DOI : 10.5958/2277-8934.2024.00012.2 *Vol 31 No 1, p 71-75*

SURGICAL REPAIR OF BILATERAL MANDIBULAR FRACTURE USING EXTERNAL SKELETAL FIXATION (ESF) TECHNIQUE IN SIX DROMEDARY CAMELS (*Camelus dromedarius*)

H.S. Bhabhor, Mahendra Tanwar, P. Bishnoi, Sakar Palecha, A.K. Bishnoi, K. Kachwaha and Narendra Singh

Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Science, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India

ABSTRACT

Six camels (3 male and 3 female) with age group of 7 to 13 year were presented with mandibular fracture. In all the animals bilateral mandibular fractures were confirmed by clinical and radiographical examination. Fracture was surgically managed by external skeletal fixation (ESF) under general anaesthesia using Xylazine HCL @ 0.4 mg/kg BW along with Ketamine @ 2 mg/kg BW, intravenously. End threaded negative profile pins (3 mm) were used at the rostral and caudal side (bilateral) of fracture fragments. The average period of fracture healing was 10.83±1.11 weeks on follow-up period. This technique was found safe and achieved the rigid fixation at the fracture site in both the transverse and oblique type of mandibular fracture effectively.

Key words: Camel, external skeletal fixation, fracture, mandible

The mandible or lower jaw is predisposed to the fracture of horizontal ramus of mandible due to presence of alveoli of tushes and mental canal in the long interdental space. Mandibular fractures occur commonly during rut season or breeding season (Gahlot, 2005; Ahmed, 2011; Siddiqui *et al,* 2012; Parashar and Gahlot, 2023; Rastabi *et al,* 2017; Al-Sobayil *et al,* 2020; Awwad *et al,* 2022). During this season the camel under rut become active, vicious and tend to bite each other leading to abnormal stress forces on the weaker portions of horizontal ramus of mandible leading to fracture (Gahlot, 2000; Bhabhor and Tanwar, 2023). Fracture of mandible leads to hanging down of lower jaw, thus making both the lips apart and hence impairs prehensions. Other symptoms include drooling of saliva, local swelling and tongue protrusion (Fubini and Ducharme, 2017; Niwas *et al,* 2020). Mandibular fractures in camel, are different from other animals, so the successful repair of this fracture depends mainly on the use of suitable methods of immobilisation (Al-Sobayil *et al,* 2020). Therefore, selection of a procedure should be dependent upon the bone involved, severity of the fracture, availability of anaesthesia, equipment, instrumentation, skill and experience of the surgeon (Ahmed and Al-Sobayil, 2012). External fixation techniques have been attempted previously to repair the mandibular fractures in camels with varying success (Gahlot *et al,* 1989; Parashar and Gahlot, 2023; Zamos *et al,* 1992). Present investigation was done to evaluate the management of mandibular fractures in camels using external skeletal fixation technique.

Materials and Methods

The clinical study was done under permission from the Institutional Ethics Advisory Committee with IAEC approval no i.e. CVAS/IAEC/CPCSEA-2044/GO/Re/SL/18/2019/12. The camels with mandibular fractures were brought to Veterinary Clinical Complex for necessary treatment. Six adult camels aged of 7 to 13 years and of both sexes (3 male and 3 female) were presented with history of fracture of lower jaw. Fracture occurred due to camel fighting (n=1), self inflicted injury (n=2), external trauma by owner (n=2) and unknown cause (n=1). Clinical examination revealed hanging of lower jaw, animals were unable to prehense, drooling of saliva and both the lips became apart due to downward hanging of rostral fracture fragment of lower jaw.

Radiographical examination was performed by both lateral and/or dorso-ventral (DV) views for

SEND REPRINT REQUEST TO H.S. BHABHOR email: drhsbsh@gmail.com

identifying location and type of fracture of rami of mandible. All fractures were across the horizontal ramus and bilateral in nature (Fig 1). Oral cavity was irrigated with 0.2% solution of potassium permanganate and administered pre-operative antibiotics (Oxytetracycline @4mg/kg IV OD) and non-steroidal anti-inflammatory agent (Meloxicam @0.5mg/kg IV OD).

Procedure

Pre-anaesthetic fasting was done for at least 24 hours and before sedation and camels were secured in sitting position. Surgical procedure was done under general anaesthesia using xylazine @ 0.4 mg/kg BW along with Ketamine @ 2 mg/kg BW, intravenously.

Mandibular fracture of animals were immobilised with external skeletal fixation technique (Fig 2-5). A stab incision was given after preparing the aseptic surgical site. A tunnel was drilled with the help of a drill bit (2.5 mm) on either side of fractured fragments using low speed, high torque power drill. The end threaded negative profile pins (3.0 mm) were introduced into the predrilled tunnel and continuously flushed with a sterile normal saline at the site. In rostral fragment, drilling was done between the roots of two adjacent teeth to insert transcortical pins. One transcortical pin in rostral fragment and one pin in caudal fragment was placed. An external fixator / connecting bar was applied with the help of clamps on both side to the lateral surface of the horizontal ramus, with minimum two pins in the rostral fragment and two in the caudal fractured fragment. The proximal and distal mini clamps were attached to the pins and tightened to maintain reduction before confirming the fracture alignment and then the two centre pins were driven into the mandible using their clamps as guides. Excessive length of pins were trimmed using pin cutter and whole ESF assembly was cleaned aseptically and protected with bandaging.

Post-operative Care

Post-operatively, all the animals were administered with inj. oxytetracycline @ 5mg/kg BW I/V, inj. meloxicam @ 0.5mg/kg BW I/M and B-complex, intramuscularly for 7days, 5 days and 5 days, respectively. Antiseptic dressing with povidone iodine solution (2%) was performed on alternate day by flushing the shafts of pins and pin insertion sites. The whole assembly was covered with sterile gauge and bandage. On follow-up, interdental wiring was applied after removal of loosened ESF (under xylazine sedation) where additional support was needed in remaining healing period.

Results and Discussion

Radiographical examination revealed 4 (66.67%) cases of transverse fractures (Fig 1) and 2 (33.33%) cases of oblique fractures of horizontal ramus of mandible and all fractures were bilateral in nature. In 3 (50%) cases of mandibular fracture, the fracture site was anterior to tushes whereas in 2 (33.33%) cases fractures were in between premolars and in 1 (16.67%) case both sides of fracture site were different, i.e. between 2nd premolar and 1st molar tooth at left side and between premolars on right side.

In all cases, the external skeletal fixator assembly provided rigid fixation and adequate support at the fracture site for a particular time period (Fig 5) and all animals were able to prehense and drink water easily after application of ESF assembly (Figs 6, 7).

In present study, fracture union was assessed on the basis of clinical and radiographical examination. External callus formation at the fracture ends at various time interval were noted. An average healing period of mandibular fractures assessed on the basis of clinical and radiographical examination was 10.83±1.11 weeks where compound fracture took more time (10-14 weeks) than simple fracture (6 weeks) for complete healing. The clinical and radiographical union of fractured fragments occurred within 6 weeks in close oblique fracture (n=1) (Fig 8) while 11 weeks in open oblique fracture (n=1) and 10-14 weeks (mean 12±0.82 weeks) in open transverse fractures (n=4). All animals were able to prehense normally (Fig 6).

In present study, loosening of ESF assembly were observed at different time interval in all the cases and later, these were removed. The average removal period of ESF recorded was 5.67±0.76 weeks. Loosening/removal of ESF assembly was observed in 4 weeks (n=2, 33.33%), 5 weeks (n=1, 16.67%), 6 weeks (n=2, 33.33%) and more over 9 weeks (n=1, 16.67%). In 4 (66.67%) cases after removal of ESF, interdental wiring was applied for additional support in remaining healing period. However, in 2 cases (33.33%) after loosening, the ESF assembly was removed but mandible showed clinical union as there was no movement at fracture site hence did not require additional support of IDW. Osteomyelitis was not observed in the cases treated by ESF, clinically and radiographically.

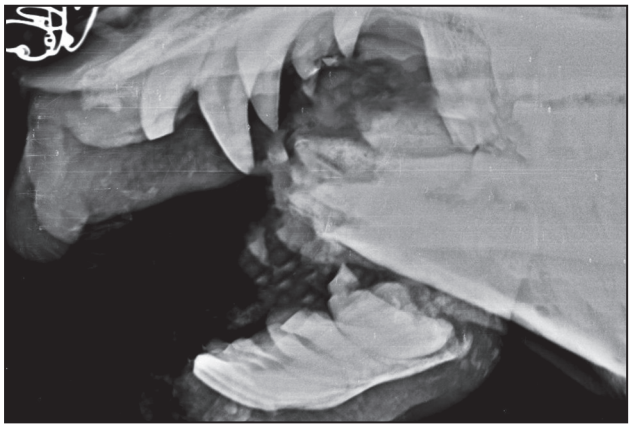

Fig 1. Lateral radiograph of mandible showing transverse fracture of horizontal ramus anterior to tushes. Note the ventrocaudal displacment of rostral fracture fragment.

Fig 2. ESF assembly at site after complete reduction of fractured mandible.

In present study, mild discharge at pin insertion site on the skin was recorded in all the cases. Submandibular abscesses were observed in 5 (83.33%) cases and these were lanced and cavity was flushed with light potassium permanganate solution and subsequent aseptic dressing with povidone iodine solution (2%) was done for one week. The submandibular abscesses in all cases healed within 7-10 days.

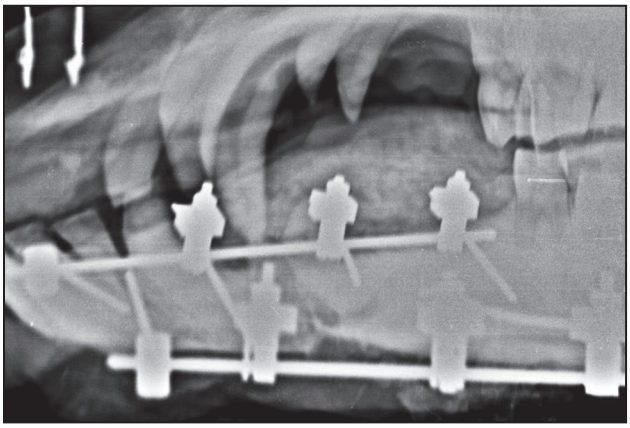

Fig 3. Lateral radiograph showing satisfactory reduction of fractured mandible using ESF device.

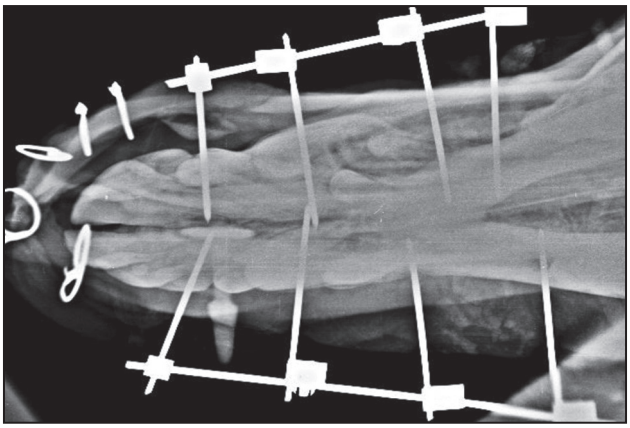

Fig 4. Dorsoventral radiograph showing satisfactory reduction of fractured mandible using ESF device.

External skeletal fixation is a technique of achieving the rigid fixation at the fracture site by percutaneous applied fixation of pins that penetrated the bone internally and externally was connected with connecting bar or clamps. They provided an early return to the function, facilitated the management of soft tissue wounds, helped preserving the local blood flow at the fracture site and allowed ease of implant removal (Vogel and Anderson, 2014).

Similar ESF technique in mandibular fracture was mentioned by Valle *et al* (2018), and Belsito and Fischer (2001) either alone or in combination with either intraoral wiring or lag screw in Mediterranean buffalo and equine, respectively. They reported healing after 10 weeks in Mediterranean buffalo and 38-76 days in horse. However, Parashar and Gahlot (2023) reported fracture healing in 6-8 weeks following transfixation of pins with fibre cast technique along with IDW in camel.

ESF technique efficiently managed not only transverse fractures but also oblique type fractures of

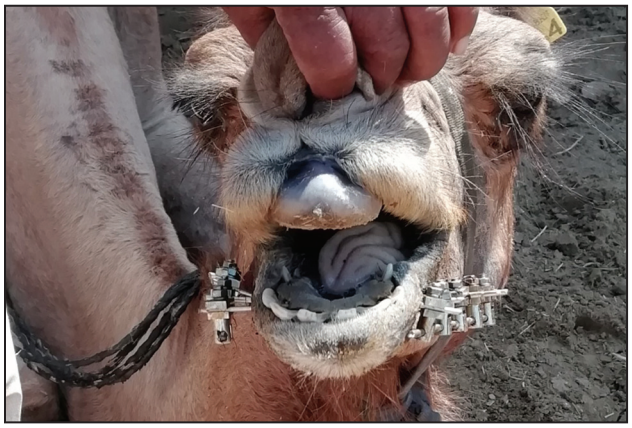

Fig 5. Rigid fixation and reduction provided by ESF assembly in case of mandibular fracture in camel.

Fig 6. Restoration of prehensile function in camel after application of ESF assembly.

Fig 7. A camel after application of ESF assembly was able to drink water conveniently.

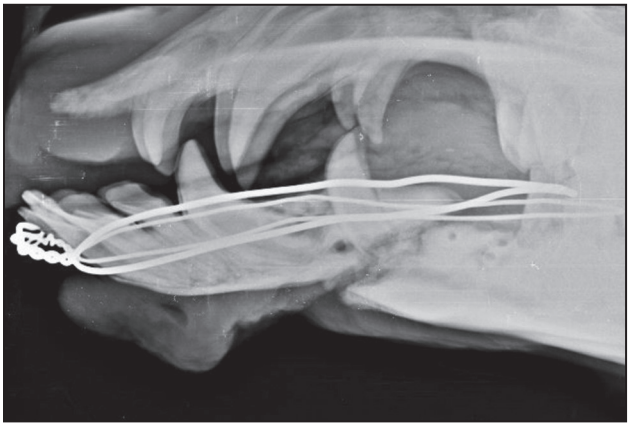

Fig 8. Lateral radiograph at 11th week revealed healing of mandibular fracture after removal of ESF assembly. The ESF was removed and additional support was provided with IDW.

mandible. IDW technique alone was not suitable for immobilisation of oblique fractures due to overriding and shortening of jaw (Gahlot *et al,* 1989; Gahlot, 2000; Parashar and Gahlot, 2023). Similarly, Parashar and Gahlot (2023) also successfully managed the oblique fractures with transfixation pins with fibre cast along with IDW technique.

The loosening of pins occurred due to thermal necrosis of bone at the pin insertion site or due to the infection in post-operative period at the pin insertion site (Singh *et al,* 2020; Smith and Kern, 1995). In this study low speed high torque power drill was used to avoid thermal necrosis of the bone.

Loosening of pin, mild discharge at pin insertion site and development of submandibular abscess (only in compound fracture) was observed during surgical repair of mandibular fractures. Amer (2013), Parashar and Gahlot (2023) and Valle *et al* (2018) also observed pin loosening during fracture healing period. Sub-mandibular abscesses is a common sequel during healing period in compound fracture of mandible (Gahlot *et al,* 1984; Bhabhor *et al,* 2020). In animals of present study osteomyelitis was not seen during healing period but many researchers recorded it during healing of fractures (Ahmed and Al-Sobayil, 2012; Ahmed, 2011; Al-Dughaym *et al,* 2003).

Conclusions

ESF technique is suitable for management of transverse and oblique type of mandibular fractures in camels.

Conflicts of Interest

The authors declare no conflict of interest.

References

Al-Dughaym AM, Ramadan RO, Mohamed GE, Fadlelmula A and Abdin Bey MR. Post-traumatic buccal infection and osteomyelitis with mandibular fracture in the dromedary camel. Journal of Camel Practice and Research. 2003; 10:74-76.

Ahmed AF. Mandibular fracture in single humped camels. Veterinary Surgery. 2011; 40(7):903-907.

Ahmed AF and Al-Sobayil FA. Fractures in young, single-humped camels (*Camelus dromedarius*). Turkish Journal of Veterinary and Animal Sciences. 2012; 63 (1):1-8.

Al-Sobayil F, Sadan MA, El-Shafaey ES and Ahmed AF. Can bone marrow aspirate improve mandibular fracture repair in camels (*Camelus dromedarius*). A preliminary study. The Journal of Veterinary Science. 2020; 21(6):e90.

Amer MSM. Clinical and educational studies on some equine fractures, Doctoral dissertation, submitted to the Cairo University. 2013.

Awwad Tamer E, El-Kammar Mahmoud H, Ahmed Howaida Abu, Korittum Sherif A. Mandibular fracture: a clinical study in dromedary camels. Alexandria Journal of Veterinary Sciences. 2022; 72(1):80-86.

Bhabhor HS and Tanwar M. Imaging studies of cadaver mandible of camel and its correlation with mandibular fracture. Journal of Camel Practice and Research. 2023; 30(3):331-335.

Bhabhor HS, Tanwar M, Palecha S, Bishnoi AK, Kachwaha K, Gahlot TK and Bishnoi P. Surgical management of mandibular fracture in camels using interdental wiring (IDW) technique. Ruminant Science. 2020; 9(10:169-172.

Belsito KA and Fischer AT. External skeletal fixation in the management of equine mandibular fractures: 16 cases (1988-1998). Equine Veterinary Journal. 2001; 33(2):176-183.

Fubini SL and Ducharme NG. Dentistry. In: Farm Animal Surgery. (2nd Edn.). Elsevier. 2017; pp 134-135.

Gahlot TK, Choudhary RJ, Chouhan DS, Chawla SK and Krishnamurthy D. Clinical evaluation of interdental wiring technique for mandibular fracture repair in camels. Indian Veterinary Journal. 1989; 66:251-254.

Gahlot TK. Fracture. In: Selected Topics on Camelids, Gahlot TK (Ed.). Sankhla Printers, Bikaner, India. 2000; pp 382-407, ISBN: 81-901141-0-7.

Gahlot TK. "The camel's lower jaw is unique." Down To Earth. 2005, Jan. 15. 2005.

Gahlot TK, Khatri SK, Chouhan DS, Choudhary RJ and Purohit RK. Repair of transverse mandibular fracture by silver wiring in camels (*Camelus dromedarius*). Indian Journal of Veterinary Surgery. 1984; 5:74-76.

Niwas R, Kumar S, Mathew RV. Surgical Management of Bilateral Mandibular Fracture in Camel by Interdental Wiring. Veterinary Clinical Science. 2020; 08(02):38-39.

Parashar MC and Gahlot TK. Surgical management of mandibular fracture in camels using modified IDW (IDW and transfixation of pins with fibre cast) technique. 2023; 30(3):323-326.

Rastabi HI, Moarabi A, Khajeh A and Kavosi N. Management of a bilateral mandibular fracture in a single-humped camel. Faculty of Veterinary Medicine, Urmia University, Urmia, Iran. Veterinary Research Forum. 2017; 8(2):171.

Siddiqui MI, Telfah MN, Rashid J and Taleb SA. Modified interdental wiring technique for mandibular fractures in camels: A Clinical Study. Journal of Veterinary and Animal Sciences. 2012; 2:57-60.

Singh AP, Singh G, Aithal HP and Singh P. The musculoskeletal system. Section D Fractures. In: Ruminant surgery. 2nd edn, Singh J, Singh S and Tyagi RPS ed. CBS Publishers and Distributors Pvt Ltd. 2020; pp 499-518.

Smith MM and Kern DA. Skull trauma and mandibular fractures. Veterinary Clinics: Small Animal Practice. 1995; 25(5):1127-1148.

Valle DG, Guccione J, Pasolini MP, Ciaramella P and Fatone G. External Skeletal Fixation for Surgical Repair of a Bilateral Mandible Fracture in a Mediterranean Buffalo. Pakistan Veterinary Journal. 2018; 38(4):456-458.

Vogel SR and Anderson DE. External skeletal fixation of fractures in cattle. Veterinary Clinics: Food Animal Practice. 2014; 30(1):127-142.

Zamos DT, Honnas CM, Herman JD, Sanders Elizabeth, Jensen JM and Holcomb JR. Surgical repair of a fractured mandible in an adult camel (*Camelus dromedarius*). Journal of Zoo and Wildlife Medicine. 1992; 23(3): 364-368.