Gross anatomical features of the sternum of green-winged macaw (Ara Chloroptera)

A.R. Sreeranjini*, N. Ashok, V.R. Indu, K.M. Lucy, S. Maya† and J.J. Chungath†

Department of Veterinary Anatomy and Histology, College of Veterinary and Animal Sciences, Mannuthy, Thrissur- 680 651, India.

Received: 15-02-2015  Accepted: 12-10-2015  DOI: 10.18805/ijar.7051

ABSTRACT

The present study was conducted on the sternum of an eight year old, male Green-winged Macaw. The sternum was quadrilateral with dorsal concave and ventral convex surfaces and four borders. The dorsal surface presented numerous pneumatic foramina. The ventral surface furnished a large, boat shaped keel. The anterior extremity showed two facets for coracoid. The anterior and posterior borders were convex. The lateral border on either side presented six costal facets. Two distinct oval foramina were seen near the posterior border. Craniolateral processes were short and stump-like. Caudolateral processes fused with the median trabecula on either side. The rostrum was distinct. The morphological features of the sternum of Green-winged Macaw conformed to that of flying group of birds. It was almost similar to that of goose in its anterior half and to that of pigeon in its posterior half.

Key words: Ara chloroptera, Green-winged Macaw, Gross anatomy, Keel, Sternum.

INTRODUCTION

The sternum or breast bone is a single flat bone forming the ventral aspect of thoracic and part of abdominal cavities. Depending upon the presence or absence of a well-developed keel on the sternum, birds are referred to as ‘carinates’ and ‘ratites’ (Mc Lelland, 1990). Anterior end of the sternum articulates with coracoid bone and lateral borders with sternal ribs. It is attached to clavicle by hypocleidial ligament and its body supports viscera. Caudal end of the sternum is cartilaginous in young birds and hence, its flexibility is an indicator of age (Dyce et al., 1996). The anatomy of sternum varies in birds according to their habits, especially flying ability.

Green-winged Macaw is the second largest type of parrot. They are seen in the forests of central and South America. They are one among the most docile macaws and are called as “gentle giant”. Their gentle, affectionate, inquisitive and intelligent nature makes them a superb family pet. They are considered to be the most intelligent of the macaws. Their number is decreasing in recent years due to habitat loss and illegal capture for parrot trade. Several studies have been conducted on the sternum of coturnix quail (Fitzgerald, 1969), chicken, duck and goose (Nickel et al., 1977), bald ibis (Nejdet et al., 2002), emu (Jagapathi et al., 2007), ostrich (Predoi et al., 2009) and pariah kite (Tomar et al., 2011). Jagapathi et al. (2007) reported that in emu, the sternum was large and bowl shaped. Anterior two third of the dorsal (visceral) surface presented numerous pneumatic foramina (Fig.1A) and hence, the sternum was lighter than that of fowl. Among the foramina, three near the anterior border were prominent. Nickel et al., (1977) observed the presence of a single large pneumatic foramen behind the cranial border of sternum in domestic fowl. Hogg (1984) reported that the sternum had a very low incidence of pneumatisation in the adult domestic

*Corresponding author’s e-mail: sreeranjiniar@yahoo.com; †Department of Veterinary Anatomy and Histology, College of Veterinary and Animal Sciences, Pookode, Wayanad, Kerala-673 756, India.
Nejdet et al. (2002) observed 15-20 pneumatic pores on the visceral surface of sternum in bald ibis. Pneumatic foramina communicate with clavicular air sac and help to lower the wing load without loss of strength. The ventral surface presented a large, boat shaped keel along its median line. The anterior extremity of this surface showed two rough, transverse facets for coracoid, guided by dorsal and ventral lips.

The anterior border was thick and convex similar to duck and goose (Nickel et al., 1977). In domestic fowl, pigeon and Pariah Kite (Tomar et al., 2011) it is triangular. The facets for coracoid were located immediately below the anterior border. The lateral border on either side presented six articular facets for sternal ribs. This border was concave with almost double the length than that of fowl. Between each facet, fossa containing pneumatic foramina was present as in fowl. The sternum of goose bears 6-7 facets and that of ostrich and rhea contains six and four facets respectively (Predoi et al., 2009). At the junction of anterior and lateral border on either side, a short, stump-like craniolateral process was noticed. In fowl the process is very large, in pigeon very short and in duck and goose small (Nickel et al., 1977). Craniolateral processes in emu were short, wide and flattened (Jagapathi et al., 2007). The posterior border was convex (Fig.1B) and caudolateral processes fused with the median trabecula on either side. However, two hook-like projections directed anteriorly from caudolateral processes in pigeon were not observed in macaw. Caudolateral processes were absent in the sternum of emu (Jagapathi et al., 2007) and pariah kite (Tomar et al., 2011). Two distinct oval foramina were seen near the posterior border as in pigeon (Fig.1A). Instead of distinct foramina, notches are present in coturnix quail (Fitzgerald, 1969) and in fowl, duck and goose (Nickel et al., 1977) due to the presence of long caudolateral processes. These notches are closed in life by fibrous membranes to strengthen the body wall.

Rostrum: The hook-like rostrum (manubrium/ sternal spine) in macaw was stronger, taller and wider than that in fowl. Tomar et al. (2011) reported that the sternum of pariah kite is devoid of rostrum. In macaw, it was located just below the anterior border of the body of the sternum. But in fowl, the rostrum projects as a continuation of the dorsal surface of the body of the sternum. In macaw it projected above the anterior border (8mm) where as in fowl it was almost in level with the anterior border. The transverse foramen present in the rostrum of fowl could not be observed in macaw. The sternoclavicular membrane which holds the sternum, coracoid and clavicle together, originates from the rostrum. A stronger rostrum in macaw is indicative of a better developed sternoclavicular membrane.

Keel: The sternum presented a well-developed keel, located along the ventro-median aspect of the body of sternum (Fig.1C). It was boat shaped with height decreasing cranio-caudally as in fowl, pigeon and Pariah Kite. But, Powlesland et al. (2006) noted that there was marked reduction in the
keel in kakapo, a large parrot. The anterior end of the keel formed the anterior most part of the sternum. But in fowl, the tip of craniolateral processes formed the anterior most part of the sternum. This part was dorsally concave and ventrally convex in macaw. It is concave in fowl and pigeon and straight in duck and goose (Nickel et al., 1977). The ventral border of keel in macaw was in the form of a steep, caudally directed arch as in pigeon. In fowl, duck and goose, it is slightly concave (Nickel et al., 1977). According to Mc Lelland (1990), keel is prominent in birds with well developed powers of flight and it gives attachment to the two important flight muscles namely pectoral and supracoracoideus. So, the extent of development of the keel bears direct relation with the extent to which a bird moves its wings, whether in flight or in swimming. Birds that fly by stroke of wings have large breast muscles and correspondingly large sternum. Birds requiring greater muscle power to take off quickly or to fly at low speeds have large keels. Duzler et al. (2006) observed that the width of the sternum and the height of the sternum were approximately equal in flying birds. According to them, the ratio of height and width of the sternum in flying group of birds is 0.96 to 1.35mm. In the present study, the above ratio was found to be 1.11mm (42mm/38mm). It can be concluded that in overall appearance, the sternum of Green-winged Macaw was almost similar to that of goose in its anterior half; to that of pigeon in its posterior half and it showed the morphological features of flying group of birds.

REFERENCES