

Morphometry of Cervical Vertebrae of Camel (*Camelus dromedarius*)

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The study on the vertebral column of camel is scanty. Hence, the present study was undertaken to ascertain the extent of morphometric variations among the cervical vertebrae in camel.

Materials and Methods

Six sets of the cervical vertebrae of adult camel approximately 10 – 15 years of age were used. Specific morphological points of the vertebrae were studied. The length (greatest antero-posterior distance) at ventral mid line of the body (Centrum), the width (greatest transverse distance between the outermost limit of the transverse processes) of each vertebra and other measurements were made with the help of meter scale and thread. The Mean and standard error of each measurement were calculated by standard methods. Mean diameter of neural ring was taken as mean of longitudinal and transverse diameter of its anterior aperture.

Results and Discussion

The number, general configuration and arrangement of cervical vertebrae of camel resembled to that of ox and horse. However, vertebrae of camel were larger, longer and more irregular in comparison. Greater length of cervical vertebrae appears logical to justify greater length of neck (107 ± 4.73 cm) i.e. about 28% of dorsal total axial length of the camel. Van Sittert *et al.*, (2010) reported it as 30% of the body length in large ungulates and about

40 to 50% of the giraffe's vertebral column. From axis backward the length of the cervical vertebrae decreased variably (1 to 20%). The width of these vertebrae decreased from first to second (31%), increased from second to fifth (15 to 23%) and again decreased in sixth (19%) and seventh (5%). Caudal end of the body of cervical vertebrae in camel was convex with slight depression in the center in contrast to a cavity present in ox and horse (Getty, 1975) to receive the anterior convexity of the body of succeeding vertebra. The fibrocartilage between the bodies of adjacent cervical vertebrae was comparatively larger and thicker which helps to accommodate the ends of the body of adjacent vertebrae.

The length of atlas was shortest (6.67 ± 0.334 cm), with width of 15.00 ± 0.577 cm which increased caudally. The supra spinous process and ventral spine were not conspicuous. The neural ring was circular with anterior mean diameter of 4.50 cm. The wings were thin and extended beyond the caudal margin of the ring. The anterior articular surface was separated by a narrow groove ventrally and wide (3.00 cm) 'U' shaped notch dorsally. Laterally it was divided completely into dorsal and ventral parts by a longitudinal rough non-articular area. There was a single foramen caudal to alar foramen in place of two reported in ox (Raghavan, 1964). The *foramen transversarium* was located at posterior part of the wing; it extended into the wing and

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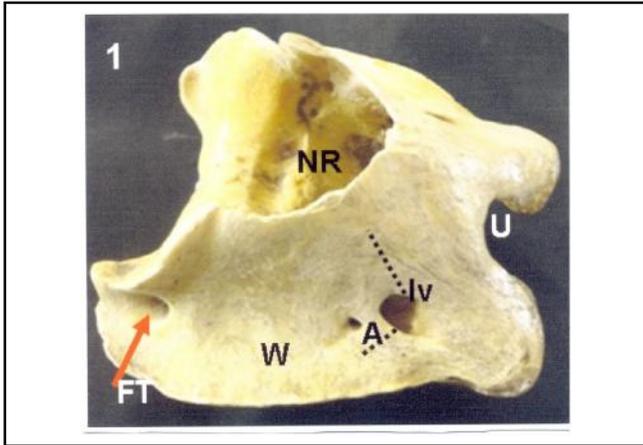


Fig 1. Atlas of camel (Dorsal view)

NR – neural ring; U - anterior dorsal notch; lv – Intervertebral foramen; A – foramen alar; W – wing; FT – foramen transversarium.

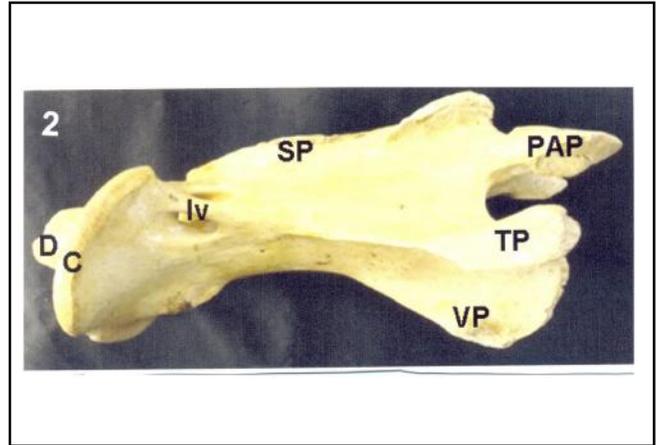


Fig 2. Axis of camel (Vento-lateral view)

D – dens process; C – collar; lv – intervertebral foramen; SP – supraspinous process; VP – ventral spine/process; TP - transverse process; PAP – posterior oblique articular process.

opened in the middle of the *fossa Atantis*.

Axis was longest (20.17 ± 0.334 cm) and narrowest (10.33 ± 0.883 cm) of the cervical vertebrae. The ventral spine was in the form of tubercles located at anterior and posterior ends of the body. The odontoid process was lip like which measured 3.00 cm and 4.33 cm in length and width respectively. The supra spinous process increased in height caudally and terminated as prominent bifid plate. Forward

inclination of dorsal spine reported in ox by Ghosh (2007) could not be noticed in the camel. The anterior oblique articular processes were absent. The posterior oblique articular processes were long, narrow and extended beyond the rim of the posterior articular surface of the body. The intervertebral foramen was located behind the dorsal part of the collar, however externally it was divided into two by a bony plate. *Foramen transversarium* was located below and behind the intervertebral foramen. The neural ring was wider in front with mean diameter of 4.50 cm than behind (3.25 cm). The transverse process was thin, extended backward and outward and terminated in the form of thick tubercle.

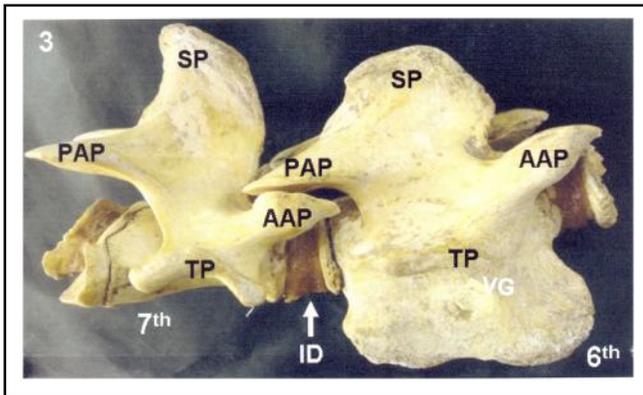


Fig 3. Sixth and seventh cervical vertebrae of camel (Lateral view)

SP – supraspinous process; PAP - posterior oblique articular process; AAP – anterior oblique articular process; TP – transverse process; ID – intervertebral disc.

The length of the cervical vertebrae decreased (18.00 ± 0.998 to 17.33 ± 0.167 cm) and width increased (12.83 ± 0.831 to 17.17 ± 0.334 cm) from third to fifth. The supraspinous process was in the form of ridge in third, increased in height and thickness in fourth and fifth vertebrae. The transverse process was well developed and had dorsal and ventral parts. The ventral part of the process was large, plate like, anterior in position and increased in size from third and fifth. The transverse distance between ventral parts of the transverse

processes widened and deepened from third to sixth. Extensive and wide transverse processes of cervical vertebrae formed a bony groove on the ventral aspect of the neck which probably is to provide protection to the soft structures. The ventral spine was conspicuous in the posterior half of the third vertebra and diminished in height in fourth and fifth. *Foramen transversarium* was small and opened in the mid lateral wall of the neural ring.

The length and width of sixth cervical vertebra of camel were equal (13.83 ± 0.600 cm). The dorsal spine was plate like with highest convexity in the middle. The transverse process consisted of a small dorsal and a large plate like ventral part. The ventral part extended to the whole length of the body of the vertebra and its ventral border was notched in the middle. The *foramen transversarium* pierced the anterior part of the transverse process and opened in the neural canal. The ventral spine was inconspicuous.

Seventh cervical vertebra was smallest among the typical cervical vertebrae of the

camel and measured 11.83 ± 0.176 cm and 13.17 ± 0.929 cm in its length and width respectively. The supraspinous process was plate like, thick and largest in the series. It slightly inclined backward in contrast to ox where it inclines forward (Budras and Robert, 2003). The transverse process was small and divided in an anterior and posterior tuberos parts. Getty (*loc. cit*) reported it as single in case of ox and horse. The *foramen transversarium* was absent; however, in some of the specimens it was present unilaterally. Ventral spine was inconspicuous.

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