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Management of mandibular fractures with ESF type-I, bone plating, and interfragmentary wiring in cattle

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Three cattle of different ages were reported with history of injury due to accidents leading to mandibular fractures. All fractures were involving horizontal ramus of the mandible, of which two were bilateral (C_1 and C_2) and one was unilateral (C_3). In C_1, bilateral hemimandibular fracture was stabilized with type-I ESF, and in C_2, only the displaced left hemimandible fracture was stabilized with Limited Contact Dynamic Compression Plate (3.5, 6-hole LC-DCP). Unilateral left hemimandibular fracture in C_3 was stabilized with inter-fragmentary orthopaedic wiring. In all the three cases, postoperative antibiotics, analgesics, multivitamins and calcium-phosphorus supplement were prescribed, also, regular flushing of oral cavity with light potassium permanganate solution, along with flushing of ESF pin tract in C_1. Owners were advised to provide soft feed to animals for 6 weeks postoperatively. In the final outcome, all the three animals were able to use the jaw for feed mastication.

Key words: *Cattle, mandible fracture, ESF, LC-DCP, orthopaedic wiring.*

Many types of surgical techniques can be used for the stabilization of mandibular fracture *viz.* pinless external fixators, interdental wiring (Reif *et al*., 2000), bone plating (Anderson, 2004), and external skeleton fixation (Valle *et al*., 2018). Intramedullary pinning can also provide adequate stabilization of fracture of rostral half of the mandibular body, whereas, fractures occurring caudal to the premolars and rostral to the vertical ramus of the mandible can be treated by application of an external skeletal fixator or a bone plate (Anderson, 2004). In present clinical report, diagnostic findings, surgical correction, and clinical outcome of mandibular fracture in 03 cases of cattle has been described.

At different times, three cases of cattle (C_1, C_2, and C_3) of non-descript breed were presented with history of accidental trauma, partially opened jaw, oral cavity swelling, tongue protrusion, inability in feeding and water intake at Veterinary Clinical Complex, CVAS, Bikaner, RAJUVAS, Rajasthan. All 03 animals were stabilized by fluid therapy, analgesic and antibiotic administration, and external splint support as a temporary stabilization (Fig. 1). Clinical and radiographic examination was performed, and thereafter, surgical stabilization was done according to the fracture type and site.

The animals were kept off-feed and water for 24 and 12 hours, respectively and restrained in lateral recumbency and extensive mandibular area was prepared for surgery by clipping, shaving and scrubbing, and oral cavity was flushed with light potassium permanganate solution (1:10000).

Case-1 (C_1): C_1 was an adult, non-pregnant, female cattle approximate 04 years of age, having bilateral mandibular fracture, where right side fracture was rostral to premolar with transverse configuration at interdental space and left side fracture was oblique in configuration between last premolar and 1st molar tooth. Both hemimandibular fractures were unstable and open inside oral cavity and were stabilized with type-I ESF as free form external skeleton fixation (ESF) technique under general anesthesia using xylazine @ 0.03 mg/kg b.wt., intramuscularly and ketamine hydrochloride @ 2.0 mg/kg b.wt., intravenously. Stab incisions were given at ventrolateral aspect of mandible and steinmann pins of 3.5 mm diameter were drilled (using autoclavable drill machine) as transcortical pin into the mandibular bone just dorsal to ventral mandibular border, while avoiding the mandibular teeth roots. In right hemimandible, one pin rostral and 03 pins caudal to fracture site were drilled, whereas on left side 02 pins rostral and 03 pins caudal to fracture site were drilled. In the ramus region, all the rostral and caudal fragment transcortical pins were smooth and trocar-ended Steinmann pins. Of the same diameter, one, end-threaded negative profile trocar-end pin was drilled in mandibular symphysis region in between the central incisors of the incisival bone. During drilling of Steinmann pins the site was continuously irrigated with normal saline solution to avoid the thermal injury or necrosis of bone. After placing all required transcortical pins in horizontal ramus and body, fracture was reduced by applying traction in rostral fragment through a bandage tied caudal to corner incisors at interdental space and proper jaw occlusion was made by apposition of upper and lower jaw. The external ends of all the pre-placed transcortical pins were interconnected via a hollow corrugated PVC

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Fig. 1: Moldable metallic sheet used as splint for mandibular support preoperatively.

Fig. 2: Transcortical pins interconnected with corrugated pipe filled with epoxy putty in C_1.

pipe (16.00 mm diameter) in 'U'-shape around the mandible and pipe was completely filled with epoxy putty (M-seal) after opening it with a linear incision **(Fig. 2)**. Both upper and lower jaws were kept stable (approx. for 45 min) in proper occlusion by externally tying a bandage around them until the filled epoxy got hardened completely. During this drying period, a uniform distance of approximate 10.00 mm was maintained between the jaw skin and inner surface of applied epoxy putty pipe. Extra length of transcortical pins outside the fixed corrugated pipe was cut by pin cutter and again epoxy was applied on their cut ends along with the pipe surface. Sterile gauze pieces soaked in povidone-iodine solution were applied at skin-pin interface and postoperatively owner was advised for their regular change after wound cleaning.

Case-2 (C_2): C_2 was an adult, non-pregnant, female cattle of approximately 04 years of age having bilateral mandibular fracture. The fracture was displaced in left hemimandible and present just rostral to 1st premolar at interdental space, while it was non-displaced fracture between 2nd and 3rd premolar teeth on right horizontal ramus. In unstable left hemimandible fracture, a 3.5 mm, 6-holed, Limited Contact Dynamic Compression Plate (LC-DCP) was applied, while for right hemimandibular fracture, the lower jaw was externally stabilized with a supportive splint made of moldable metallic sheet. Surgery for bone plating was performed under general anaesthesia, induced with propofol @ 2.0 mg/kg b.wt. intravenously, with endotracheal intubation for maintenance of anaesthesia with 2-3% isoflurane inhalant anaesthesia in 100% oxygen, in lateral recumbency. After aseptic preparation of surgical site at left hemimandible, fracture site was surgically exposed at ventro-lateral aspect of ramus by providing longitudinal incision on the ventral border of the horizontal ramus. After deviating the soft tissue using periosteal elevator, a straight, 3.5 mm, 6-holed, LC-DCP was applied laterally on the exposed bone surface near ventral border of horizontal ramus of mandible after maintaining fracture reduction with the help of reduction forceps. During surgical exposure of bone surface for the plate application, surgical wound communication with the oral cavity was avoided. Two 3.5 mm diameter transcortical cortical screws of 20.00 mm length were placed through plate holes in each fragment **(Fig. 3)**. After bone plate application, surgical site was thoroughly flushed with Normal Saline solution and the wound was sutured appropriately.

Case-3 (C_3): C_3 was a young, male cattle approximately 01 year of age, and was having unilateral mandibular fracture of left ramus at interdental space. The fracture was complete, with long oblique fracture line, so it was stabilized with interfragmentary orthopaedic wiring under general anaesthesia using Midazolam @ 0.2 mg/kg body weight and Ketamine @ 2.0 mg/kg body weight, intravenously. After exposure of fracture site through longitudinal incision provided at ventro-lateral aspect of mandible, fracture reduction was achieved and bone reduction forceps was applied. Two holes, perpendicular to fracture line, were drilled in each fractured fragment and two separate stainless steel orthopaedic wires (22G) were passed through these holes and knot was tied to achieve compression between the fragments **(Fig. 4)**. After application of interfragmentary wire, surgical wound site was thoroughly flushed with Normal Saline solution and wound was closed by standard procedure.

Immediate postoperative radiographic examination was performed with lateral oblique and dorsoventral projections to assess the quality of fracture fixation. Postoperatively, in all the three cases, administration of antibiotic strepto-penicillin 2.5 g intramuscularly b.i.d for 15 days, NSAID meloxicam 0.3 mg/kg b.wt. intramuscularly o.d. for 3 days, oral supplementation of multivitamins for 15 days, and calcium-phosphorus for one month was done. Animal owners were instructed for feeding of soft food to animal for at least 06 weeks and also regular flushing of oral cavity with light potassium permanganate antiseptic solution after every feeding. Regular antiseptic dressing of pin tract wounds in case of ESF application, and suture line in other 02 cases was also

Fig. 3: LC-DCP plate fixed with rostral and caudal fractured fragments with two screws in each fragment in C_2.

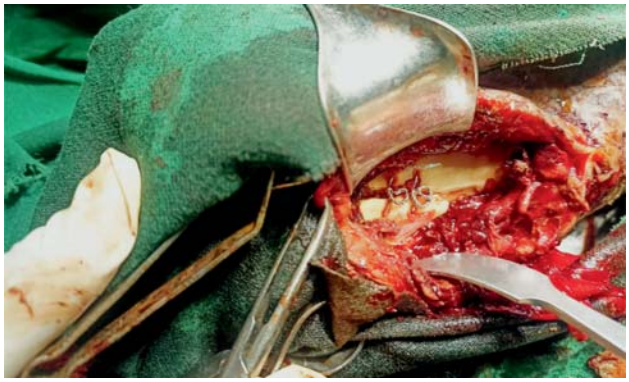

Fig. 4: Interfragmentary orthopaedic wiring (22G) in long oblique fracture of interdental space in C_3.

advised. Long term follow-up of all the three cases, through telephonic contact or during the possible clinical revisit by the owner with its animal, was done.

Among the present cases, all the 03 animals were able to drink water with proper jaw occlusion on the day surgery and began intake of soft diet from the next day of surgery. This indicates that with the use of respective fracture fixation techniques in these cases, good jaw occlusion and fracture stability was achieved. Proper apposition of fracture fragments for spontaneous healing, accelerated return of mandible function. In mandibular surgery, area caudal to interdental space is complicated because of presence of heavy muscle mass of the masseter and its vascularity, along with the location of the parotid duct, nerve, and the facial artery and vein (Catcott and Smithcors, 1972).

Immediate postoperative radiographic examination revealed the achievement of satisfactory fracture alignment, jaw occlusion, and implant position in all the three treated cases. On further 6th and 5th week follow-up postoperative radiographic examination, no deviation in achieved fracture alignment was seen, and even slight obliteration of fracture line was noticed in C_1 and C_2 cases, respectively. On physical examination, ESF assembly of C_1 was also found intact till this period. After this period, purulent discharge from pin tracts was observed and assembly became dislodged, but the pin tract wounds got healed within few days with regular flushing and dressing with antiseptic solution. Long term follow-up of animal condition was received through mobile phone images and videos sent by the owners. Animal owners were satisfied with the feeding habit, production and activity of the animal, however, slight deviation in jaw but with normal occlusion was observed in all the three cases.

The animals were able to move mandible during mastication of feed material and general health of all three animals appeared normal after surgery. In case C1, the tongue remained protruded up to the 4th postoperative week which was resolved later.

Some postoperative complications were also noticed in all the three cases, which included, pin tract infection (C_1), suture line abscess (C_2), and suture dehiscence (C_3). Animal C_3 died 02 weeks postoperatively due to occurrence of other trauma and systemic infection. However, the occurrence of complications did not affect the ultimate outcome of the other two cases (C_1 and C_2). Most of the mandibular fractures in the molar part are open into the oral cavity, and therefore osteomyelitis, alveolar periostitis, and bone sequestration are their common complications. The main goal of the surgical treatment is to stabilize the fracture sufficiently to allow the animal to feed comfortably until enough callus has formed to stabilize the fracture (Lischer *et. al.*, 1997).

It is concluded that rigid surgical fixation of mandible fracture using appropriate techniques can provide good healing condition of for early return of the function of the mandible.

References

Anderson, D.E. 2004. Orthopaedic injuries in small ruminants. American Association of Bovine Practitioners Proceedings of the Annual Conference. **37**: 135-139.

Catcott, F.J. and Smithcors J.F. 1972. Equine Medicine and Surgery. Wheaton, Illinois American Veterinarv Publications, 2nd ed., 881.

Lischer, C.J., Fluri, E. and Auer, J.A. 1997. Stabilization of a mandibular fracture in a cow by means of a pinless external fixator. Vet. Rec. **140**: 226-229.

Reif, U., Lischer, C.J., Steiner, A., Flüuckiger, M.A. and Auer, J.A. 2000. Long term results of bovine mandibular fractures involving the molar teeth. Vet. Surg. **29**: 335-340.

Valle, G.D., Guccione, J., Pasolini, M.P., Ciaramella, P. and Fatone, G. 2018. External skeletal fixation for surgical repair of a bilateral mandible fracture in a Mediterranean Buffalo. Pak. Vet. J. **38 (4):** 456-458.