GROSS STUDIES ON THE LUMBAR VERTEBRAE IN BLUE BULL (*BOSELAPHUS TRAGOCAMELUS*)[#]

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ABSTRACT

The present study had been conducted on the lumbar vertebrae of blue bull. There were six lumbar vertebrae. The transverse processes were spreading out laterally and slightly bent forward. The length of the first transverse process was the shortest and straight, which gradually increased up to the last. The width of last two processes was less than the same of first four vertebrae. The height of spinous process decreased gradually from first to the last. The mammillary processes of lumbar vertebrae were fused with the anterior articular processes, which were thick and tuberous. In the last lumbar vertebra, the body was compressed from above downwards and the neural ring was widest. The articular processes were placed wide apart from body. The interarcuate spaces were gradually increased from the fourth-fifth lumbar and sixth lumbar-sacrum vertebra.

Key words: Blue bull, lumbar vertebrae, transverse process, mammilary process

Introduction

The blue bull is protected under Schedule III of the Indian Wildlife Protection Act, 1972. The aim of this study was to investigate the bones of vertebral column of blue bull which will be helpful to field and zoo veterinarians in many veterolegal cases to differentiate these bones from those of some other small ruminants. The report is available on vertebral column of barking deer (Suri *et al.*, 2012; Rajani and Chungath, 2012). The present study will help in understanding and will provide better approach for surgical intervention in osteological affections.

Materials and Methods

The present study was conducted on lumbar vertebrae of six adult blue bulls (*Boselaphus tragocamelus*) of either sex. The permission for the specimen's collection was sought from Additional Principal Chief Conservator of Forest, Jaipur. The skeletons were collected from the Bikaner zoo after official approvals. Afterwards, the specimens were brought to the Department of Veterinary Anatomy and Histology, Bikaner and processed as per standard technique (Raghavan, 1964).

Results and Discussion

There were six lumbar vertebrae in blue bull (Fig. 2) which was comparable to the observations of Getty *et al.* (1930) and Levine *et al.* (2007) in horse, sheep and ox, Raghavan (1964) in ox, Hughes and Dransfield (1953) in horse and ass, Maala *et al.* (1992) in calamian deer, Kumar *et al.* (2000) in red deer, Rajani and Chungath (2012) in Indian muntjac, Suri *et al.* (2012) in barking deer, Tiwari *et al.* (2012) in tiger, Rajani *et al.* (2013) in spotted deer and Choudhary *et al.* (2015b) in black buck and it was nonconforming with the reports of Brelend (1943) in cat, Miller *et al.* (1964) and Elizabeth *et al.* (2009) in dog and Smuts and Bezuidenhout (1987) in camel. Rajani *et al*. (2011) reported seven lumbar vertebrae were present in leopard.

The transverse processes of each lumbar vertebra were long plates of bone spreading out laterally at right angle from the body, being slightly bent forward (Fig. 1 and 2). They were thick at the base and thin laterally. The length of the transverse processes of the first vertebra were shortest and were straight, gradually increased up to the 4th but the width of last two processes were less than first four vertebrae in blue bull (Fig. 2). These findings were compatible with the reports of Suri *et al*. (2012) in barking deer, Rajani *et al.* (2012) in leopard, Tiwari *et al.* (2012) in tiger, Rajani (2013) and Iniyah *et al.* (2015) in spotted deer, Meena *et al.* (2013) in chital and Choudhary *et al.* (2015b) in blackbuck whereas mismatched with that of ox (Getty *et al.,* 1930 and Raghavan, 1964) where the transverse process of last lumbar was shorter than fifth, in camel (Smuts and Bezuidenhout, 1987) where the transverse processes were longest in mid lumbar region, in cat (Brelend, 1943) and dog (Miller *et al.*, 1964 and Levine *et al.*, 2007). The longest transverse process was usually the third or fourth in most domestic mammals, except in carnivores, in which the fifth or sixth lumbar vertebrae carried the longest transverse process and in the horse, the transverse processes of the 5th and 6th (last two) lumbar vertebrae and last lumbar and first sacral vertebrae articulated with each other (Konig and Lirbich, 2005).

The supraspinous processes were broad and flattened plates of bone. The height of spinous processes decreased gradually from first to last and width of the summit of spines was less in last two. The spinous processes were relatively low, wide and perpendicular to the long axis of the vertebrae in blue bull which simulates the findings of Getty *et al.* (1930) in ox and horse, Raghavan (1964) in ox, Smuts and Bezuidenhout (1987) in camel, Rajani *et al.* (2013) in spotted deer, Meena *et al.* (2013) in chital, Choudhary *et al.* (2015b) in blackbuck and distincted with Miller *et al.* (1964) in dog, Dyce *et al.* (2006) in dog, Rajani *et al.* (2011) in leopard, Suri *et al.* (2012) in barking deer, Tiwari *et al.* (2012) in tiger and Konig and Liebich (2005) in ox.

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The infraspinous process of the lumbar vertebrae was in the form of a small tubercle anteriorly in blue bull whereas a rudimentary ventral crest was present in ox and horse (Getty *et al*., 1930) and in ox (Raghavan, 1964).

The articular processes were better developed and placed further apart than in the thoracic region and mamillary processes were fused with the anterior articular processes, which were thick and tuberous (Fig. 1). The anterior articular processes were concave and directed medially and posterior articular processes were convex and directed laterally. The anterior articular processes were nearer than the posterior articular processes of the same vertebrae in blue bull which was concurrent to the finding in ox, horse and sheep (Getty *et al*., 1930), ox (Raghavan, 1964 and Frandson and Spurgeon, 1992), dog (Miller *et al*., 1964), in camel (Smuts and Bezuidenhout, 1987), in chital (Meena *et al*., 2013) and in blackbuck (Choudhary *et al*., 2015b) and distinct with Rajani *et al.* (2011) in leopard, Tiwari *et al.* (2012) in tiger, Rajani (2013) and Iniyah *et al.,* (2015) in spotted deer; where the articular processes were strongly curved with concave facet on its medial aspect.

The bodies were constricted in the middle and expanded at the extremities resembling those of the thoracic vertebrae except the sixth which was wide in its length and the body of the fifth was generally the longest which conformed the observations made by Getty *et al.* (1930) in horse, ox and sheep, Hughes and Dransfield (1953) in horse and Raghavan (1964) in ox. However they were in contrast to the findings of Miller *et al.* (1964) and Smuts and Bezuidenhout (1987) in camel, Dyce *et al.* (2006) in dog, Rajani *et al.* (2011) in leopard, Suri *et al.* (2012) in barking deer, Tiwari *et al.* (2012) in tiger, Rajani *et al.* (2013) in spotted deer, Meena *et al.* (2013) in chital and Choudhary *et al.* (2015b) in blackbuck where the vertebral bodies of lumbar vertebrae were approximately of equal length and Levine *et al.* (2007) found in ox, that the sixth lumbar vertebra was equal in length and horse having much longer.

The neural canal was uniform up to the third or fourth and then increased in width and height up to last lumbar vertebrae. The posterior notches were larger than the anterior ones. The intervertebral foramen were larger in the posterior vertebrae and sometimes formed complete lateral vertebral foramen in the cranial part of the series which were in accordance with the findings of Getty *et al.* (1930) in horse and ox and Raghavan (1964) in ox, Rajani *et al.* (2013) in spotted deer and Choudhary *et al.* (2015) in blackbuck.

The interacuates spaces gradually increased between fourth-fifth lumbar and sixth lumbar - first sacrum in blue bull (Fig. 2) whereas the interacuate space between sixth and seventh lumbar vertebra were almost equal to the lumbo-sacral space in camel (Smuts and Bezuidenhout, 1987), in leopard (Rajani *et al.,* 2011), in chital (Meena *et al*., 2013) and the interacuate spaces between the last two lumbar vertebrae were also wide enough to allow injections into the vertebral canal in cat (Konig and Liebich, 2005).

Fig. 1: Dorsal view of fourth lumbar vertebra showing spinous process (1), Mammillo-articular processes (2, 2*), Caudal articular processes (3, 3*), Transverse processes (4, 4*) and Anterior articular surface of body (5)

Fig.2: Lumbar vertebrae (L1-L6) of blue bull showing transverse process (TP), spinous process (SP), mammillo-articular processes (ma) and caudal articular process (c)

References

Brelend OP (1943) Manual of comparative anatomy, Mcgraw-Hill Book Company. Inc, Newyork and London, pp. 146-151.

Choudhary OP, Singh I, Bharti SK, Mohd KI, Dhote BS and Mrigesh M (2015b) Gross studies on lumbar, sacrum and coccygeal vertebrae of blackbuck (*Antelope cervicapra*). *Indian Vet. J*. **92**(3): 75-78.

Dyce KM, Sack WO and Wensing CJG (2006) *Text book of Veterinary Anatomy*. 4th ed., Saunders Elsevier. pp. 35-41.

Elizabeth A, Baines Grandage J, Herrtage M and Stephen JB (2009) Radiographic defination of the anticlinal vertebra in the dog. *J. Vet. Radiol. Ultrasound*. **50**(1): 69-73.

Engelke, Elisabeth C, Christina P, Pfarrer Christiane D, Sager MW and Helmut R (2016) Radiographic morphometry of the lumbar spine in munich miniature pigs. *J. Am. Assoc. Lab. Anim. Sci.* **55**(3): 336-345.

Frandson BS and Spurgeon TL (1992) Anatomy and physiology of farm animal. Lea and Febiger, Philadephia. 5th ed., pp. 64-68.

Getty R, Sisson S and Grossman JD (1930) The Anatomy of the Domestic Animal. 2nd ed., W.B. Saunders Comp. Philadelphia. pp. 25-27, 33-45, 125-130.

Hughes HV and Dransfield JW (1953) Oesteology and arthrology of domesticated animal, 4thed., BTC London. pp. 25-51.

Iniyah K, Jayachitra S, Balasundaram K and Sivagnanam S (2015) Gross anatomical studies on vertebral column in white spotted deer (*Axis axis*). *Asian J. Sci. Tech*. **6**(2): 1083-1085.

Konig HE and Liebich HG (2005) Veterinary anatomy of domestic animals, 3rd ed. Schattauer, Stuttgart Germany. pp. 49-104, 145-160, 215-236.

Kumar N, Kukreti S, Ishaque M and Mulholland M (2000) Anatomy of deer spine and its comparison to the human spine. *Anat. Rec.* **260**(2): 189-203.

Levine JM, Levine GJ, Hoffman AG, Mez J and Bratton GR (2007) Comparative anatomy of the horse, ox and dog. The

vertebral column and peripheral nerves CE article-1, pp. 279-281.

Maala CP, Arca RR, Bravo MVA, Villamor C and Marte RG (1992) vertebral column of the Calamian Deer (*Axis cervus*) calamianensis. *Philip. J. Vet. Anim. Sci*. **18**(3): 229-238.

Meena V, Joshi S, Mathur R and Choudhary OP (2013) Gross studies on the thoracic and lumbar vertebrae in chital (*Axis axis*). *Indian J. Vet. Anat*. **25**(2): 83-85.

Miller ME, Christensen GC and Evans HE (1964) Anatomy of the dog. WB Saunders Company, Philadelphia, USA. pp. 51-61.

Raghavan D (1964) Anatomy of ox. Indian Council of Agricultural Research, New Delhi. pp. 17-38.

Rajani CV and Chungath JJ (2012) Studies on the lumbar, sacral and coccygeal vertebrae of Indian Muntjac (*Muntiacus muntjak*). *Indian J. Vet. Anat.* **24**(2).

Rajani CV, Maya S, Sreeranjini AR and Raj VI (2011) Morphological studies on the lumbar vertebrae in leopard (*Panthera pardus*). *Tamilnadu J. Vet. Anim. Sci.* **7**(6): 258-261.

Rajani CV, Sajitha IS, Pradeep M and Chungath JJ (2013) Morphological studies on the thoracic, lumbar, sacral and coccygeal vertebrae in spotted Deer (*Axis Axis*). *Tamilnadu J. Vet. Anim. Sci.* **9**(2): 113-121.

Smuts MS and Bezuidenhout AJ (1987) *Anatomy of dromedary*, Oxford Science Publication, pp. 9-20.

Stubbs NC, Hodges PW, Jeffcott LB, Cowin G, Hodcson DR and McGowan CM (2006) Functional anatomy of the caudal thoraco-lumbar and lumbo-sacral spine in the horse. *Equine Vet. J*. **38**(36): 393-396.

Suri S, Sarma K, Doley PJ and Dangi A (2012). Anatomical studies on the vertebral column of barking deer (*Muntiacus muntjak*). *Indian J. Vet. Anatomy* **24**(2): 71-73.

Tiwari Y, Taluja JS, Vaish R, Pandey A and Shrivastav A (2012) Biometry of lumbar vertebrae in tiger (*Panthera tigris*). *World Res. J. Wildlife Res*. **1**(1): 05-08.