

Surgical management of bilateral mandibular fractures with intraosseous wiring in dogs

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Abstract

Fractures are very common in dogs and usually involve both sides of the mandible. The majority of fractures occur due to trauma following road accidents, falls from heights, or fighting injuries. Various techniques have been used for the management of mandibular fracture in dogs, including tape muzzles, circumferential wiring, interdental wiring, intraoral splinting, intraosseous wiring, external skeletal fixators, and plating. The present study describes the surgical treatments of bilateral mandibular fractures in eight dogs presented to the Surgery OPD, TVCC, BVC, Patna, with a history of bleeding from the mouth, reluctant to eat, and persistently open mouth after injury. Based on the history, clinical, and radiological examinations, the cases were diagnosed as bilateral mandibular fractures, and surgical management was decided. Surgery was carried out under general anesthesia. The oral cavity was aseptically prepared, and the fractured mandibles were reduced by applying steady traction on the lower jaw to achieve proper alignment. Bilateral interdental wiring was performed by creating holes with an electric drill for wire placement. Orthopedic wires were threaded through these holes, twisted securely in the bone region, and positioned to bridge the fracture line effectively. Finally, the wires were tightened using a wire twister for proper immobilization. Post-operative antibiotics and analgesics were administered. All animals fully recovered within 30 days without any serious complications.

Keywords: Iatrogenic trauma, Immobilization, Intraosseous wiring, Mandibular fracture, Orthopedic wire

Highlights

- Mandibular fracture was diagnosed based on the history, clinical, and radiological examinations.
- Surgery was carried out under general anesthesia in lateral recumbency.
- Holes were drilled proximal and distal to the fracture, and wires were passed through.
- Orthopedic wires were twisted together to bridge the fracture line.

Mandibular fractures are among the most common fractures, accounting for 1.5 to 2.5% of all fractures in dogs. Young animals are more prone to mandibular fractures; approximately 50% are below one year of age (Carvalho *et al.*, 2015). The most common location of fractures in dogs is the mandibular body, which is involved in 80% of cases, with the premolar area being the most commonly fractured site. Fractures account for only 15% of mandibular symphysis injuries. However, in cats, the mandibular symphysis is the most frequently affected area, with nearly 73% of mandibular fractures occurring in this region. The mandibular body and ramus are affected in only 16% and 11% of cases, respectively (Castejón-González *et al.*, 2022). Mandibular fractures mainly occur secondary to trauma and are often open with mucosal defects (Boudrieau, 2012).

The surgical treatment of mandibular fractures is effective and has reduced complications during fracture repair by selecting appropriate techniques

(Sangamitra and Vijay, 2021). Various techniques have been used for the repair of mandibular fractures in dogs, including tape muzzles, circumferential wiring, interdental wiring and intraoral splinting, intraosseous wiring, external skeletal fixators, and plating techniques (Rani *et al.*, 2022). Intraosseous wire fixation is a simple technique that works on the basis of the tension-band principle. Due to the small size of the wire, tooth roots are easily avoided when placing wires on the alveolar surface of the bone. It provides support against distracting (due to bending) and shearing forces at the fracture site. A single wire suture of 1.5-mm diameter, when applied to thicker bones, such as in the mandibular body or ridges of the vertical mandibular ramus, sufficiently neutralizes bending forces (Boudrieau, 2020). If anatomic reduction can be maintained, lateral bending, shear, and rotational forces on the mandible are minimal. The present report describes the surgical management of bilateral mandibular fractures in eight dogs.

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The study involved eight clinical cases of bilateral mandibular fractures presented at the Surgery OPD, TVCC, BVC, Patna. The dogs had a history of mouth bleeding, reluctant to eat, and a persistently open mouth after traumatic injury. Clinical examination revealed blood-tinged excessive salivation, abrasions around the mouth, local swelling, mal-alignment of the lower jaw, drooping mandibles, tongue protrusion, and fractures of the mandibles. Radiological examination showed complete bilateral fractures at various locations, including between the 3rd and 4th premolar teeth, 2nd and 3rd premolar teeth, molar and premolar teeth, and premolar and incisor teeth. Based on the history, clinical, and radiological examinations, the cases were diagnosed as bilateral mandibular fractures, and surgical management was decided.

Surgery was performed under general anesthesia. General anesthesia was induced with premedication of atropine sulphate (0.04 mg/kg body weight, intramuscularly) and xylazine (1 mg/kg body weight, intramuscularly), followed by induction with ketamine hydrochloride (5 mg/kg body weight, intramuscularly) and maintenance with a combination of diazepam (5 mg/mL) ketamine (50 mg/mL) in 1:1 ratio, intravenously. The oral cavity was prepared aseptically, and reduction of the fractured mandibles was performed with steady traction on the lower jaw, maintaining proper alignment. Bilateral intraosseous wiring with orthopedic wire of 20 to 22 gauge wires, depending on the weight of the animals, was performed by creating holes for the placement of a single wire using an electric drill. Orthopedic wires were passed through these holes, twisted together in the bone region, and intraosseous wiring was positioned to bridge the fracture line. Finally, the wires were tightened using a wire twister for proper immobilization.

Postoperatively, the animals were treated with a broad-spectrum antibiotic (ceftriaxone/tazobactam) at 25 mg/kg body weight intravenously every 12 h for 7 days and a non-steroidal anti-inflammatory agent (meloxicam) at 0.1 mg/kg body weight intramuscularly

daily for 3 days. Owners were advised to provide a liquid diet for one week, followed by a semisolid diet and then normal feed in the subsequent weeks.

All animals started licking the water on the same day of the operation. Latero-medial and dorso-ventral radiographs showed proper reduction. After four weeks, radiological examination confirmed the union of the fractures. All animals fully recovered within 30 days without any serious complications (Table 1). Four dogs were under one-year-old, two dogs were between one and two years old, and two dogs were over two years old. Out of eight dogs, six were males, and two were females. Breed-wise distribution showed that four dogs belonged to the Spitz breed, two dogs were Mongrels, and one dog each belonged to the German Shepherd and Labrador Retriever breeds. Small breed dogs under 12 months old were the most commonly affected group (Table 1). As dogs mature, their bone mineral content and density increase (Lorinson *et al.*, 2008). Therefore, younger dogs, with their relatively low bone density, are more susceptible to mandibular and other fractures (Kitshoff *et al.*, 2013). The relative sizes of the victim and the attacker significantly influence the severity of bite wounds (Shamir *et al.*, 2002). Larger animals have stronger biting forces (Ellis *et al.*, 2009), making smaller dogs more prone to fractures, particularly of the mandible, when bitten by larger dogs compared to when larger dogs are bitten by smaller dogs.

All clinical cases of mandibular fractures in the present study were open, as the mandibles are covered with a small amount of soft tissue. Traumatic injuries to the mandible or maxilla, often associated with accidents, may also involve other body regions, necessitating clinical examination and treatment for other injuries along with the correction of mandibular fractures (Rani *et al.*, 2022). In the present study, compression of the lumbar vertebrae was observed in two cases and subsequently treated.

Healing of mandibular fractures is possible with the presence of a small fracture gap and minimal mobility if infection is prevented, revascularization is encouraged,

Table 1. Distribution of fractures based on breed, age, sex, type of fracture, size of orthopedic wire used, and healing time

Case No.	Breed	Age	Sex	Type of fracture	Size of wire used	Healing time (days)
1	Spitz	4 years and 2 months	Male	Oblique	20G	30 days
2	Spitz	3 years	Male	Transverse	20G	30 days
3	Spitz	5 months and 16 days	Female	Transverse	22 G	21 days
4	Spitz	1 year	Male	Oblique	20G	30 days
5	Mongrel	3 months and 18 days	Male	Oblique	22 G	21 days
6	Mongrel	9 months	Male	Oblique	22 G	21 days
7	German Shepherd	7 months and 13 days	Female	Transverse	20G	21 days
8	Labrador Retriever	5 months and 15 days	Male	Oblique	20G	21 days

Management of mandibular fracture in dogs



Fig. 1. Clinical case of bilateral fracture



Fig. 2. Complete recovery



Fig. 3. Pre-operative radiograph of mandible



Fig. 4. Post-operative radiograph of mandible

and vascularity is protected. Unstable and bilateral mandibular fractures require surgical correction. Appropriate pre-operative, intra-operative, and post-operative management of jaw fractures is imperative for successful results. Intraosseous wiring provides proper immobilization, which can also be achieved by tape muzzles (Arcabasso and Torres, 2019), mini-plate fixation (Murthy *et al.*, 2023), circular external skeletal fixation (Marshall *et al.*, 2010), bignathic encircling and retaining devices (Nicholson *et al.*, 2010), and plating (Evenhuis *et al.*, 2022).

A single intraosseous wire was applied in a simple interrupted pattern to counteract bending forces. This wire can be supplemented with a second wire, typically positioned parallel to the first on the aboral mandibular surface, to counteract rotational and shear forces. When two wires are placed slightly apart, they distribute support over a larger fracture area, particularly beneficial in large-breed dogs (Boudrieau, 2020). Intraosseous wiring minimizes iatrogenic trauma to the mandibular nerves, blood vessels, and tooth roots. The small size of the wire provides flexibility in its placement on the biomechanically favorable alveolar surface, preventing interference with the tooth roots

(Smith, 2002). In the present study, intraosseous wiring was done with 20 G and 22 G orthopedic wires, which were strong enough to maintain stability and provide adequate immobilization of the mandibular fracture.

Mandibular fractures can be repaired using intraosseous orthopedic wiring without any serious post-operative complications. Orthopedic wiring is a comparatively simple method for repairing mandibular fractures compared to other techniques.

Conflict of interest: The authors have no conflict of interest in the present clinical case study.

Author's contribution: RK: Carried out the diagnosis, anesthesia, surgical management and post-operative observation of clinical cases; A: Carried out the anesthesia and assisting during surgical clinical cases; BK: Carried out post-operative care, management and recording the data.

Data availability statement: All the data supporting the findings have been presented in this article. The corresponding author is willing to provide the raw data upon reasonable request.

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