Journal of Chemical, Biological and Physical Sciences

An International Peer Review E-3 Journal of Sciences

*Available online at*www.jcbsc.org

Section B: Biological Sciences

CODEN (USA): JCBPAT Review Article

Fracture Management in Animals: A Review

Tanvi Mahajan[1], Subha Ganguly[2]* and Parveez Ahmad Para[3]

[1]Assistant Professor, Department of Veterinary Anatomy & Histology,

[2]Associate Professor & Head, Department of Veterinary Microbiology,

[3]Assistant Professor, Department of Livestock Products, Technology, Arawali Veterinary College (Affiliated with Rajasthan University of Veterinary and Animal Sciences, Bikaner), N.H.- 11 Jaipur Road, V.P.O. Bajor, Dist. Sikar, Pin – 332001, Rajasthan, India.

Received: 1 September 2015; **Revised:** 11 September 2015; **Accepted:** 16 September 2015

Abstract: Bones fracture frequently and often result in significant impairments, functional limitations, and disabilities, especially when the hand is involved. When fractures occur, there is a disruption of the skeletal tissue organization and a loss of mechanical integrity. The goal of fracture healing is to regenerate mineralized tissue in the fracture area and restore mechanical strength to the bone. Of equal importance is the reconstitution of the normal soft tissue gliding and movement about the fracture site.

Keyword: periosteum , olecranon , tuberosity , osteoporotic ,

INTRODUCTION

A fracture is a dissolution of bony continuity with or without displacement of the fragments. It is always accompanied by soft tissue damage of varying degrees, there are torn vessels, bruised muscles, lacerated periosteum, and contused nerves. Sometimes there are injured internal organs and lacerated skin. The trauma to soft tissue must always be taken into consideration and is often vitally more important than the fracture itself[1].

ETIOLOGY OF FRACTURES

EXTRINSIC CAUSES

Direct Violence: Trauma is the most common cause of fractures in small animals and is usually due to automobile injury or falling from a height. Since direct trauma is rarely delivered in a calibrated amount to a specific place, the resultant fracture is rarely predictable. The amount and direction of force will vary from accident to accident. Most fractures resulting from violent direct trauma are either comminuted or multiple[2].

Indirect Violence: Fractures due to indirect trauma are more predictable than those due to direct trauma. Generally a force is transmitted to a bone in a specific fashion and at a "weak link" within the bone, causing a fracture to occur.

Bending Forces: Bending fractures occur when force is applied to a specific focal point on a bone to the extent that the traumatic force overcomes the elastic limit of the bone diaphysis[3]. The initial effect of a bending force is a cortical break opposite the site of the trauma. The periosteum will remain intact on the side of the force while tearing over the fracture on the opposite side. With additional force the entire bone snaps, with attendant tearing of vascular and soft tissue structures within or on the diaphysis. Bending fractures are generally oblique or transverse.

Torsional Forces: Torsional fractures occur when a twisting force is applied to the long axis of a bone. Usually this is a result of one end of a bone being placed in a fixed position while the other end of the bone is forced to rotate. The resulting fracture will be a very long spiral with sharp points and often sharp edges. It is possible for the sharp points or edges to compromise soft tissues or to cut through the skin and result in an open fracture[4]. Torsional forces generally result in short or long spiral fractures. (Example: A cat jumping from a garage roof to a fence misjudges the distance and catches its hock in the fence. The resulting force of its body twisting against the fixed lower extremity results in a spiral fracture of the tibial diaphysis.)

INTRINSIC CAUSES

Fractures Due To Muscular Action: Fractures caused by violent contraction of a muscle are called avulsion fractures. They may occur because of violent isometric contraction, but are associated more commonly with trauma that results in forceful muscular shortening. These fractures frequently occur in immature animals while the physeal plate remains open. Such muscular forces are more likely to separate a cartilaginous union than the eventual bony union of mature animals[5].

Avulsion fractures affecting bony prominences that serve as the major origin or insertion of a muscle are seen routinely. The processes commonly avulsed include the acromion, scapular tuberosity, greater humeral tubercle, olecranon, ischial tuberosity, greater trochanter, tibial tuberosity, and the calcaneus of the fibular tarsal bone[6].

Pathologic Fractures: Pathologic fractures occur because of underlying bony or systemic disease that causes one, many, or all bones of an animal's skeletal system to be abnormal and thus more susceptible to fracture. Pathologic fractures may occur from any type of trauma: bending force, torsional force, compressive force, or shearing force. Often the only force necessary to cause fracture is the animal's weight; thus, spontaneous fracture occurs without overt trauma[7].

Pathologic fracture may occur through any of the following types of bony pathology: neoplasia, bone cysts, osteoporotic bone caused by secondary NHPO, nutritional hyperparathyroidism, localized bone infection

(osteomyelitis), osteoporotic bone caused by disuse following prolonged external fixation or removal of a rigid internal device[8].

PRINCIPLES OF TREATMENT

The ideal objective of fracture treatment is to provide a completely rehabilitated patient as quickly as possible. Successful fracture treatment comprises a perfectly aligned bone of full length that has solidly united joints that are freely movable to their fullest range, and musculature, innervation, and integument surrounding the site of the previous fracture that are completely normal. This idealized concept can rarely be achieved in a clinical situation. It is important that the surgeon strive to meet these criteria using all avenues of treatment by means of operative and no operative management of the fracture[9,10]. The objectives to be striving to include the following:

1. Sufficient reconstruction or restoration of normal form to meet the requirements expected of the limb
2. Immobilization of bone fragments until fracture healing has occurred
3. Mobilization of all joints involved during the process of fracture healing to prevent joint stiffness, fracture disease, and muscle atrophy[11.]
4. Rehabilitation of the patient within a reasonable time, allowing the animal to continue at the level of service at which it functioned previous to the injury

From the objectives it is clear that even for the same fracture the type of treatment needed may vary from animal to animal. The racing sled dog exhibits a greater need for function than does the 12-year-old house pet. The amount of function lost by the older animal can be considerable and still allow for maintenance of performance at the preinjury level. The racing sled dog cannot afford to lose function, since this prevents a return to the level of preinjury function.

METHODS OF MANAGEMENT

Fracture management can be classified according to the type of method used to achieve bony union. This classification is given below:

Closed reduction with external fixation such as a cast or splint Open reduction without internal fixation, with reduction maintained in a cast or splint. External skeletal fixation in which reduction may be either open or closed and immobilization of the bone is maintained through the use of pins, clamps, and sidebars Open reduction with internal fixation, such as intramedullary pins or plate and screws Closed reduction with internal fixation: rather than making the exposure in the fracture site, an incision is made through the skin allowing introduction of the internal fixation device, for example, closed intra-medullary pinning or Kuntscher nailing

Closed Reduction: Closed reduction, usually with external fixation in the form of a cast or splint, can be accomplished in many fractures seen in small animal orthopedics. The technique is used whenever a fracture can be reduced to the point at which the displacement is not more than one half the width of the diaphysis of the broken bone. Axial and rotational alignment should be correct, and the fracture should be inherently stable after reduction so overriding does not occur when the animal is placed in a cast or splint. If these criteria are met, the animal's fracture can be safely treated with external fixation. One additional problem associated with casting and splinting is immobilization of joints above and below the fracture site. Although it has been shown by Sarmiento that it is unnecessary to immobilize the joint above and below

the fracture site, it is often advantageous to do so to maintain stability at the fracture site, thus initiating fracture healing[12]. If immobilization of the joint above or below the fracture site will cause limitation of joint movement following fracture healing, other forms of fracture treatment should be considered. The most common fracture treated with closed reduction and cast or splint immobilization in our clinic is that of the radius and ulna, followed with less frequency by the tibia. The humerus and femur are treated with closed reduction and external fixation less commonly. Metacarpal, metatarsal, and other shorter bones can also be immobilized in a cast or splint after reduction.

Open Reduction without Internal Fixation: Occasionally transverse or short oblique fractures occur with sufficient overriding that closed reduction is impossible. These fractures are completely stable once reduced; therefore, an open reduction is accomplished using a bone elevator to reduce the fracture fragment, and no internal fixation is necessary. These fractures are then incorporated in plaster or some cast material and treated as closed fractures after closed reduction. Fractures treated in this manner include midshaft to distal one third radial and ulnar fractures and proximal transverse tibial fractures[13]. By obtaining a perfect reduction, these fractures usually heal rapidly without further interference of the blood supply by an internal fixation device. When performing open reduction without internal fixation, it is important that internal fixation equipment be available should it become necessary at the time of surgery.

External Skeletal Fixation: Trans fixation pinning, whether using half pins or full pins, can be accomplished by means of either open or closed reduction techniques. Occasionally in severely comminuted fractures, the proximal and distal fragments are grasped with the trans fixation pins to maintain axial alignment, allowing the central comminuted aspect of the fracture to coalesce and heal. In these cases open reduction is usually not carried out, but the end result is satisfactory. Trans fixation pinning is also often used with open reduction of open fractures following thorough surgical debridement.

Open Reduction and Internal Fixation: Open reduction and internal fixation allows the anatomical reduction of fracture fragments with complete control over their immobilization. This excellent reduction and stability encourages rapid union with earlier useful function of the limb. The need for an external splint or cast, which would compromise the function of the joint and lead to muscle atrophy, is eliminated.

Indications for open reduction and internal fixation include fractures that require open reduction because of inability to reduce and/or stabilize the fracture by closed means. Many comminuted or overriding fractures cannot be brought into adequate approximation and alignment by closed methods; therefore these fractures must be treated by open reduction and internal fixation. Most of these fractures are inherently unstable when reduced; hence the internal fixation must be applied after the open reduction. Certain fractures can be treated with closed reduction and internal fixation, but the best functional result is usually achieved with open reduction and internal fixation. The criteria for using one method over another depend on the expected result, the final desired function of the animal, and the skill of the surgeon. Occasionally open reduction and internal fixation is performed with the goal of limiting the convalescent period of rehabilitation. The total time of the surgeon involved with the patient decreases, since it is unnecessary to perform cast or splint changes weekly over a continuing period. This results in faster rehabilitation of the dog and fewer problems for the owner. Fractures associated with arterial laceration and/or nerve trunk denervation are often opened as a result of these complications. Since it is important to immobilize the fracture to prevent reinjure of the trapped nerve or injured blood vessel, internal fixation is accomplished at this time[14].

SUMMARY

When examining an animal with a fractured bone, it is important to remember that the entire animal may need treatment, as well as the fracture. Every fracture is part of a functioning animal, and although the fracture may be obvious it is only a small portion of the problems present because of the trauma sustained.

REFERENCES

1. J. Jenny, Orthopaedic Notes, Unpublished, University of Pennsylvania, 1970.
2. W. O. Brinker, Types of fractures and their repair, *In Archibald J (ed): Canine Surgery*, 2nd ed, Santa Barbara, American Veterinary Publications, 1974, 957- 960.
3. H. R. Denny, A Guide to Canine Orthopaedic Surgery, Oxford, Blackwell Scientific Publications, 1980.
4. A. F. De Palma, The Management of Fractures and Dislocations, Vol. 1 and 2. Philadelphia, WB Saunders, 1959.
5. J. J. Gartland, Fundamentals of Orthopaedics, Phila- delphia, WB Saunders, 1965.
6. E. P. Leonard, Orthopaedic Surgery of the Dog and Cat, 2nd ed, pp 90-94. Philadelphia, WB Saunders, 1971.
7. R. B. Salter and W. R. Harris, Injuries involving the epiphy- seal plate, *J Bone Joint Surg.*, 1963, 45A, 587.
8. W. G. Whittick, Canine Orthopaedics, *Philadelphia, Lea & Febiger*, 1974, 127-130.
9. M. Allgower and P. G. Spiegel, Internal fixation of fractures: Evolution of concepts, *Clin. Orthop. Rel. Res.*, 1979, 138, 26.
10. O. P. Hampton and W. T. Fitts, Open reduction of common fractures, In Modern Surgical Monographs, *New York, Grune & Stratton*, 1959.
11. R. B. Salter, P. F. Simmonds, B. W. Malcom et al., The biological effect of continuous passive motion on the healing of full-thickness defects in articular cartilage, *J Bone Joint Surg.*, 1980, 61A, 1232.
12. A. H. Downer and V. L. Spear, Physical therapy in the management of long bone fractures in small animals, *Vet. Clin. North Am.*, 1975, 5, 157.
13. A. Sammiento, L. Latta, A. Zilioli et al., The role of soft tissues in the stabilization of tibial fractures Res, 1974, 105, 116.
14. J. C. Ellsasser, C. F. Moyer, P. A. Lesker et al., Improved healing of experimental long bone fractures in rabbits by delayed internal fixation, *J. Trauma.*, 1975, 15, 869.

Corresponding author: Subha Ganguly;

Associate Professor & Head, Department of Veterinary Microbiology, Arawali Veterinary College, N.H.- 11 Jaipur Road, V.P.O. Bajor, Dist. Sikar, Pin – 332001, Rajasthan, India.