



CASE REPORT

External Skeletal Fixation for Surgical Repair of a Bilateral Mandible Fracture in a Mediterranean Buffalo

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ABSTRACT

The surgical treatment and follow-up of a bilateral fracture of the molar part of the horizontal mandibular ramus, of a dairy Mediterranean Buffalo in “the field” were described. The mandibular region was swollen, painful and unstable on palpation. The radiographic examination confirmed the diagnoses. The association between sedation and nerve block of the mandibulo-alveolar nerve assured restraint and analgesia. The fractures were stabilized by linear skeletal external fixation, recycled from human medicine allowing a good mouth occlusion. Fifty-five days after surgery the fractures were completely healed and the heifer regularly calved 3 months after without any consequence for calf health.

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INTRODUCTION

Fractures of the mandible are the most common fractures of the cranium in cattle, usually involving the interdental space and the molar part of the horizontal ramus of the mandible (Lischer *et al.*, 1997a). To the author's knowledge, there is only a report about the surgical repair of mandibular fractures in a newborn buffalo calf (Singh, 1997) and no reports describe clinical and therapeutic features of mandibular fractures in adult Mediterranean Buffaloes (MB).

The present case describes clinical presentation, surgical treatment and follow-up of a bilateral fracture of the molar part of the horizontal *mandibular ramus* in a MB, stabilized by external skeletal fixation (ESF).

Case history: A 6 months dairy pregnant primiparous MB, 28 months old, was presented with a five days history of anorexia and severe salivation after knocking the head against the mixer-wagon during the feeding time. After the injury, the consumption of solid food and water had ceased, and general body condition rapidly worsened (BCS 2.75/5).

Clinical examination: On clinical examination, the rectal temperature was 39°C, the heart rate was 65 bpm and the respiratory rate was 48 breaths/minute. The buffalo showed extreme salivation and nasal discharge (Fig. 1A). Upon inspection of the mouth the mandibular region was

bilaterally swollen and painful; instability and crepitus were elicited on palpation. An open wound was present in the right intraoral side of the mandibular gingiva behind the second premolar (P2) (Fig. 1B). No additional pathological findings were detected.

Diagnosis: Radiographic examinations of the horizontal ramus of the mandible have been performed in latero-lateral and latero-lateral oblique projections (12 mAs – 74 Kv) by a digital portable X-ray system (ECOTRON, EPX-F2800, Seoul, Korea). A diagnosis of a complete bilateral ventrally displaced mandibular fracture was made. Radiographic examinations were suggestive of loss of the lamina dura surrounding the right tooth root of P2 and some bone fragments were evident around the fracture gap both sides. (Fig. 1B)

Treatment adopted: The buffalo was premedicated with Xylazine cloridrate (Rompun 2%, Bayer, Germany) 0.03 mg/kg i.v. and a mandibulo-alveolar nerve block was performed both side according to (Semieka and Misk, 2003). Briefly, a spinal Quincke needle (BD Medical - Medical Surgical Systems, Spain) 22 G × 3.1 inches [8 cm] was inserted 5-7 cm ventral to the mandibulo-temporal joint along the caudal border of the ramus. It was directed rostrally for 4-5 cm, medial to the caudal border of the ramus. Ten mL of Lidocaine 2% (Lidocaina 2%, Ati srl, Italy) was used for each nerve. Three additional Xylazine cloridrate 0.01 mg/kg i.v. boli were administered during

surgery to maintain an adequate plane of sedation. The fractures were reduced and stabilized by linear skeletal external fixator (IESF). After the routine aseptic preparation of the surgical field, the first smooth Kirschner pin (4mm ϕ x 250mm; Alcyon, Italy) was placed as a full pin in the rostral part of the jaw, back to the fourth incisor. The forward traction on the first full pin allowed the reduction of fracture. The reduction was considered good in presence of correct anatomical occlusion of the mouth (Fig. 2B). One positive threaded pin (4mm ϕ x 150mm; Alcyon, Italy) was placed, in both sides, cranial to the *incisura vasorum* in order to preserve the parotid duct and the artery and the facial vein. Two other threaded pins (4 mm ϕ x 150mm; Alcyon, Italy) were placed approximately 5cm rostrally and caudally to the fracture gap. All pins were connected to the bars (6mm ϕ x 500mm; Alcyon, Italy) through ESF clamps (4/6 size; Alcyon, Italy). A supplementary connecting system, Polymethyl-Methacrylate (PMMA; Fast fix "Formatray", Alcyon, Italy), was applied around clamps and bars involving pins.

Sodium Benzyl penicillin Procaine, Dihydrostreptomycin (Fatromicina FATRO, Italy) 30mL/kg q.d. i.m. and Meloxicam (Metacam, Boehringer Ingelheim, Germany) 0.5 mg/kg q.d. i.v., were administered for 10 and 7 days, respectively. Approximately 24h post-surgery, the MB was able to drink, chew and ruminate; physical general condition rapidly improved. Five days after surgery the farmer referred the traumatic pull out of three half pins on the left side. Therefore, a telescoping unilateral dynamic External Skeletal Fixator (dESF) recycled from human medicine (Monotube® Triax™ Unilateral External Fixation System; Stryker®, Kalamazoo, Italy) was chosen and applied, opportunely cleaned and sterilized (Fig. 2AC). Sedation and mandibulo-alveolar nerve blocks were performed as previously described.

The dESF was applied using the rostral full pin, placed in the previous surgery, and other 3 positive threaded pins (4mm ϕ x 16cm; Alcyon Italia S.p.A.) were placed through the dedicated clamps. All pins were inserted with the same technique of the previous implant. Other 10 and 5 days of antibiotic and NSAID were prescribed, respectively.

Fifty-five days after the second surgery, the good clinical condition and the radiological findings set the condition for an immediate removal of both the implants (Fig. 3). Moderate cutaneous and pin tract infections were treated with topic administration of Oxytetracycline spray (NeoSprayCaf®, q.d. for 4 days, Farmaceutici, Italy). No infections were instead detected within the oral cavity. The heifer regularly calved 3 months after (esteemed calving time) without any consequence of calf health.

DISCUSSION

According to authors knowledge this is the first clinical case describing the surgical treatment of a complete, bilateral mandibular fractures in a dairy MB. Fractured bones' repair is not commonly described in MB (Lischer *et al.*, 1997a) and no reports about mandibular fracture in adults exist. The surgical approach in our case was based on bovine studies (Lischer *et al.*, 1997a) and on economic considerations.



Fig. 1: Picture showing the inability to close the mouth at first clinical presentation (A). Lateral radiograph of the Mediterranean Buffalo head at the first presentation. On the right side the fracture line (star) is cranial the second premolar (P2) (B).

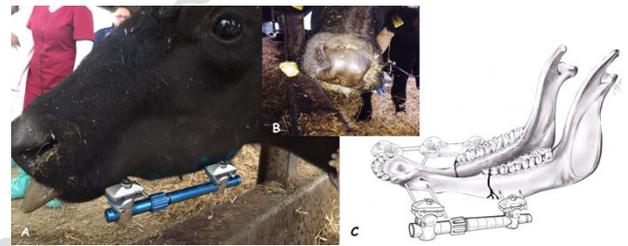


Fig. 2: Monotube® Triax™ left in place (A). Picture showing MB mouth occlusion obtained after surgery (B). Drawing represent the fracture lines and fixation systems in place (C).



Fig. 3: Lateral oblique radiograph of the Mediterranean Buffalo head, at 55 days after surgery and after implants removing. Right side: good reduction and bone healing (star). Left side: adequate bone reaction despite non-anatomical reduction (arrow).

We used the dosage of Xylazine indicated for bovines. At the best of our knowledge, no studies are present about the use of Xylazine in buffalo, even if Xylazine is one of the most used drugs in Buffalo clinical practice. Some concerns exist about the use of Xylazine in pregnant cows because of its oxytocine-like effects (Piccinno *et al.*, 2016). However, in *in vitro* studies, Xylazine induced modest effects on contractility in bovine uterine strips from 90 to 120 and 150 to 180 days of pregnancy and lidocaine decreased the tonic effect on pregnant uteri. The combination between sedation and local nerve block of the mandibulo-alveolar nerve was chosen to assure restraint and analgesia during the standing surgery. These techniques are considered safe and inexpensive while providing analgesia with minimal adverse effects (Re *et al.*, 2016). In this case the nerve block at the mandibular

foramen was performed to block the mandibulo-alveolar nerve, according to Semieka and Misk. (2003). Few reports describe the pathways of cranial nerves in buffaloes and the techniques of regional anaesthesia are mainly based upon the knowledge in cattle. Semieka and Misk. (2003) describe an easier technique in three buffaloes. However further *ex vivo* and *in vivo* studies would be necessary in a large number of animals and the chance of using ultrasound guided techniques could be investigated (Ravary *et al.*, 2004).

The conservative management of mandibular fractures has a poor prognosis, because the animals are unable to chew and therefore lose weight rapidly until they are generally exhausted (Lischer *et al.*, 1997a). The main goal of the surgical treatment is to achieve the stability of the fracture site and a good mouth occlusion sufficient to allow a comfortable eating until complete bone healing (Lischer *et al.*, 1997a).

In bovine various techniques have been reported to stabilize the fracture of the mandible (Lischer *et al.*, 1997a). In this case, the open fracture involved the molar part of the horizontal *mandibular ramus*. Usually these fractures are opened and contaminated (Ravary *et al.*, 2004). Their management requires an adequate debridement and disinfection of the site, to avoid the osteomyelitis, alveolar periostitis and bone sequestration (Ravary *et al.*, 2004). The environmental conditions of a standing surgery in the field are not suitable to perform an open reduction of fractures and they do not allow an easy applying of a plate and screw fixation.

The ESFs are largely employed in orthopaedic surgery and are an effective method for stabilization of many mandibular fractures in different species (Davidson and Bauer 1992; Lischer *et al.*, 1997b). They provide an early return to function, management of soft tissue wounds, preservation of local blood flow to the fracture site, ease of implant removal (Vogel and Anderson, 2014)

In this case the use of the linear ESF was sufficient to provide strength and stability to the mandibular fracture. The slight bone reabsorption around pins and a moderate periosteal bone reaction, suggest that the stability of the implant was adequate for all the bone healing time despite the non-anatomical reduction of the fracture gap. The osseous sequestrum and osteomyelitis have been reported in fragmented bovine mandibular fractures, treated with an AO/ASIF-Pinless External Fixators (Reif *et al.*, 2000). In our case the clinical and radiographic follow-up, despite the bilateral fragmentation, did not show signs of complications.

Economic considerations and non-availability of orthopaedic implants for large animals at the field level makes compound fractures non-treatable. In human medicine, the majority of external fixators are intended as "single-use" temporary frames, in place for a limited period of time prior to definitive fixation of skeletal injuries (Chaus *et al.*, 2014).

Based on our experience the employing of ESF recycled from human medicine seems to be a valid solution to treat the fractures of molar part of the mandibular ramus in conditions of economic constraints.

Authors contribution: GDV, JG, MPP, PC, GF participated in the conceptual aspect of the clinical approach to the case. GDV, JG, MPP, PC, GF complete clinical examination and collateral investigations of the patient. GDV, GF performed the surgical procedures. JG, MPP performed the anaesthesia during the surgery. All the authors provide the consultation about the follow-up. All authors provided consultation and coordination of the manuscript. GDV, JG, MPP wrote the first draft of the manuscript, with all authors involved in reviewing. All authors read and approved the final version of the manuscript.

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