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IMAGING STUDIES OF CADAVER MANDIBLE OF CAMEL AND ITS CORRELATION WITH MANDIBULAR FRACTURE

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ABSTRACT

The imaging study was conducted on 3 cadaver mandible of male camel. CT scan and computed radiography were performed for detailed morphological study of horizontal ramus of mandible in order to correlate with common fracture sites. The anatomical details of horizontal ramus of mandible viewed in both of the diagnostic imaging techniques correlated with findings of twelve mandibular fracture cases in camels and proved the weakest site was found in the vicinity of the alveolus of 1st premolar at horizontal ramus of mandible.

Key words: Cadaver mandible, camel, computed radiography, computed tomography, mandibular fracture

Mandibular fracture is the most common serious problem in camels which is higher in males than female camels (Al-Mujalli, 2012). It occurs commonly during rut season (Siddiqui *et al,* 2012; Parashar, 2013) and seen at cranial or caudal, or across the 1st premolar (Gahlot, 2000). Computed Tomography (CT) is an excellent diagnostic tool to study the detailed anatomy of horizontal ramus of mandible which is useful to evaluate the weakest point at mandible in camels (Parashar, 2013; Tucker and Farrell, 2001). Camel has a different anatomy of mandible hence imaging technique enables studying the surgical anatomy of mandible that would help identifying more susceptible region in mandible which predisposes lower jaw to fracture and help developing diverse immobilisation techniques for repair these fractures. It is imperative to augment the skill and knowledge for improvement of external fixation techniques with the help of advance diagnostic imaging to achieve rapid and effective outcome in mandibular fracture management. Present study was therefore done to evaluate the complex anatomy of the mandible by CT scan and Computed Radiographic imaging techniques in camels.

Materials and Methods

The computed radiography of three cadaver mandible of adult male dromedary camel was performed using factor 60kVp and 10mAs. A positive contrast radiograph using barium sulphate @ MICROBAR was taken by introducing the contrast material into the mandibular foramen to detail out the mandibular canal. The computed tomography of three cadaver heads was done using factor 100kVp and 120mAs (HITACHI) (Fig 1). Both imaging techniques were performed for detailed morphological study of horizontal ramus of mandible and to correlate with common fracture sites.

The common fracture sites were examined by clinical and radiological examination of 12 adult male camels (*Camelus dromedarius*) with mandibular fractures which were presented in Veterinary Clinical Complex of the College of Veterinary and Animal Science, Bikaner.

Results

Computed Radiography

Computed radiography (CR) of cadaver mandible was performed in both lateral and dorso-ventral views. In lateral view of mandible, the height of horizontal ramus was more at caudal ramus (10.43±0.21 cm) than rostral ramus (3.26±0.16 cm). The average length of diastema measured was 15.80±0.15 cm. However, it was further divided into two regions, i.e. rostral to the 1st premolar (rostral interdental space) (5.47±0.14 cm) and caudal to the 2nd premolar (caudal interdental space) (9.93±0.60 cm) (Fig 2). The mandible of camel was composed of two horizontal ramus which were fused rostrally

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Fig 1. Obtaining CT scan of camel head.

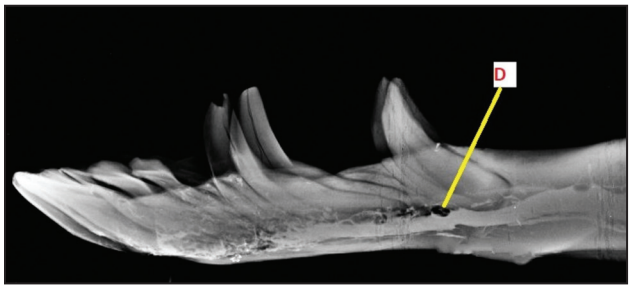

Fig 3. Lateral positive contrast radiograph showing opening of mandibular foramen into mental canal rostrally (D).

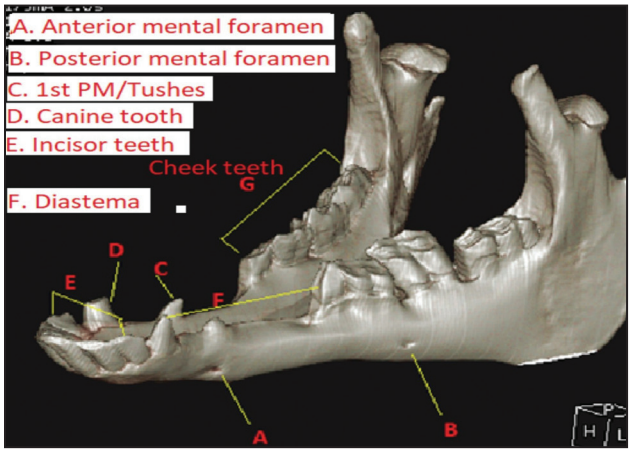

Fig 5. Three dimensional reconstructed CT image of cadaver mandible showing mental foramen, 1st premolar, canine tooth, incisor tooth and diastema.

(mandibular symphysis) midway between the roots of 1st premolar.

There was distinct presence of 1 pair of canines, 3 pair of incisors, i.e. central, intermediate and laterals

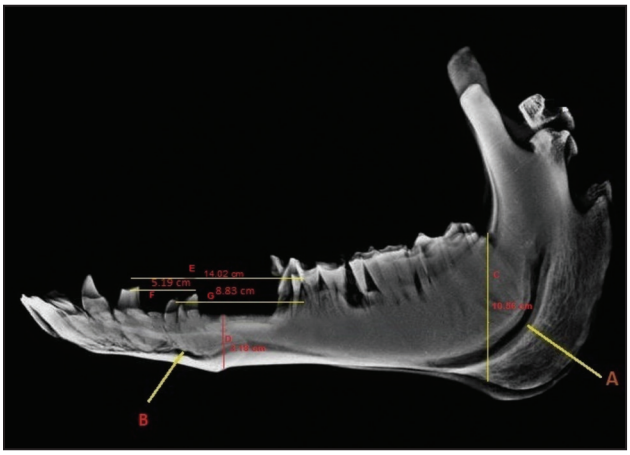

Fig 2. Lateral radiograph showing biometry of cadaver mandible, showing mandibular canal (A), mental canal (B), caudal horizontal ramus (C), rostral horizontal ramus (D), interdental space/ diastema (E), rostral interdental space (F) and caudal interdental space (G).

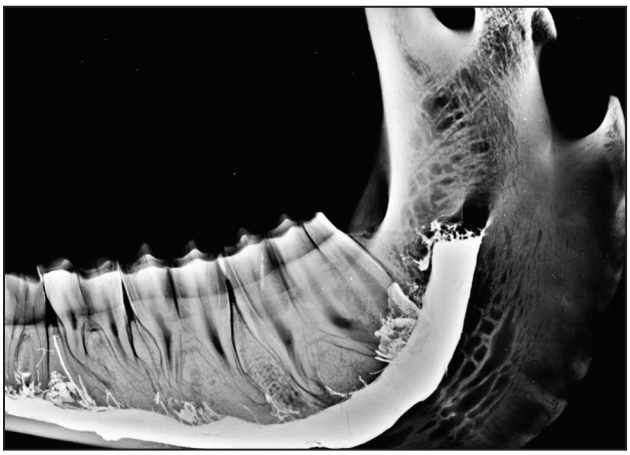

Fig 4. Positive contrast radiograph showing opening of mandibular foramen at vertical ramus of mandible.

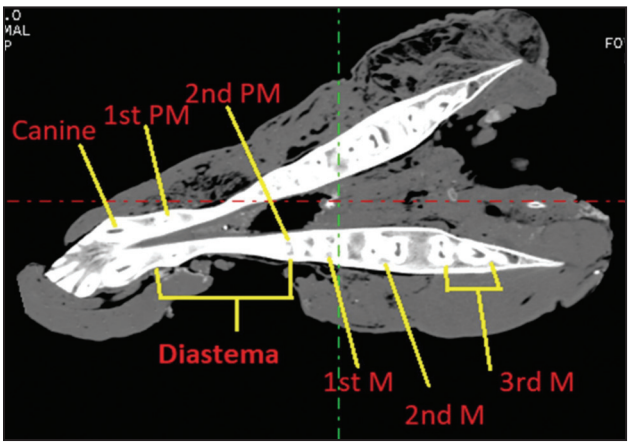

Fig 6. Multiplanar CT images in dorsal plane demonstrated arrangement of teeth in horizontal ramus with diastema.

and 1 pair of premolar at diastema. These are also known as tushes or wolf tooth. At the end of the diastema the horizontal ramus had 1 pair of 2nd

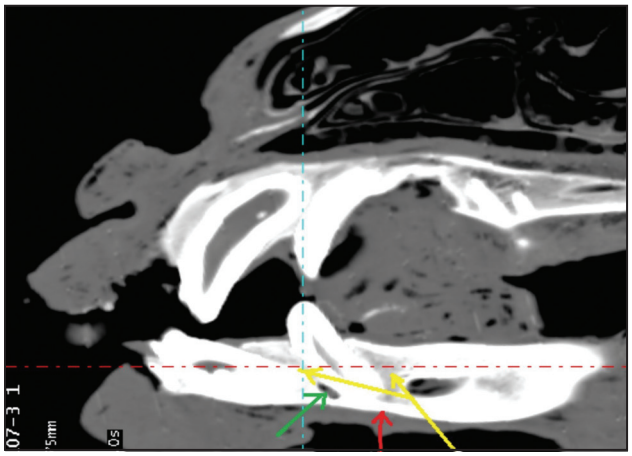

Fig 7. Sagittal plane of CT showing hollowness at either side of alveoli (yellow arrow), opening of anterior mental foramen (green arrow) and less osteogenic thickness (red arrow).

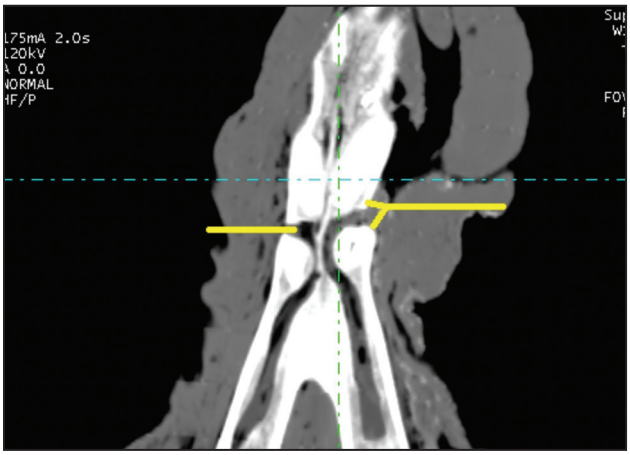

Fig 8. Dorsal plane of CT showing hollow passage of mandibular and mental canal communicating particularly at cranial to the alveolus of 1st premolar tooth.

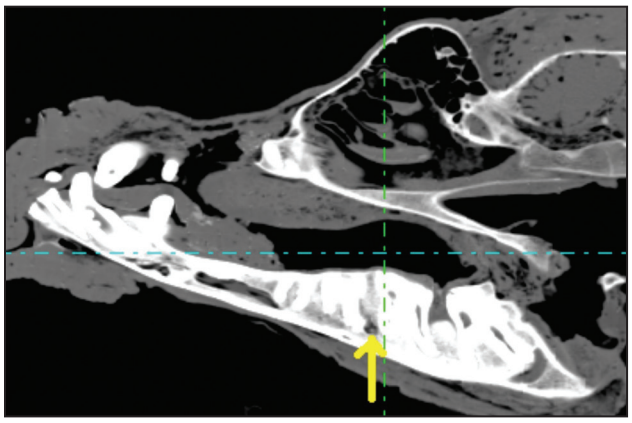

Fig 9. CT image of dorsal plane showing posterior mental foramen situated just caudal to the alveoli of 1st molar tooth.

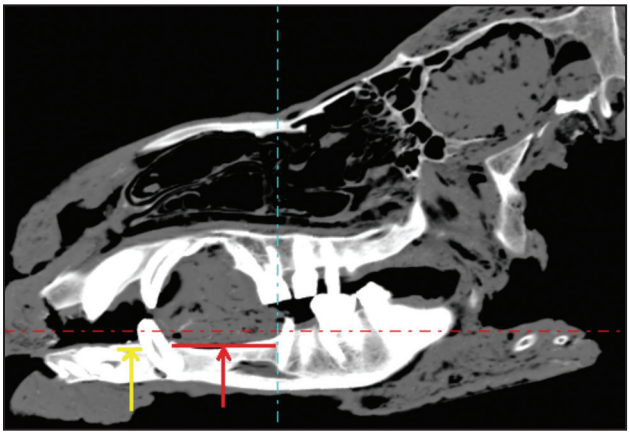

Fig 10. Sagittal plane of CT showing short cranial interdental space (yellow arrow) than caudal interdental space (red arrow).

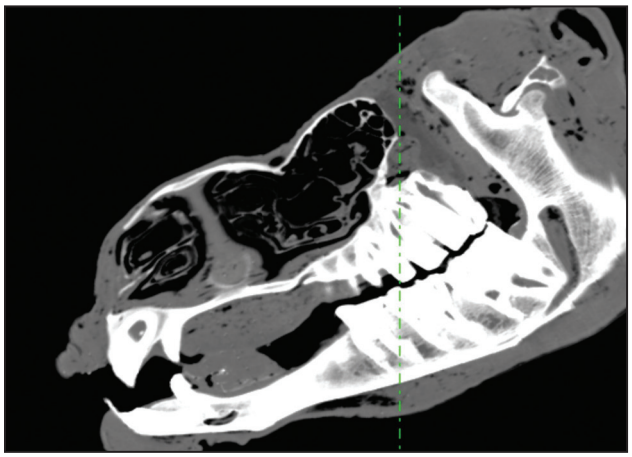

Fig 11. CT image of sagittal plane showing gradually increased width of horizontal ramus caudally merged into vertical ramus.

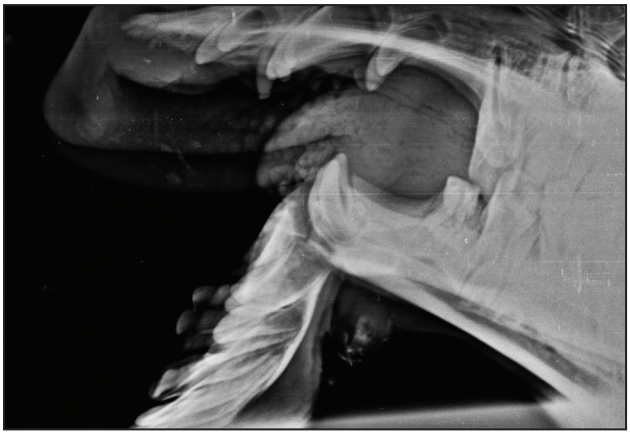

Fig 12. Lateral radiograph of mandible showing transverse fracture of horizontal ramus anterior to tushes

premolars and 3 pairs of molars. The posterior mental foramina was located between roots of 1st molar & 2nd molar and anterior mental foramina was located just posterior to the roots of 1st premolar.

The boundary of horizontal ramus remained up to roots of 3rd molar and thickness of ramus was more

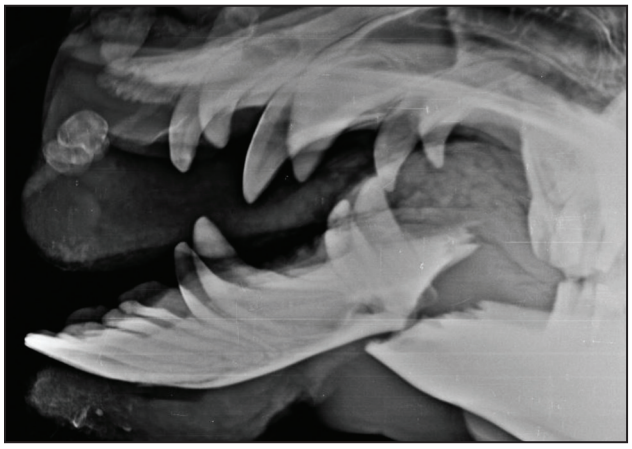

Fig 13. Lateral radiograph showing oblique fracture of horizontal ramus of mandible.

till here. The vertical ramus began just posterior to the roots of last molar and it lost its thickness and became a flat bone here containing mandibular foramina on medial aspect and mandibular condyles on dorsal aspect. There was evidence of medullary canal in horizontal and vertical ramus. However, it appeared wider in the vertical canal and became narrower progressively in horizontal canal towards the incisors.

The contrast radiograph revealed a long mandibular canal travelling through vertical ramus to horizontal ramus and was in continuation to the mental canal. It became narrower progressively towards the incisors (Figs 3 & 4).

Computed Tomography

Three dimensional (3-D) reconstructed images of cadaver mandible showed 3 pairs of molar teeth, 2 pairs of premolar, 1 pair of canine and 3 pairs of incisor teeth (Fig 5). The mandible had long interdental space which was divided in two parts by the presence of alveoli of 1st premolar (Fig 6). A distinct hollowness was evident at the alveolus of 1st premolar. A distinct bulge of alveoli of 1st premolar was evident with presence of anterior mental foramina just below to it. The osteogenic thickness of horizontal ramus ventral to the alveolus of 1st premolar was comparatively less (Fig 7). A distinct hollow passage of mandibular and mental canal of both the horizontal rami communicated rostrally cranial to the alveolus of 1st premolar (Fig 8). The posterior mental foramen was distinct at horizontal ramus just caudal to the alveolar of the 1st molar tooth (Fig 9). The cranial interdental space was shorter than the caudal interdental space. The horizontal ramus evidenced thickness at the interdental space which gradually increased towards caudal interdental space (Fig 10). The horizontal ramus gradually increased in width until the alveolus of last molar tooth and then it got merged with vertical ramus of mandible which was almost like a flat bone having a mandibular foramen on medial aspect (Fig 11).

Study of Mandibular fracture

Clinical and radiographical examination of fracture sites of mandible was done in twelve cases. Among the cases of mandibular fracture, most common fracture site was anterior to 1st premolar/ tushes (n=6, 50%) (Fig 12) followed by between premolars (n=5, 41.67%) (Fig 13) and fracture site was different on both sides, i.e. between premolars on right side and between 2nd premolar and 1st molar tooth on left side (n=1, 8.33%). Out of 12 cases of mandibular fracture, the oblique fracture (open/close) was observed in 2 (16.67%) cases and transverse fracture (open/close) in 10 (83.33%). Eleven (91.67%) fractures were bilateral and one (8.33%) was unilateral.

Discussion

Computed tomography is considered the best valuable imaging options for the assessment of outlining the details of camel bone structures (Emam *et al,* 2020). The narrowest part of the horizontal ramus was at the interdental space and at the same site there was distinct presence of alveoli of 1st premolar, which predisposed the site to the fracture than other parts, which are comparatively wider. The presence of the mental canal and alveoli of the 1st premolar render this site of horizontal ramus quite weak and become prone to fracture (Siddiqui *et al,* 2012). In sagittal reconstructed images predicted by CT scan, the comparative bone thickness at rostral ramus was less than caudal ramus. Gahlot and Chouhan (1994) also reported that mandible of camel was anatomically weak at horizontal ramus due to presence of alveoli of 1st premolar and mental canal in the region.

CT scan and contrast radiography of mandible explained the intricacies of anatomy of mandible which helped in understanding the weakest site of mandible, i.e. close or across the alveoli of 1st premolar, at which the incidence of mandible fracture was highest in camel.

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