Indian Journal of Veterinary Anatomy 24 (2): 71-73, December 2012

Anatomical Studies on the Vertebral Column of Barking Deer (*Muntiacus muntjak*)

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Received: 24 June 2012; Accepted: 26 December 2012

ABSTRACT

The vertebral column of barking deer was comprised of 35 segments. The supraspinous process of atlas was represented by a raised tubercle separated by a prominent ridge. Axis had wider dens. The third cervical vertebra had crest like supraspinous process which increased posteriorly. The 4th, 5th, 6th and 7th cervical vertebrae were characterized by the presence of a tubercle midway along the outer margin of the bony plate. The body of 13th thoracic vertebra was longer and constricted in the middle with strongly curved anterior and posterior extremities. The elongated plate like transverse processes of 6th lumbar vertebra were flattened dorso-ventrally and projected downward and forward. The fusion of completely fused five sacral vertebrae had two dorsal and four ventral sacral foramina.

Key words: Anatomy, Barking deer, Vertebral column

The vertebral column is the fundamental part of the skeleton. It consists of a chain of median unpaired, irregular bones which extend from the skull to the end of the tail. It helps to divide the body into various regions. Paucity of available literature on gross morphology of the vertebral column in Barking deer prompted the present study.

MATERIALS AND METHODS

The present study was conducted on the vertebral column of one barking deer. After maceration and proper cleaning (Raghvan, 1964) various morphological characteristic of vertebrae were recorded and compared with other domestic animals.

RESULTS AND DISCUSSION

The vertebral formula of barking deer was C_7 T_{13} L_6 S_5 Cy_4. Atlas, of deer had a neural ring and two wings as in Calamian deer (Maala *et al.*, 1992). The neural ring was roughly triangular in outline with upper two angles rounded off as also reported earlier in Sambar deer (Shalini *et al*., 2004). The anterior articular cavities for lodgment of occipital condyles were deep in barking deer and not clearly divided into two parts as observed in Sambar deer (Shalini *et al*., 2004). These cavities of deer were separated ventrally by a deep "U" shaped notch as in ox (Raghvan, 1964).

Dorsally, the articular cavity had "C" shaped central notch which was "V" shaped in ox (Raghvan, 1964). At the dorsum of the neural ring of atlas, the supraspinous process was represented by a raised tubercle followed by presence of two very prominent articular facets at base of tubercle, separated by a prominent ridge (Fig. 1). The articular surfaces on posterior side of the ring were larger and inverted comma shaped in the Barking deer. The transverse processes (wings) of atlas of deer were thin, translucent bony plates with thick, convex margins projecting downward ventrally and backward as that of horse (Sisson and Grossman, 1953). The ventral process was represented by a caudally placed prominent tubercle as in sheep and goat unlike in Sambar deer where it was in the form of a faint crest (Shalini *et al*., 2004).

The fossa atlantis was deep and wings of atlas of deer were pierced by foramina on either side of articular facet of atlas. Alar and inter vertebral foramina were presented with single external opening and were not joined by a deep furrow unlike as in domestic animals (Sisson). Four additional unnamed foramina were also present on wings of deer. However, in Sambar deer only one foramen opened in the fossa atlantis (Shalini *et al*., 2004).

Axis had wider dens in barking deer (Fig. 1). It

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was deeply notched dorsally and ventral collar was wider. Supraspinous process flanked anteriorly over the neural ring as in dog (Nickel *et al.*, 1986). The anterior end of supraspinous process was blunt and wider. The ventral process was like a ridge. The transverse process was single and pointed, projected backward and inward in barking deer. In contrast, these were directed laterally in sambar deer (Shalini *et al.,* 2004). The two ridges from transverse process converged upto ventral process forming a "V" shaped structure. The intervertebral foramen and foramen transversarium opened into a common opening just behind the anterior notch in barking deer.

The supraspinous process was in the form of low crest in 3rd cervical vertebra (Fig. 1) as in horse (Sisson and Grossman, 1953) but it was in the form of a tubercle which increased in height posteriorly in 4th and 5th cervical vertebrae as in ox (Raghvan, 1964). The two ridges arose from either side of supraspinous process and diverged posteriorly to terminate on posterior articular processes. Transverse process of C_3 was divided into an anterior and posterior division as in horse (Sisson and Grossman, 1953). The anterior and posterior articular process as were joined by thin bony plates as in ox (Raghvan, 1964). The 4th, 5th, 6th and 7th cervical vertebrae of barking deer were characterised by the presence of a tubercle midway along the outer margin of the bony plate. The infraspinous processes of cervical vertebrae were in the form of spines which increased caudally and terminated into a pointed tubercle (Fig. 1).

Transverse process of 4th cervical divided into cranio-ventral and caudo-dorsal divisions as in horse (Getty, 1965). Cranio-ventral division extended below the body of the vertebra. Transverse process of 5th divided into dorsal and ventral divisions as that of cattle (Fig. 1). Transverse process of 6th divided into dorsal and ventral parts, ventral division being quadrilateral and extending below to the level of body of the vertebra. The sixth cervical vertebra of barking deer was short and wider than the 5th one. The transverse process had two distinct thin bony plates from 5th cervical vertebra onwards i.e. small horizontal and large vertical with thick margins. The largest foramen transversarium was also recorded in 6th cervical segment as in ox (Raghvan, 1964). The bodies of cervical vertebrae became shorter in length posteriorly with strongly curved anterior and posterior extremities.

Seventh cervical of barking deer showed undivided tuberous transverse process and lacked a foramen transversarium like in other domestic animals (Getty, 1965). Anterior articular processes were large, facing upward whereas, posterior articular processes were diverging outward and downward and were present at the base of supraspinous processes. The supraspinous process was thin and directed upward with small pointed tuberous summit in barking deer. The spine of 7th cervical segment rose abruptly in height. The large and concave demifacets were present on posterior aspect of body of the vertebra in the barking deer.

Thoracic vertebrae in deer were 13 and their bodies were longer and constricted in the middle. The anterior and posterior extremities of thoracic vertebrae were strongly convex and concave, respectively. These demifacets were more prominent and well marked in barking deer. The transverse processes of thoracic vertebrae were thin bony plates with facets for tubercles of the ribs. The dorsal mamillary processes were absent.

The supraspinous processes of thoracic vertebrae were highest in 4th and 5th segment (Fig. 2) as observed by Maala *et al.*, (1992) in Calamian deer. These were thin bony plates having thin anterior and posterior borders with flat lateral surfaces. They were directed upward, backward marked by a posterior spinous tubercle in lower 2/3rd in all the thoracic vertebrae except the last one as also reported in horse (Sisson and Grossman, 1953). The height of the supraspinous process of thoracic vertebrae decreased posteriorly in the series. The borders were straight up to T_8 but from T_9 to $T_{13,}$ the posterior borders of spines became convex. The curvature was pointed in T_{13}. The supraspinous process of last thoracic vertebra decreased in height, smallest in series, and was just like quadrilateral bony plate that resembled with the supraspinous process of lumbar segment.

The lumbar vertebrae were six in number having roughly triangular body and distinct vertebral spine as in the Calamian deer (Maala *et al.*, 1992). The bodies of lumbar vertebrae were compressed and constricted in the middle and were comparatively longer. Anterior articular processes got fused with mammillary processes to form curved deeply concave articular facets for articulation with the posterior oblique processes of preceding vertebrae in barking deer. The transverse processes were elongated plates which were flattened dorso-ventrally, projecting downward and forward. Adjacent transverse processes were widely separated as in ox (Raghvan, 1964). The supraspinous processes were thin bony plates having thick dorsal margins. The supraspinous processes were projected upward and backward with sharply concave anterior and posterior borders in barking deer as in ox (Raghvan, 1964). Anterior and posterior borders of adjacent vertebrae met each other as observed in last thoracic vertebrae of horse (Sisson and Grossman, 1953). Transverse processes of the lumbar vertebrae increased in length posteriorly, being the longest in L_3 and L_4 and then decreased posteriorly. Last lumbar vertebra had pointed transverse process (Fig. 3).

Sacrum of barking deer was formed by complete fusion of 5 segments. Median and two lateral sacral crests were present having thick dorsal margins as in ox (Raghavan, 1964). Dorsal and ventral sacral foramina were 2 and 4 in number, respectively in deer. The ventral foramina were larger than the dorsal ones. In deer, first pair of dorsal sacral foramen was present medial to the lateral sacral crest and the last pair being lateral to the lateral sacral crest as reported in ox (Raghavan, 1964). On the ventral surface, the *sulcus vasculosus* was prominent in deer. Anterior articular process of first sacral segment was curved and longer. The supraspinous process of first sacral segment was placed more posteriorly in deer thereby leaving a wide oval gap between last lumbar and first sacral vertebra which might be a suitable site for giving epidural anaesthesia (Fig. 3). The wings of sacrum were directed laterally in deer. Transverse process of last sacral segment was directed backward. The space between dorsal spine of last sacral segment and first coccygeal was smaller in deer.

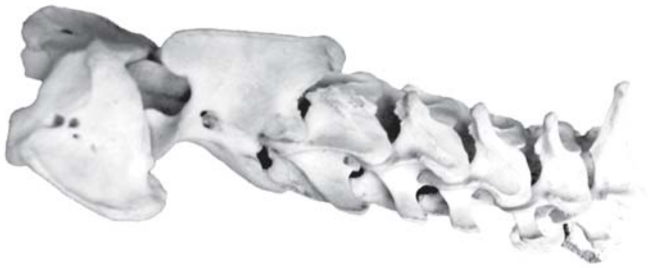

Fig. 1. Atlas, axis, C_3, C_4, C_5, C_6 and C_7. Note spine like supraspinous process and postero-dorsal and antero-ventral transeverse processes.

Fig. 2. Thoracic vertebrae showing hightest supraspinous process in T_4 and T_5 and last thoracic resembles like lumbar vertebra.

Fig. 3. Lumbar vertebrae, sacrum and last two coccygeal vertebrae.

The first 2 coccygeal vertebrae of deer had neural rings with other characters of typical vertebra, thereafter the remaining two had body only.

REFERENCES

Getty, R. 1965. *Sisson and Grossman's The Anatomy of the Domestic Animals*. Vol. I, W.B. Saunders Co., Philadelphia.

Maala, C.P., Arca, R.R., Bravo, M.V.A., Villamor, C. and Marte, R.G. 1992. Vertebral column of the Calamian deer Cervus (*Axis calamianensis*). *Philippine Journal of Veterinary and Animal Sciences* **18**: 229-238.

Nickel, R., Schummer, A. and Seiferle, E. 1986. *The Anatomy of Domestic Animals*. Vol. 1, Verlag Parey, Berlin.

Raghavan, D. 1964. *Anatomy of Ox*. Indian Council of Agricultural Research, New Delhi.

Shalini, Sarma, K., Kalita, A. and Zama, M.M.S. 2004. Comparative anatomy of the atlas and axis of Bakarwali goat, local sheep and Sambar deer. *Indian Veterinary Journal* **81**: 71-73.

Sisson, S. and Grossman, J.D. 1953. *The Anatomy of the Domestic Animals*. 4th edn., W.B. Saunders Co., Philadelphia.