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Orthopaedic Emergencies: A Modern Guide to Managing Open Fractures in Veterinary Medicine

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Abstract

Open fractures are frequently encountered in veterinary practice. The main reason behind open fractures is automobile trauma. Due to late presentation and much contamination, the open fractures pose a great difficulty in its management. An open fracture is a result of high-energy trauma. This may lead to exposure of bone, increased risk of infection, and improper wound healing. So, the management of open fractures becomes important for the dog. This article discusses the overview of management of open fractures in animals. In the high-stakes world of veterinary orthopedics, few scenarios are as urgent or demanding as the open fracture. Defined by a break in the bone that communicates with the external environment through a skin wound, these injuries are biological "dirt bombs". The clock starts ticking the moment the skin breaks, shifting the clinical focus from simple mechanical stabilization to the aggressive prevention of osteomyelitis.

Keywords: Open fracture, contamination, fixation.

1. Occurrence

The cattle had higher percent of open fractures (54.38%) as compared to that in buffaloes (17.76%). (Yadav GP et al., 2019). Out of total number of fractures (81), 69 were closed (85.18%) and 12 were open (14.82%). In dogs, all fractures were closed except one, which was in humerus due to gunshot (bullet) injury. However, in cows, closed and open fractures were equal (50% each). (Khushwaha et al., 2011). The high per cent of open fractures in cows were probably due to fact that most of the fractures were seen in tibia, metatarsal or metacarpal bones, which have less muscle covering and also fractures in these bones were mostly oblique or comminuted in nature and had sharp edges that normally results in tearing of muscles and skin (Aithal et al., 2007).

2. Classification: Assessing the Damage

The Gustilo-Anderson classification system remains the gold standard for grading these injuries. Understanding the grade is crucial for determining the prognosis and the intensity of the required intervention. Open fractures are described into three types by on the basis of associated soft tissue damage. Type 3 is further divided into 3 types. Type I has wound <1cm with minimal soft tissue damage, contamination and comminution. Type II has wound area >1cm with moderate soft tissue damage and minimal periosteal stripping. Type IIIA suffers severe soft tissue damage and substantial contamination with adequate coverage. Type IIIB suffers with severe soft tissue damage and substantial contamination with inadequate coverage. Type IIIC suffers arterial injury which requires repair. (Gustilo et al., 1976; Gustilo et al., 1984).

The major shortcoming of this scheme is that it only results in moderate (60%) interobserver agreement (Brumback and Jones, 1994). The Orthopaedic Trauma Association has proposed a new, as yet untested, scheme (Orthopaedic Trauma Association, 2010; Wang et al., 2011) that consists of five factors including skin defect (S), muscle injury (M), arterial injury (A), bone loss (B) and contamination (C). They are each divided into mild, moderate and severe subgroups (1–3).

Table1. New classification scheme as proposed by the Orthopaedic Trauma Association (Orthopaedic Trauma Association, 2010)

Factor	Severity
Skin	1) Can be approximated 2) Cannot be approximated 3) Extensive de-gloving
Muscle	1) No muscle in area, no appreciable muscle necrosis, some muscle injury but with intact muscle function 2) Loss of muscle but the muscle remains functional, some localised necrosis in the zone of injury that requires excision, intact muscle-tendon unit 3) Dead muscle, loss of muscle function, partial or complete compartment excision, complete disruption

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	of a muscle-tendon unit, muscle defect does not approximate
Arterial	1) No injury 2) Artery injury without ischemia 3) Artery injury with ischemia
Contamination	1) None or minimal contamination 2) Surface contamination (easily removed, not embedded in bone or deep soft tissue) 3a) Embedded in bone or deep soft tissue 3b) High risk environmental contamination
Bone loss	1) None 2) Bone missing or devascularised but still some contact between proximal and distal fragments 3) Segmental bone loss

This system is more precise, and may help communicate patient status, guide treatment decisions and predict prognosis (Millard and Towle, 2012).

3. The "Golden Period" and Initial Stabilization

The immediate priority is never the bone; it is the patient. Before addressing the fracture, the clinician must stabilize life-threatening issues (shock, thoracic trauma, or haemorrhage) using triage protocols (ABCDE).

Immediate Wound Care

Once stable, the wound must be protected.

Cover the wound: Apply a sterile, saline-soaked gauze dressing immediately to prevent further nosocomial contamination.

In one study, 92% of open fracture infections were caused by bacteria acquired while the patient was in the hospital (Carsenti-Etesse et al., 1999).

Clip and Clean: Generously clip the hair around the wound. Apply sterile lubricant to the wound itself before clipping to prevent hair fragments from entering the deep tissue.

4. Debridement and Lavage: "The Solution to Pollution"

The most critical step in managing an open fracture is surgical debridement. The goal is to convert a contaminated wound into a clean surgical one.

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Aggressive Debridement: Debridement should be performed on an urgent, but not emergent basis; adequacy of debridement and timeliness of soft tissue closure coverage (Perry 2016). Remove all devitalized tissue, debris, and small, unattached bone fragments (those without soft tissue attachments).

The study's findings imply that the formation of delayed union or atrophic non-unions may be influenced by repetitive irrigation and debridement, which are linked to prolonged stiff immobility. Therefore, when treating open fractures, repeated irrigation and debridement may be required to limit infection.

The possibility of nonunions must be recognized by the surgeon. The healing process should be closely monitored. Once sufficient soft tissue covering has been achieved, early preventive measures including bone grafting, dynamization of external fixators, or conversion of a rigid fixator to an intramedullary nail may be required. (Park et al., 2002).

Copious Lavage: Use large volumes of sterile isotonic crystalloid (0.9% NaCl or Lactated Ringer's).

Pressure Matters: *Medium-pressure systems* deliver solutions at pressures near 7 to 8 psi, which has been shown to be effective in dislodging foreign material and bacteria without risk of driving bacteria into the wound. Such a system can be developed by using a 35-ml syringe and an 18-gauge needle.

5. Antibiotic Therapy: Hit Early, Hit Hard

Antibiotics should be administered as soon as possible—ideally within one hour of injury. There was no change in the infection rates of type 1 and type 2 fractures, which were 5.8% and 6%, respectively, in a randomized, double-blind trial of 171 open fractures in people treated with ciprofloxacin alone or a combination of second-generation cephalosporin and gentamicin. According to Patzakis et al. (2000), the ciprofloxacin-only group had a considerably greater infection risk for type 3 fractures (31%) compared to the cephalosporin/gentamicin group (7.7%). Type 3 fractures need greater antimicrobial coverage because of the degree of soft tissue impairment and higher contamination, which increases the likelihood of infection, perhaps with several species (Patzakis et al., 2000).

6. Fracture Fixation: Stability is Key

Stability is not just for bone healing; it is essential for fighting infection. Mobile bone fragments irritate soft tissues and promote bacterial growth.

External coaptation is not normally recommended as the definitive method of fixation for any open fracture in our veterinary patients. Frequent removal of casts and splints is required

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to appropriately evaluate and assess most open fracture wounds, and this makes adequate stabilisation difficult to achieve (Nunamaker and Berg, 1985).

External Skeletal Fixation (ESF)

ESF is often the treatment of choice for Type II and III open fractures. It allows for rigid stabilization while keeping the hardware away from the "zone of injury," providing easy access for daily wound care.

Internal Fixation

Plates and screws are generally reserved for Type I fractures or cases where the wound can be definitively debrided and closed. Modern "biological plating techniques (minimally invasive) are increasingly used to preserve the remaining blood supply.

Delayed union and non-union rates are reported as 0–5% in type 1 fractures, 1–14% in type 2 fractures, and 2–37% in type 3 fractures (DeLong et al, 1999; Harley et al, 2002). Amputation may be necessary with type 3 fractures, fractures with multiple complications, and those associated with severe neurovascular injury (Millard and Towle., 2012).

7. The Road to Recovery: Post-Operative Care

Managing an open fracture doesn't end in the OR.

Analgesia: Multimodal pain management (opioids, NSAIDs, and local blocks) is mandatory.

Wound Management: For large soft-tissue defects, Negative Pressure Wound Therapy (NPWT) has revolutionized veterinary care by stimulating granulation tissue and reducing edema. While NPWT appears to be a promising modality in the management of musculoskeletal wounds, additional studies are required before a definitive recommendation can be made (Okike and Bhattacharyya, 2006).

Monitoring: Frequent radiographic follow-ups are necessary to watch for signs of implant failure or sequestration (dead bone fragments).

Conclusion

The management of open fractures is a marathon, not a sprint. Success hinges on early intervention, meticulous debridement, and rigid stabilization. While these cases are challenging and often costly, a systematic approach allows most veterinary patients to return to excellent functional mobility.

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