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Research Article

Anatomical Studies of Axis (C2) in Ox and its Comparison with the Similar Bone in Horse, Dog, Sheep and Goat

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Abstract

The axis (C2) vertebra was observed in ox and compared it with the similar bone in different species of animals as to Horse, Dog, Sheep and Goat. The axis of ox was positioning cranially with spout like odontoid process which called as the dens. It was projected from the body. Due to its tooth like process, it was also known as vertebra dentata. The blade like supraspinous cranial process had increasing height and thickness towards its caudal progression, however, its infraspinous process was observed as the median ridge. In horses, the axis had longer body than the ox. The dens was conical and narrow. Cranially the undulated saddle shaped articular area was observed. The dorsal spine was more massive but it was dividing into two ridges that terminating at the posterior articular processes. The ventral articular surface of the dens had merging with cranial articular surface. The axis of dog had cylindrical longer dens. Large and heightened spine as the pendant was observed, which was terminating caudally by the tuberosity of two crests. The axis of sheep had small, blunt and convex dorsal spinous process without remarkable ventral spine. The axis of goat had thin and heighted dorsal spinous process that overlaps the adjacent cranial and caudal cervical vertebrae.

Keywords: *Anatomy; Axis; Epistropheus; Ox; Horse; Dog; Sheep; Goat*

Introduction

The C2 vertebra is popularly known as the axis. The anatomical description of the same in Ox is well placed on record but its comparison with different species of animals as to Horse, Dog, Sheep and Goat is meagerly documented. This tooth like projected process from the body is also known as vertebra dentata. Therefore, this study of comparative anatomy is specifically undertaken for the axis of Ox with Horse, Dog, Sheep and Goat.

Materials and Methods

The cadavers of different animal species were processed after proper maceration, cleaning, drying and disinfection with the help of hot air oven. Six each dried samples of second cervical vertebrae viz. axis from every mentioned species were chosen for present anatomical studies. These different species of animals were including ox (*Bos indicus*), horse (*Equus ferus*), dog (*Canidae canis*), sheep (*Ovis aries*) and goat (*Capra hircus*). The anatomical studies of axis in ox were explored in comparison with the similar bone of other species. This study

was the part of revolving fund project for articulation of bones to have the skeletons of different animals and thereby supplies the same to other educational institutions as the study material.

Results and Discussion

Axis of Ox

Axis (C2) of ox was identified as the longest and heaviest among all of the cervical vertebrae. It had spout like appearance named after odontoid process that was cranially projected from the body of axis (Figure 1). It was identical to the fovea dentis of atlas. Its cylindrical body (corpus vertebrae) carries a well developed ventral crest (crista ventralis). The cranial extremity of the body was characterised by a centrally located dens, which might be regarded as the displaced body of the atlas based on its development (Figure 2). The axis of Ox is also called vertebra dentata due to its tooth like process which named after dens. The dorsal surface of dens was deeply concave due to their either side elevation of lateral mass, which had rough surface for the attachment of ligaments that hold it in place. The ventral articular surface of the dens (facies articularis ventralis dentis) was confluented with the cranial articular surface (facies articularis cranialis) (Figure 3).

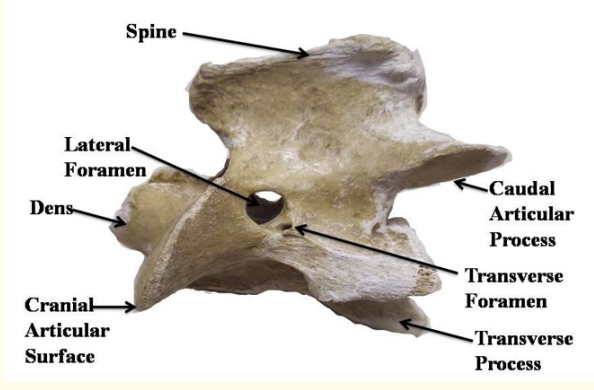

Figure 1: *Lateral view of axis bone of Ox.*

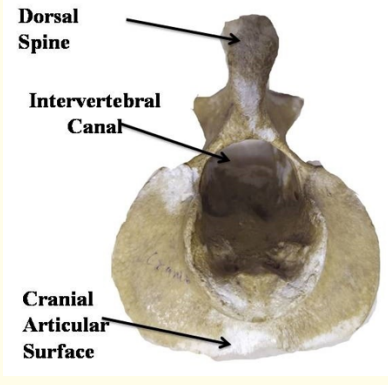

Figure 2: *Cranial view of axis bone of Ox.*

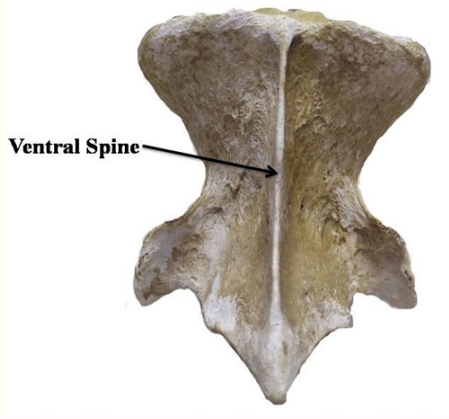

Figure 3: *Ventral view of axis bone of Ox.*

The lateral vertebral foramen was circular and discovered very much closer to the cranial border of the arch. The circular intervertebral foramen was positioned at the base of the transverse process. The transverse processes which were less pointed and smaller had a perforation toward their root by a transverse foramen in accommodating the vertebral artery, vein and nerve (Figure 1).

The blade resembling dorsal supraspinous process showed its increase in height and thickness towards caudal progression and terminated abruptly at the level of caudal articular surface that was looking as the tubercle (Figure 5 and 6). The infraspinous process was observed in the form of a median ridge (Figure 4). The present observations were corroborating as per the mentioning cited by Ghosh (2015).

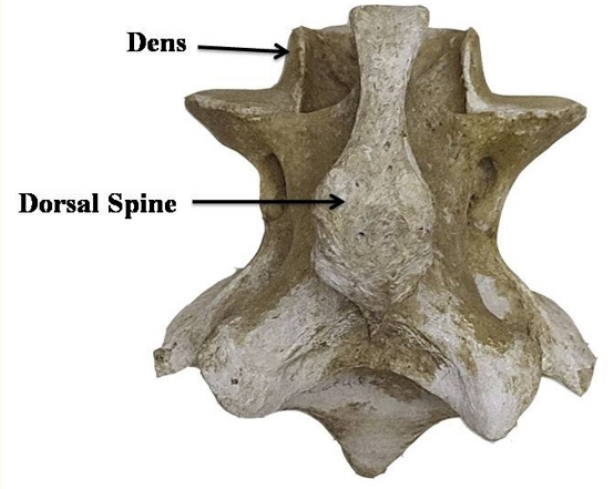

Figure 4: *Dorsal view of axis bone of Ox.*

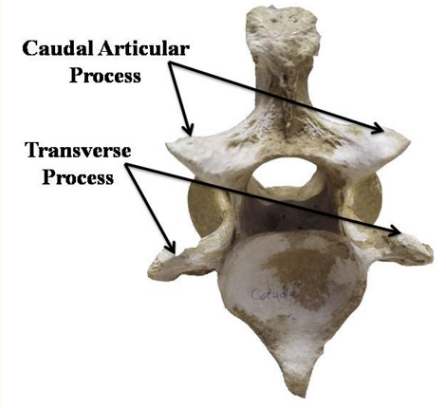

Figure 5: *Caudal view of axis bone of Ox.*

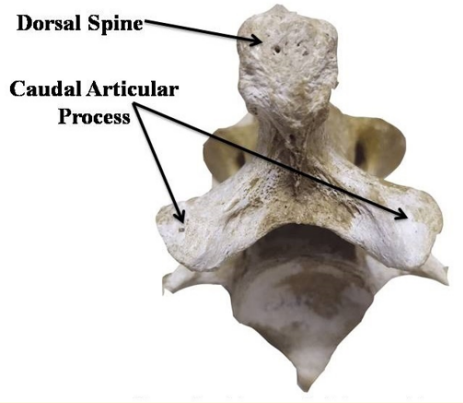

Figure 6: *Caudo-dorsal view of axis bone of Ox.*

Axis of horse

The body was longer in comparison with that of ox. The conical shaped dens was long, narrower and pointed. The cranial extremity had an undulated saddle shaped articular area. The archial border of dens had an either side foramen at its base that was known as the lateral foramen. The groove that extended ventrally and caudally from the lateral foramen was sufficiently showed the position of ventral branch of second cervical spinal nerve. The caudal border has the usual notches as per the illustrations revealed by Getty., *et al* [4]. The spine was more massive and dividing posteriorly into two ridges, which terminate on the posterior articular processes. The ventral articular surface of the dens (facies articularis ventralis dentis) was confluented with the cranial articular surfaces (facies articularis cranialis) as in the ox. The caudal extremity has also observed with usual shallow depression cavity. The ventral crest had a resemblance with that of typical vertebra as described by Getty., *et al* [4]. The ventral articular surface of the dens (facies articularis ventralis dentis) was also confluented with the cranial articular surface (facies articularis cranialis) similar to that of ox. The spine was continuous with caudal articulating surface (Figure 7). The oval shaped intervertebral foramen was observed with thinner transverse process [6].

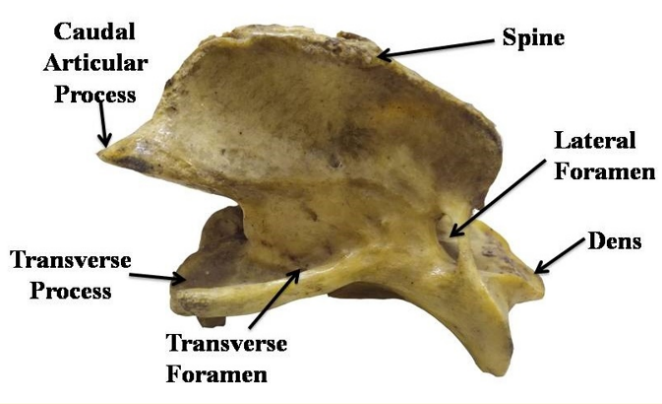

Figure 7: *Lateral view of axis bone of horse.*

Axis of dog

The cranial extremity of the axis was identified in the name of dens that was cylindrically rounded rod shaped longer structure. It had inclined little above in a way to be positioned almost upto the occipital bone. The margin of dens had a condyloid oblique area for cranial articulation. A largely heighted and notable sized spine was evident which was analogous to the dorsal arch of atlas which was identical to the pendant. It was projected cranially above the dens. The findings were not different than the findings mentioned by Bhattacharya., *et al* [1]. The spine was terminated caudally by the tuberosity, which had a connection of two crests with the posterior articular processes. The anterior notches were large. The caudal articulating surface was smooth and concave that was facing intervertebral disc. The transverse processes were pointed, directing backward and outward and had perforation by relatively large transverse foramen (Figure 8). The present revelations were very much similar as mentioned by Konig and Liebich [6].

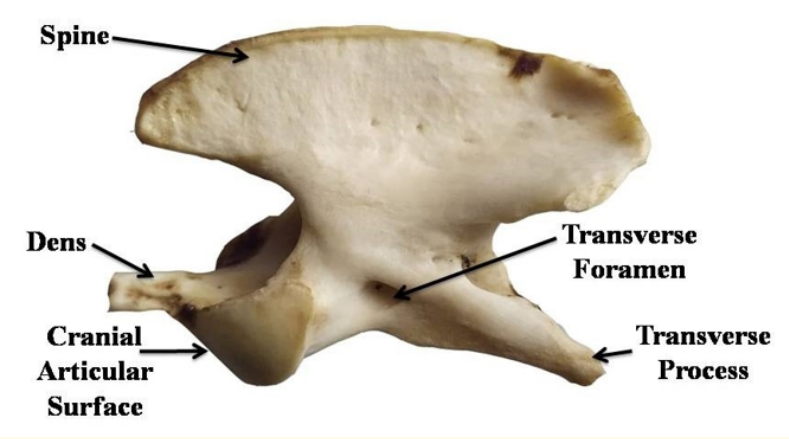

Figure 8: *Lateral view of axis bone of dog.*

Axis of sheep

The small spinous process of the axis was blunt and convex. The ventral spine was insignificant. The free end of transverse process was pointed to some extent. The dorsal spine was also comparative with the similar structure in ox but it was not finishing as the tubercle. The thickness of cranial and middle part of dorsal spine was almost same like ox, where the middle part of dorsal spine was thinner than cranial one. At ventral aspect, the posterior boarder of axis was roughly triangular in ox but no such structure was present in sheep and goat. In sheep, the caudal part of dorsal spine and the caudal articular process was very close to each other while in goat and ox they were far apart. Tubercle at posterio- ventral surface was rough and wider. The ventral surface of cranial articular ring had a deep notch. Transverse processes were smaller (Figure 9). The observations were comparable with the observations stated by Ghosh [5] in larger ruminants.

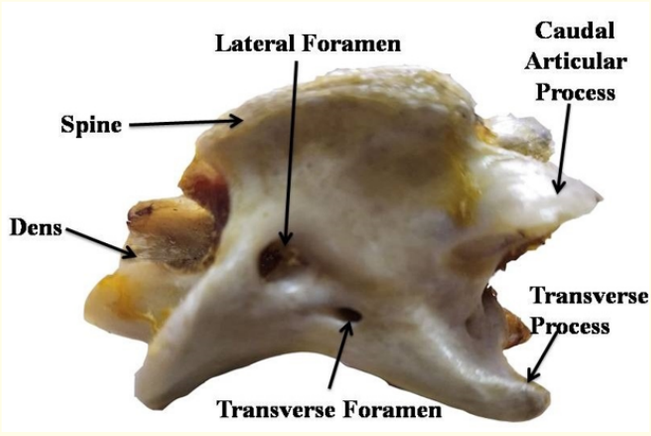

Figure 9: *Lateral view of axis bone of sheep.*

Axis of goat

The dorsal spinous process was thin and heightened rather than the sheep. It was observed over lapping the adjacent cranial and caudal cervical vertebrae. The large inter vertebral foramen was there but the transverse foramen was not observed. Tubercle at posterio-ventral surface was smooth and narrower. The ventral surface of cranial articular ring had a shallow notch. Transverse processes were long and reaching next cervical bone (Figure 10). The present mentionings were very much comparable with the revelations of the similar bone in larger ruminants by Ghosh [5].

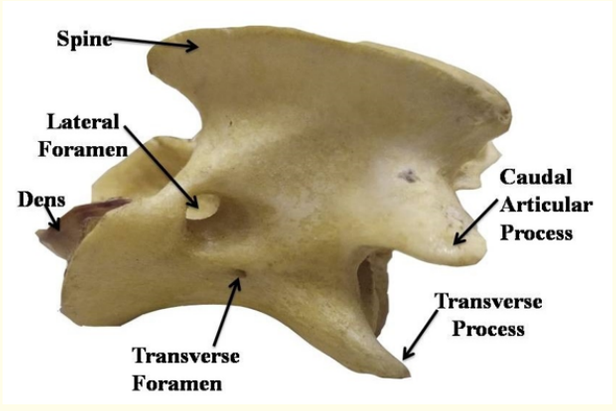

Figure 10: *Lateral view of axis bone of goat.*

Conclusion

The C2, axis bone of different species of animals as to Horse, Dog, Sheep and Goat were studied and compared their anatomical features with the similar bone of Ox. Cranially placed spout like odontoid process was identified as the dens. It was projected from the body. Its tooth like process was sufficiently elaborating as the vertebra dentata.

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