Nursing patients with Fractures

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Fractures

A fracture occurs when there is a break in the continuity of the bone.

It can occur either as:

- A result of trauma

Or

- A pathological fracture

Bone is a specialised type of connective tissue consisting of cells or osteocytes in a matrix comprised of calcium phosphate which gives bone its hardness.
Classification of fractures

Fractures can either be open or closed

Closed fracture = A fracture with no break in the skin

Open fracture = a wound that has penetrated the skin and the fracture ends are open to the outside environment

Fractures can also be described in many other ways

1. The area that the fracture involves

Articular fractures = Fractures that involve the joint
Diaphyseal fractures = A fracture in the midshaft of diaphysis of the bone

Physeal Fracture = A fracture through the growth plates of a young animal
**Condylar fracture** = A fracture where the condyles are involved e.g. humerus or femur

2. **The type of displacement**

**Greenstick** = An incomplete fracture of a bone in immature animals
**Fissure** = A fine crack which may displace during surgery or if the site is put under any type of stress

**Depressed fracture** = a fragment of bone is pushed into an underlying cavity, most commonly found in the skull

**Compression** = is often used to describe a fracture of the vertebral column. This results in the shortening of the vertebra by a crushing effect
**Impacted** = Fragments of the cortex are forced into cancellous bone

![Image of impacted bone]

**Alvusion** = a fracture from a bony prominence is torn away from the rest of the bone usually by the pull of a muscle, ligament or tendon

![Image of alvusion]


3. The direction of the fracture line

<table>
<thead>
<tr>
<th>Direction</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse</td>
<td>The fracture line is at 90 degrees to the axis of the bone</td>
<td><img src="image1.jpg" alt="Example" /></td>
</tr>
<tr>
<td>Oblique</td>
<td>Fracture line is at an angle of at least 30 degrees</td>
<td><img src="image2.jpg" alt="Example" /></td>
</tr>
<tr>
<td>Spiral</td>
<td>The fracture line curves around the bone</td>
<td><img src="image3.jpg" alt="Example" /></td>
</tr>
<tr>
<td>Longitudinal y or t</td>
<td>Refers to the appearance of the fracture lines in bone</td>
<td><img src="image4.jpg" alt="Example" /></td>
</tr>
</tbody>
</table>
4. Number or types of fracture

<table>
<thead>
<tr>
<th>Direction</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Simple</strong></td>
<td>One fracture line creating two fragments</td>
<td><img src="image1.jpg" alt="Example of simple fracture" /></td>
</tr>
<tr>
<td><strong>Comminuted</strong></td>
<td>More than one fracture line creating more than two fragments</td>
<td><img src="image2.jpg" alt="Example of comminuted fracture" /></td>
</tr>
<tr>
<td><strong>Wedge</strong></td>
<td>A multifragmented fracture with some contact between the main fragments after reduction</td>
<td><img src="image3.jpg" alt="Example of wedge fracture" /></td>
</tr>
<tr>
<td>Type</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Segmental</td>
<td>One or more large complete fragments of the shaft of bone</td>
<td></td>
</tr>
<tr>
<td>Irregular</td>
<td>A diaphyseal fracture with no specific pattern</td>
<td></td>
</tr>
<tr>
<td>Multiple</td>
<td>More than one fracture in the same or different bone</td>
<td></td>
</tr>
</tbody>
</table>
**Diagnosis of a fracture**

**Clinical signs**

- History from the owner - has the animal fallen or had some sort of trauma
- Clinical examination

**Signs seen on clinical examination will include:**

- Inflammation
- Pain localised to the affected bone
- Local swelling and heat
- Bruising at the fracture site leading to discolouration
- Marked loss of function (lameness/non weight bearing)
- Visible or palpable deformity of the affected bone
- Abnormal mobility at the fracture site
- Crepitus when the injured part is moved

Radiographs should be taken - 2 views are essential to enable the Veterinary Surgeon to make a proper diagnosis and plan for a repair

Even if it is obviously fractured a good quality radiograph will confirm details such as a hairline fracture etc that may affect a treatment and surgical plan
Fracture Repair

The aim of fracture fixation is to restore the functional anatomy of the fractured bone

We do this by:

- Restoring the continuity of the bone
- Restore the length
- Restoring the shape of the bone
- Maintaining soft tissue function

All essential tissue (blood vessels, muscles and nerves) need to removed from the fracture site especially when fixation is involved, or repaired

Stabilisation of the fractures

Reduction – the fragments should be brought together in the correct alignment

Fixation – The fragments should be immobilised in the correct alignment until union occurs

It is important that the fracture is properly looked after before surgery. This will prevent displacement of the fracture, pain and non union

Fracture fixation techniques are classified into 3 areas

1. **External** – Using casts or spints
2. **Internal** – Using pins, screws, plates etc
3. **external – Internal** – Using external fixators
There are several factors that need to be taken into account before repairing a fracture. These include:

- Identifying the classification of the fracture
- The age of the patient
- The size of the patient
- The temperament of the patient
- Presence of bacteria
- Cost
- Expectations of the owner (working vs. pet)

**External**

*Aim = to limit movement at the site of the fracture*

This type of fixation is not suitable if the joints above and below the fracture cannot be immobilised

**Advantages**

- Simple
- Economical
- Non Invasive

**Disadvantages**

- Limited applications, 
- They don't provide sufficient stability for many fractures
- Risk of ulcers
- Restrict activity of joints
Casts

Casts should be used for stable fractures such as greenstick, simple or spiral fractures.

It can also be used if the fracture occurs close to an intact bone that will provide a splint like mechanism.

Suitable cast material

- Comfortable
- Reach maximum strength quickly
- Hardwearing
- Radiolucent
- Strong and lightweight
- Easy to remove
- Water resistant
- Breathable
- Economical
<table>
<thead>
<tr>
<th>Type</th>
<th>Example</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polypropylene impregnated with resin</td>
<td>Dynacast optima</td>
<td>Easy to apply, Radiolucent, Strong, Lightweight, Hard wearing</td>
</tr>
<tr>
<td>Fibreglass impregnated with resin</td>
<td>Vetcast plus</td>
<td>Easy to apply, Immersed in water then applied, Wear gloves as very sticky</td>
</tr>
<tr>
<td>Thermoplastic polymer mesh</td>
<td>Hexcelite, Turbocast</td>
<td>Hard wearing, Expensive to purchase, Can be reused</td>
</tr>
<tr>
<td>Plaster of Paris</td>
<td></td>
<td>Cheap and comfortable, Messy to apply, Heavy bulky plaster, Radio opaque so has to be removed</td>
</tr>
</tbody>
</table>

**Postoperative care of splints**

- Owners should be given written instructions on care and what to look out for
- Protect the bottom of the cats when going outside
- Growing animals will need a new cast applied weekly
- Check cast daily
Complication of a cast

- Limb swelling
- Decubital ulcers
- Cast loosening
- Prolonged immobilisation of the limb causing limb stiffness, muscle atrophy
- Joint laxity
- Delayed union, Malunion, non union
- Refracture on removal of cast

Limbs should remain in the cast from 4-6 weeks. Radiographs should be taken at intervals to assess healing.
**Internal fixation**

This involves the use of pins, plate's screws and wire

**Advantages**

- Suitable for fractures in any bone
- Versatile
- Allows accurate reduction
- Allows limb function to return early on

**Disadvantages**

- Expensive and time consuming
- Technically demanding
- Cost of buying equipment in
- Risk of surgery and wound healing
- Open fractures with soft tissue involvement may not be suitable

**Implants and techniques**

**Intramedullary pins**

They are referred to as Steinman pins and they are stainless steel rods with a sharp trocar points
They are placed into the medulla using a Jacobs chuck and key.

**Advantages**

- Cheap
- Quick to use
- Require minimal surgical exposure
- Easy to implant and remove

**Disadvantages**

- Less stable
- Slower function return
- Slower healing
- More aftercare
- Not suitable for unstable fractures

**Post op management**

- 2 radiographic views are necessary
- Provide clients with written instructions
- Exercise restrictions
- Analgesia
- Avoid stairs and jumping on furniture
- Check for pin migration
- The pin is usually removed under anaesthetic once union is achieved
Interlocking nails

Solid rods of different diameters with holes through which screws are inserted.

The nails are placed into the medulla and the screws fix the rod within the bone.

More reliable than pins but requires expensive equipment.

Arthrodesis and Kirschner wires

Smaller pins. Arthrodesis wires have a trocar (pointed end) at each end, whereas K-Wires have a flattened bayonet point at one end and a trocar at the other.

They are used as an intramedullary pin in very small bones.
**Cerclage wire**

Malleable monofilament stainless steel wire used to supplement the use of IM pins, external fixators and bone plates.

It compresses large fragments by encircling the bone. It can also be used as a tension band.

**Tension band wire**

Used to fix an avulsed fracture. It uses two different directional forces to create compression of the fracture.

A K wire is placed into the bone and a wire placed in a figure of 8 is placed around the end of the pin. It is anchored within a predrilled hole on the opposite side of the bone.
Venables and Sherman plates

Venables plates = rectangular bone plate with round holes varying from 4-8

The plate is secured to the bone bridging the fracture with Sherman self tapping screws

A Sherman plate is similar to the venables plate but narrows between the holes making it lighter but not as strong

The plate is contoured (bent to shape) before screws are placed
ASIF/AO Systems

ASIF = Association for the Study of Internal Fixation and is used in North America to name the patent and copyright of the system of orthopaedic equipment.

There is a wide variety of equipment used under ASIF repair

The most commonly used plate is called the Dynamic compression plate (DCP)

The DCP serves many functions depending on how it is applied to the fractured bone.

It is available in several different sizes 2.0mm, 2.7mm, and 3.5mm

It is used for compressing fractures, for neutralisation of spiral fractures where compression is not possible and the fracture has to be reconstructed or as a buttress stabilising the fracture site and bridge a fracture that is not reconstructable. The defect is then usually filled with a cancellous bone graft.
**Pre tapped screws**

These screws are identified by their hexagonal head

They need a special type of screwdriver to be able to place them.

They are available in different sizes, widths and lengths.

**Lag screw technique**

The lag screw is not a type of screw but a technique. It is used to stabilise and compress fracture fragments. The fracture is reduced using bone forceps, a hole is drilled into the fragment, and the far cortex is drilled with the drill bit. The far cortex is tapped but the near cortex fragment isn’t. When the screw is driven into the hole it doesn’t grip the fragment just grips the far cortex. This compresses the fragment into place.
Postoperative care following internal fixation

- 2 radiographic views should be taken to assess repair
- Analgesia throughout recovery
- Adequate nutrition
- IVFT
- Assisted walking
- Daily monitoring of TPR
- Sutures should be removed 10 days post op
- Clients should be given written instructions on care
- Exercise restrictions with short bouts of lead exercise in the first 3-4 weeks. Hydrotherapy can be used once the wounds have healed

Complications

- Infection

This if often due to poor technique or choice of implants. In some cases postop care in the home environment is not good enough to protect the implants from failure
**External Skeletal Fixation (ESF)**

This stabilises fractures using pins that are inserted through a small stab incision in the skin and then into the bone.

They travel through both cortices and are fixed on the outside of the limb with bars and clamps or acrylic resin.

A simple frame consists of one bar and three or four pins exciting from the bone whereas a more complex frame consists of multiple pins and three or more bars.
Advantages

- Minimal instrumentation required
- Clamps and bars are reusable
- Minimal disruption of soft tissue
- Minimal foreign body at fracture site
- Open wound management easy
- Easy to combine with other implants
- Alignment is adjustable
- Assessment of fracture healing easy
- Easy to remove

Disadvantages

- Soft tissue problems possible
- Application technique requires practice
- Premature pin loosening common
- Difficult to apply to proximal limb
- Can be difficult to obtain good x-rays
Types of fractures that are suitable for external fixation

- Long one fractures
- Comminuted fractures
- Open and infected fractures
- Delayed union and non union
- Mandibular fractures

**APEF System**

APEF = Acrylic pin external fixator

It uses corrugated tubing which is filled with polymethylmethacrylate which is a type of bone cement

The pins are placed into bones with the corrugated tubing fixed to the ends of the pins

The tubes are then filled with cement and held in place until hardened. This is particularly useful in mandibular fractures where the tubing forms a bumper bar
**Bone Grafts**

Bone grafts can be harvested from either cortical or cancellous bone. They are used to supplement fracture repair and accelerate healing across a wide gap.

**Cortical bone grafts** = Whole segments of solid bone in a fracture. It takes a long time for the graft to become fully incorporated in the repair.

**Cancellous bone** = Harvested from inside the medulla of long bones. The commonest sites used are the humerus and ilium.

Cancellous bone grafts are an essential part of the repair of complex fractures as they contribute cells and growth factors involved in bone healing.

**Post operative care**

- Open wounds should be treated and dressed appropriately.
- The limb should have a compressive bandage applied for 2-3 days (changed daily) to minimise swelling.
- The ends of the pins should be covered with tape to prevent damage to the owners furniture.
- Air should be able to circulate between skin and pins.
- Cats need to be cage rested.
- Exercise should be limited to lead exercise only.
- Owners should be told to expect a small amount of scab formation at the site of the pin. This is normal and should not be cleaned.

**IT IS IMPORTANT THAT SCABS ARE NOT REMOVED!!**

- Excess exudate should be seen by a vet.
- Elizabethan collar should be applied
- Written instructions should be given to the owner

**Complications of external fixators**

- Swelling of soft tissue impinging on the clamps and acrylic bars
- Excessive exudate from the pin site causing movement
- Loosening of pins but in some cases individual pins can be removed without losing the stability of the frame