extend to the cranial border of the sternum.

The most characteristic feature of the sternum of the pelican was, the hypocleidium of the clavicle fused to the ventral part of the cranial border of the sternal crest permanently (Fig.3). It is in agreement with observations of Nelson (2005) and Kaiser (2007) in pelicans and frigatebirds. They opined that the fusion makes the pectoral girdle more rigid, which facilitates soaring with relatively small breast muscles. But, in the case of domestic birds they are separate and the hypocleidium is connected to the sternal crest by a membrane (Nickel et al., 1977).

The cranial border of the sternum was convex and thick in the centre, but thin and sharp laterally. A deep groove was present in the centre of the cranial border. On either side of the central groove, narrow grooves with sharp edges, for the distal end of the coracoid bones were present (Fig.4). This is in agreement with the observations of Nickel et al. (1977) in domestic birds. In the present study it was also observed that, on either side of the central groove a rounded, wide and convex articular area extending up to the dorsal border was noticed.

The sternal spine, a thick, triangular process with sharp edges, extended only from the ventral edge of the groove of the cranial border (Fig.4). It's ventral border was continuous with the cranial border of the sternal crest. It's dorsal surface was continuous with the central groove and was broad behind and narrow in front and was sloping downwards. It had openings on either side near ventral border. But in the fowl, two processes arise from the dorsal and ventral edges of the groove which fuse into a median vertical plate leaving an opening between them. In the pigeon they remain separate, while in the duck and goose only the ventral process is present (Nickel et al., 1977).

On either side of the cranial border, a short, flat, triangular dorsolaterally directed craniolateral process was present (Fig.1). This process is very large in the fowl, very short in the pigeon and small in the duck and goose (Nickel et al., 1977). The lateral borders present five thin and short articular cylinders for the sternocostal bones (Fig.4). Between each pair, there were numerous pneumatic foramina present, which lead into the sternum. Pneumatic foramina were also present behind the cranial border, in the centre of dorsal surface and also near the lateral border in the cranial half (Fig.1). At the caudal end on each side of the caudal border, a short laterally directed caudolateral process was present (Fig.1). In the fowl, the caudolateral process was very long and narrow, but in the pigeon it was short and fused with the caudal border of the sternum (Nickel et al., 1977). The thoracic process present in the chicken and pigeon was absent in the pelican, as in the case of goose (Nickel et al., 1977). The caudal border of the sternum was triangular, thick and sharp and present a short process at the centre (Fig.1). But in the case of chicken the caudal part of the sternum is highly elongated (Nickel et al., 1977).
The clavicles were completely fused to the anterior border of the ventral end of the sternal crest. The clavicles were bent and curved laterally, cranially, dorsally and at the end slightly caudally. They joined in an open angle. Ventral end was thick, and was thin in the middle and gradually expanded and was thickest dorsally. The dorsal and lateral borders of the clavicles had ridges. The expanded dorsal ends were irregularly triangular. Its lateral and medial surfaces were concave and present a ridge laterally. The caudal border of the dorsal end had a sharp ridge medially, a groove in the centre and pneumatic foramina, and the lateral border was thick (Fig.3). Kaiser (2007) opined that the greatly inflated clavicles and sternum may play an important role in heat regulation. Excess heat generated by the flight muscles is radiated into the hollow core of the bones and passed out of the body with the exhaled air.

REFERENCES


Fig. 1: Photograph showing dorsal view of the sternum of Spot-billed pelican

Fig. 2: Photograph showing ventral view of the sternum of Spot-billed pelican
Fig. 3: Photograph showing dorsolateral view of the sternum of Spot-billed pelican