COMPARATIVE MORPHOLOGY OF THE ATLAS AND AXIS OF GREEN-WINGED MACAW *(Ara Chloroptera*) AND DOMESTIC FOWL

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Abstract

The present study was conducted on the atlas and axis of an eight year old, male Green-winged Macaw, brought for post mortem examination to the Department of Veterinary Pathology at the College of Veterinary and Animal Sciences, Mannuthy, Thrissur. The atlas was ring shaped and presented dorsal and ventral arches. The dorsal arch was convex transversely and enclosed a large, transversely ovoid, vertebral foramen between the two arches. Caudal part of dorsal arch articulated with the cranial articular processes of the axis. The ventral arch presented cranial and caudal articular surfaces and a ventral crest. The cranial articular socket that articulated with the occipital condyle was a more distinct glenoid cavity. The axis articulated with atlas through a foramen seen dorsal to the articular socket. The caudal articular surface of ventral arch presented a convex semicircular articular facet ventrally and a perforated, concave area dorsally for dens. A well developed ventral crest pointed caudo-ventrally from the ventral arch. The axis was shorter and contained a body and dorsal arch. The dorsal arch presented a well developed dorsal spinous process. Cranial articular process was indistinct whereas the caudal articular process was large, prismatic and pointed. The dens of axis was short and stump and articulated through the foramen seen in the ventral arch of atlas. The body presented an articular fovea caudally that articulated with the body of third cervical vertebra. Ventral to cranial articular processes on either side, foramen transversarium was noticed. Ventral surface of the body of axis furnished a distinct ventral crest. So, the atlas and axis of Green-winged macaw showed morphological features that allowed free rotation of the neck without causing damage of the delicate blood vessels of head and neck.

Key words: Morphology, gross anatomy, atlas, axis, Green-winged macaw

The neck of birds helps to perform various functions like prehension, head balancing during locomotion, orientation, preening, display, etc. The number of cervical vertebrae in birds is highly variable (9–11 in parrots, 23–25 in swans). Size, morphology and number of vertebrae are three important variables involved in the motion of the neck (Tambussi, *et al.,* 2012).

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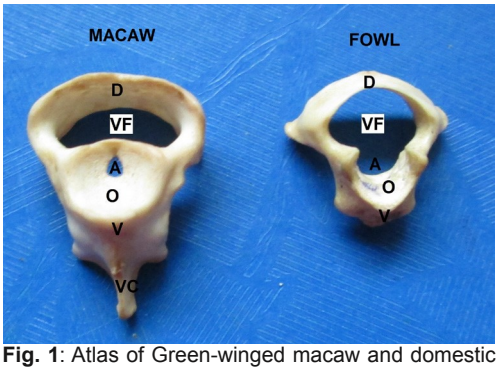

Fig. 1: Atlas of Green-winged macaw and domestic fowl– Cranial view

D- Dorsal arch, V- Ventral arch, VF- Vertebral foramen, VC- Ventral crest, O- Articular socket for occipital condyle, A- Articular area for dens of axis

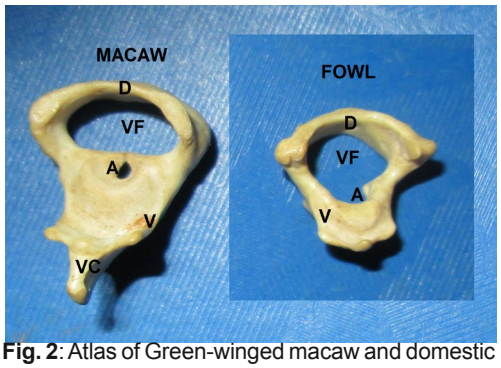

Fig. 2: Atlas of Green-winged macaw and domestic fowl– Caudal view

D- Dorsal arch, V- Ventral arch, VF- Vertebral foramen, VC- Ventral crest, A- Articular area for dens of axis

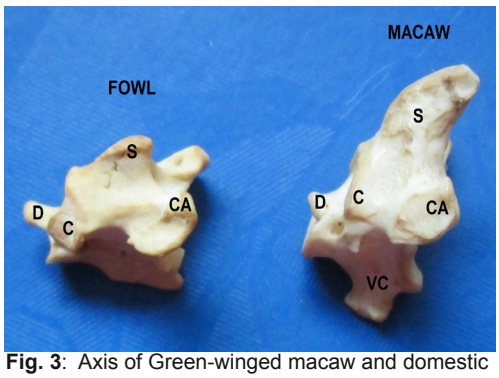

Fig. 3: Axis of Green-winged macaw and domestic fowl–Lateral view

D-Dens, C-Cranial articular process, CA-Caudal articular process, S- Spinous process, VC-Ventral crest

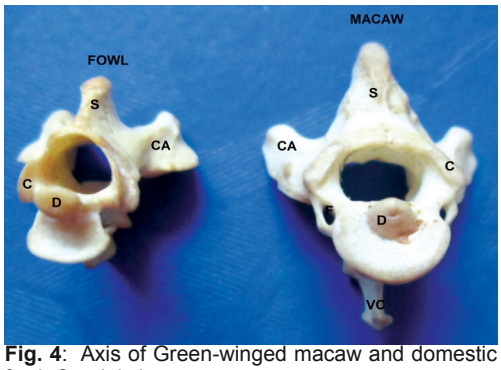

Fig. 4: Axis of Green-winged macaw and domestic fowl–Cranial view

D-Dens, C-Cranial articular process, CA-Caudal articular process, S- Spinous process, VC-Ventral crest, F-Foramen transversarium

According to Van Der Leeuw *et al.* (2001) the difference between chicken and ducks in movement pattern of neck, results from both a difference in the control system of the neck, and a difference in the anatomy. In the present study, the morphological features of the atlas and axis of an eight year old male Green-winged Macaw was noted and was compared with that of domestic fowl.

Materials and Methods

The present study was conducted on the atlas and axis of an eight year old male Green-winged Macaw, brought for post mortem to the Department of Pathology at the College of Veterinary & Animal Sciences, Mannuthy, Thrissur. The bones were cleaned and examined for studying the morphological features and were compared with that of domestic fowl.

Results and Discussion

The atlas was an atypical, ring shaped vertebra with a dorsal arch and a ventral arch as reported by Nickel *et al.* (1977) in the domestic fowl. The dorsal arch was convex transversely, but was less convex and wider than that in fowl. The large vertebral foramen between the dorsal and ventral arch was large and transversely ovoid (Fig.1). The ventral arch presented cranial and caudal articular surfaces and a ventral crest. The articular surface seen on the cranial side of ventral arch that articulated with the single occipital condyle was a large and more distinct glenoid cavity. The atlanto-occipital joint is exceptionally mobile and allows the beak to be used for a wide variety of tasks (Mc Lelland, 1990). Bitoiu *et al.* (2011) observed that the glenoid cavity that articulated with the occipital condyle in Common Buzzard was half moon shaped. Dorsal to the articular socket for occipital condyle, the atlas of fowl presented a depression for the dens of axis. But in macaw, instead of depression, the axis articulated through a foramen seen dorsal to the articular socket.

Caudal part of dorsal arch that articulated with the cranial articular processes of the axis did not present the lateral processes seen in fowl. The caudal articular surface of ventral arch presented a convex semicircular articular facet ventrally which articulated with the concave articular fovea ventral to dens and a perforated concave area dorsally that articulated with the dens (Fig. 2). This surface was wider, deeper and more extensive in macaw than that in fowl. Unlike in fowl, the ventral arch in macaw furnished a well developed ventral crest that pointed caudo-ventrally.

The axis was shorter than that in fowl and contained a body and dorsal arch (Fig. 3). The dorsal arch presented a dorsal spinous process that was well developed as in duck and goose (Nickel *et al.,* 1977). The cranial articular process was flat and not well developed whereas in fowl it was distinct. This feature allowed easy rotation of axis around atlas. The caudal articular process was large, prismatic and pointed caudo-dorsally whereas it was quadrilateral in fowl. They furnished facets ventrally which articulated with cranial articular processes of third cervical vertebra. The dens of axis was short and stump than that in fowl and articulated through the foramen seen in the ventral arch of atlas. The body presented an articular fovea caudally that articulated with cranial surface of the body of third cervical vertebra. Ventral to cranial articular processes on either side, foramen transversarium which conducted vertebral artery, vein and nerves was noticed instead of grooves in fowl (Fig. 4). The extra space in the transverse foraminae, as the holes surrounding the vertebral arteries creates a set of cushioning air pockets that allow the artery to move around when twisted (John Hopkins Medicine, 2013). Ventral surface of the body furnished a distinct ventral crest which was taller than that in fowl (Fig. 3). Bitoiu *et al.* (2011) reported the presence of a ventral spine of 2 mm length in the axis of Common Buzzard. In nutshell, the atlas and axis of Green-winged macaw showed morphological features that allowed free rotation of the neck without causing damage of the delicate blood vessels of head and neck.

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