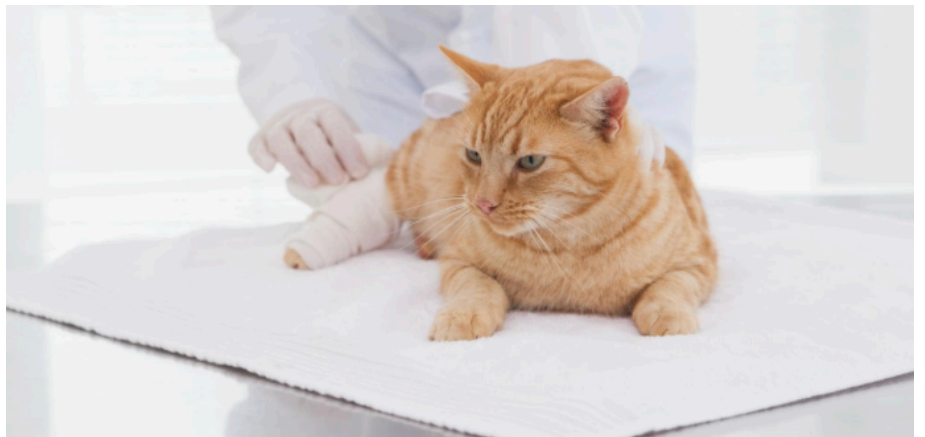


LIMBS (LONG BONE) FRACTURES

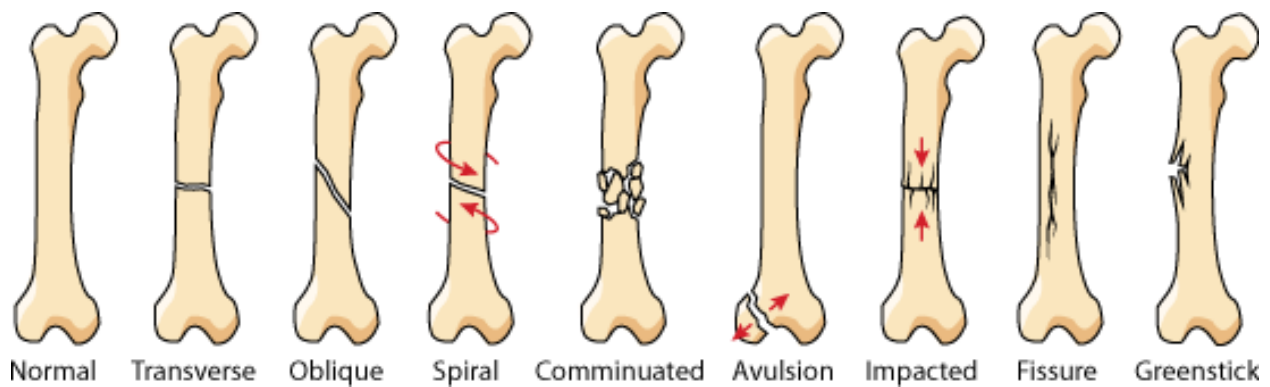


LONG BONE FRACTURES

The long bones of cats & dogs are identical to the bones of the legs & arms of people & just like people, dogs & cats can break these bones due to vehicular trauma, fight with other animals & some sporting injuries to name a few causes.

LIMB ANATOMY

Front feet:	phalanges (toes; 3 bones in each toe) metacarpal bones (hand; 4 main bones) carpal bones (wrist)
Forearm:	radius & ulna
Upper arm:	humerus & scapula (shoulder blade)
Back feet:	phalanges (toes; same as front feet) metatarsal bones (foot; four main bones) tarsal bones (hock or ankle)
Lower leg:	tibia (shin bone) & fibula
Thigh:	femur
Pelvis:	ilium, acetabulum (hip socket), ischium
Joints:	carpus (wrist)—made up of small carpal bones & radius elbow—made up of radius, ulna & humerus shoulder—made up of humerus & scapula tarsus (ankle)—made up of small tarsal bones & tibia stifle (knee)—made up of tibia & femur hip—made up of femur & pelvis (acetabulum)



FRACTURE CLASSIFICATION

A bone can break in many ways; we call these fractures. To make it easier to plan for therapy, veterinary surgeons classify fractures into several categories.

- *Incomplete*: a fracture that is more like a bend in the bone; the bone may only be broken partway around the circumference of the bone; most commonly seen in young animals.
- *Complete*: the bone is broken through its full circumference & 2 or more bone fragments are created.

Complete fractures are further described based on the shape of the break.

- *Transverse*: break is straight across the bone at a right angle to the length of the bone.
- *Oblique*: break is at diagonal across the bone, creating 2 bone fragments w/ sharp points.
- *Comminuted*: break is in 3 or more pieces of varying shapes.

A fracture that results in an open wound in the skin is called an *open* fracture; these can be created when the broken bone penetrates the skin (from the inside out) or when an object goes through the skin & breaks the bone. If there is no open wound near the fracture, it is called a *closed* fracture.

SIGNS & SYMPTOMS

Typically, severe lameness is noted & the affected limb is obvious. Most pets with fractured limbs will **hold up the affected limb**. Some pets are able to bear some weight on the limb, depending on the location & nature of the break. Pets that have sustained major trauma, such as being struck by a motor vehicle or falling from a height, may have more than one broken limb, & may be unwilling or unable to walk. You may notice **swelling, pain or abnormal movement** at the affected site.

With trauma being involved, it is very important to note that other systemic signs may be possible. Abdominal trauma can result in hemorrhage (bleeding) & rupture organs (such as urinary bladder). Thoracic trauma can result in pulmonary contusions (bruising & hemorrhage within the lungs), hemorrhage around the lungs & air around the lungs caused by a tear in the lung. All of these can be very critical injuries & may delay the definitive treatment of the fracture.

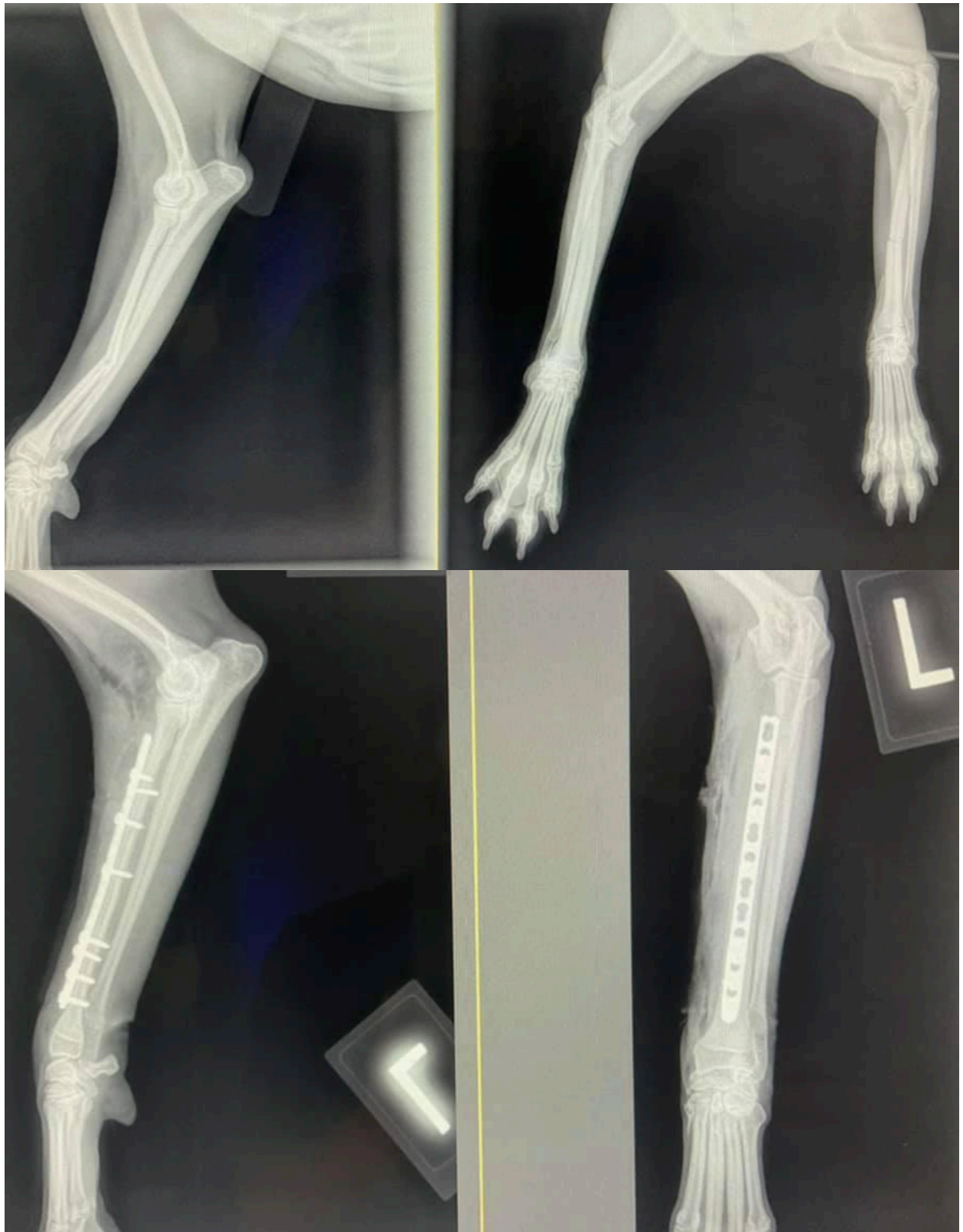
DIAGNOSTICS

Your primary care veterinarian will assess your pet thoroughly, to evaluate for any other injuries to vital organs. Your veterinarian will likely recommend **x-rays** of the affected region. Often times pets need a pain medication or sedative for x-rays to be obtained. Other tests that may be recommended initially include complete blood work, abdominal & thoracic (chest) radiographs & possibly abdominal ultrasound.

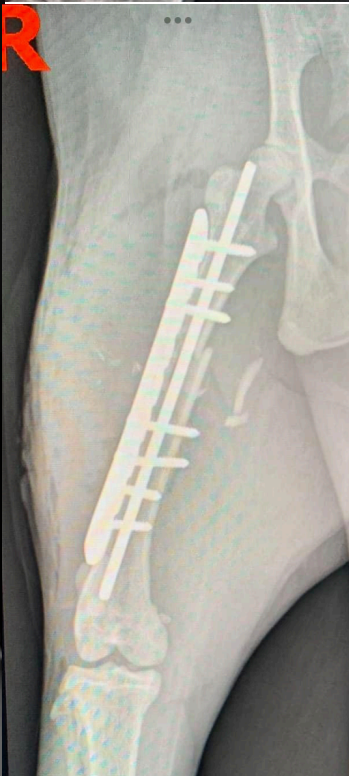
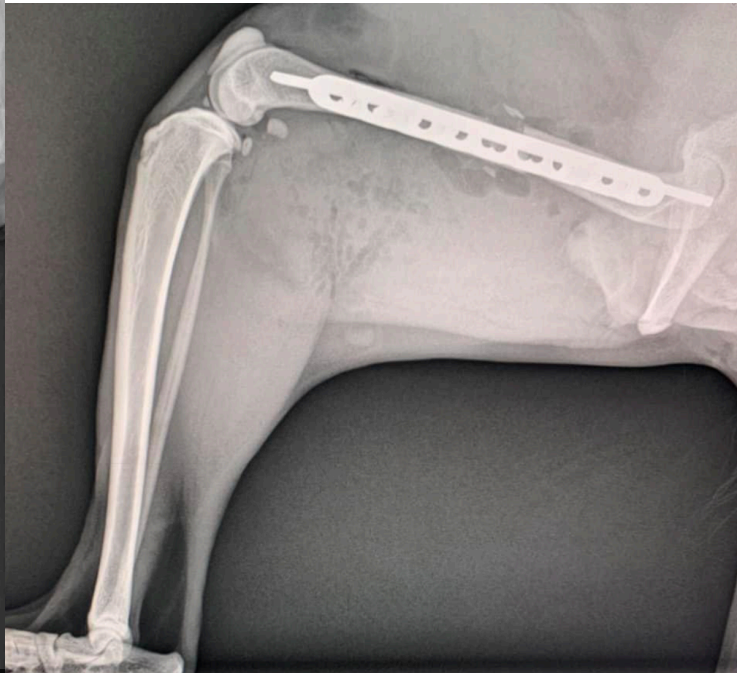
HUMERUS FRACTURE



RADIUS - UNLA FRACTURE



FEMUR FRACTURE



TIBIAL - FIBULA FRACTURE



TREATMENT

When a bone breaks, one of the first things that needs to happen is for the **bone fragments to be immobilized** so they cannot move. A fracture that is immobilized will hurt a lot less & the sharp ends of the bone fragments will NOT cause further damage to the muscles, nerves & blood vessels surrounding the bone.

At home, before you can get to a veterinary clinic or hospital, you can **confine your pet to a very small space**. Ideally your pet is lying down in a box, crate or kennel; movement is limited to only that necessary to go to the bathroom or maintain cleanliness. **Seek veterinary care as soon as possible – at least call to receive instruction**; a bone fracture is very painful & other dangerous medical conditions may have been created at the same time as the fracture. Do NOT give any medications or apply any therapy unless you receive clear guidance from your vet.

Closed fractures are ideally treated within 1–5 days; open fractures are best treated with an initial surgery to clean the wound & bone within 8 hours of the injury (a final surgery for open fractures can be delayed for 24–48 hours.)

Usually, the best way to temporarily immobilize a fracture prior to final treatment is to place the leg in a splint. To properly immobilize a bone, the joints above & below the affected bone must be prevented from moving. It is fairly easy to temporarily immobilize bones below the elbow & below the knee; the upper arm & the thigh are more challenging to manage because the shoulder & hip are difficult to splint. Often it is best to put the limb in a sling or simply confine your pet to a small space while plans for definitive treatment are made. Splints & bandages, as well as confinement, are best managed at a veterinary facility.

Fracture Repair

When a bone is broken, it is unable to resist the normal physical forces that act on bones when a pet walks on a leg. Some of these normal forces are:

- Bending (like the force used to break a pencil in half)
- Torsion (a twisting force around the bone)
- Compression (the force that gravity puts on us when we bear weight on our legs)
- Traction (the pulling force applied to a small portion of bone by a muscle at its attachment on the bone)

The strength of normal, healthy bone resists these forces. A bone breaks when it is subjected to a force that is greater than its own strength. Once it is broken, it must be immobilized sufficiently to allow the bone to heal back together. This is where veterinary treatments, like those listed below, are used to ensure quality bone healing & good leg use.

External Coaptation: a **splint**; applied to the outside of the limb; good at resisting bending forces & fair at resisting torsion & compression forces.

External Fixation: a **surgically applied device that is attached to the bone with pins** that thread into the bone, but come out through the skin. These pins are connected to a rigid bar with clamps to “splint” the bone on the outside. This method is very good at resisting bending, compression & torsion forces.

Internal fixation: **surgically applied devices implanted inside the bone or on the surface of the bone**. Various devices are available & offer different results against the various forces such as plates, screws, pins & wires.

Several factors go into making up a final treatment plan for a fracture. Each factor has characteristics that support easy/rapid fracture healing & characteristics that result in slow/complicated fracture healing. Your veterinarian may refer you to veterinary surgeon for your pet’s fracture repair because of the experience & training involved in successful fracture fixation.

After all is considered, you may be faced with choices for fracture repair; one option might be best for your home environment, time investment & possible financial constraints. A splint repair option is NOT necessarily the “easiest” or “cheapest”. Splints need frequent evaluations & changes & complications may result in a longer overall healing period, whereas some fixation methods improve the chance of successful outcomes without demanding post-operative care.

Your active participation in this decision-making process will improve the overall outcome of your pet’s medical condition.

AFTERCARE & OUTCOME

As a general rule, follow all instructions provided to you by your veterinary surgeon. Some of those instructions may include the following recommendations:

BANDAGE CARE

If your pet has splint for final fracture treatment or if a bandage was applied after surgery to help with pain & swelling, careful monitoring & maintenance is necessary for safe & effective bandage wear. Major problems can result from simple bandages; please do NOT hesitate to call your veterinarian &/or veterinary surgeon if any problems are noted. **Monitor the bandage for slipping or damage from chewing**, etc. If it changes position or becomes wet or loses its integrity, serious problems may occur with healing or new problems with pressure sores may develop. Please call your veterinarian if any changes in bandage position occur; the bandage may need to be replaced.

If the end of the bandage is open, check the 2 central toenails TWICE daily. They should be close together. If they are spreading apart, this indicates **toe swelling which can result in serious complications** & the bandage needs to be assessed by your veterinarian within 4-6 hours. Please call your veterinarian if any swelling is noted.

The bandage must be kept clean & dry. Place a plastic baggy on the end every time your pet goes outside. Remove the plastic covering when indoors.

If the **bandage gets wet or you notice any bad odor** coming from the bandage, it will need to be evaluated within 2-4 hours; serious skin problems may develop.

We strongly advised that you *do NOT modify* the bandage in any way. Adding tape or other wrappings can seriously compromise the safety of the bandage/splint. If you are concerned about the security or integrity of the bandage, please return to your veterinarian &/or veterinary surgeon for re-evaluation & re-application as needed.

*Please know that **bandages & splints can cause very serious complications**. They can be an effective treatment tool for fracture healing & pain control, but careful monitoring & appropriate follow-up must occur. If you have any questions or concerns related to issues outlined above or in general regarding bandage/splint wear, please do NOT hesitate to call your veterinarian &/or return for evaluation. Your pet cannot tell you that the bandage hurts or is uncomfortable; you need to be attentive to any change.*

ACTIVITY RESTRICTION

Confine your pet as directed by your veterinary surgeon; this often includes confining him or her to one section of the house on carpeted floors. Use baby gates, etc. to prevent access to slippery floors or stairs. Do NOT allow jumping on/off furniture. Confine to a small area, room, or crate when unattended. Do NOT allow any playing, running, or jumping. For dogs, use a short leash when going outside for bathroom breaks. The best way to confined cats is to have a large dog crate where food & liter can be place. A small room can also serve as a confined are, but cat cats like to jump, so furniture should be removed.

Your pet will feel like fully using the leg before the fracture is sufficiently healed.

Please continue the restriction during this time until bone healing has been confirmed with x-rays. Puppy or Kitten fractures x-ray follow up at 4-6 weeks & adult fractures at 8-10 weeks. Failure to do so may cause serious healing problems.

ASSISTING YOUR PET

Your **pet may need assistance to stand & walk** in the first few days or weeks following his or her injury. Even if your pet is able to move on his or her own, it is often wise to provide light assistance until he or she is completely stable, especially on slippery surfaces or when going up or down a short flight of stairs. Dogs will often accept help; cats rarely do. Some dogs will fight the assistance & refuse to move. Adjust your efforts as needed to help your pet without creating more difficulties for both of you. Some pets will need to be held up strongly, others will just need light support to prevent slipping or falling to one side.

For front leg injuries, a simple **sling can be created out of 2 straps**. One strap goes under in front of the right leg & comes out behind the left leg; the other strap goes under in front of the left leg & comes out behind the right leg. The straps should cross on the underside of the chest, & you hold all four ends as a handle over the top of the chest. Adjust the strap length to allow you to stand comfortably upright as you assist your pet. Variations on this sling technique can be customized as you see fit.

For back leg injuries, a similar **sling can be created out of two narrow straps or one wide band**. The two straps can be looped under each back leg & held up like you are pulling on a pair of pants; adjust the length of the straps to allow you to stand comfortably as you assist. Alternatively, the wide band of cloth can be used as a sling under the belly from one side to the other just in front of the back legs.

There are several sling-type products commercially available that are specifically designed to help you help your dog walk during his/her recovery. You may find some of these products online & are definitely easier to use.

MEDICATIONS

Give any prescribed Rx as directed. Do NOT give human pain medication to pets without first consulting with a veterinarian.

Rxs may include antibiotic, anti-inflammatory, pain &/or sedation.

Medications will be discussed at your pet's end of day or the next day discharge appointment with your veterinary team.

FOLLOW-UP

Patients with trauma severe enough to break bones can often have internal injuries as well; sometimes these injuries are NOT apparent until days or weeks after the incident. Have your pet checked by a veterinarian as soon as possible if any signs of illness such as vomiting, trouble breathing, prolonged inappetence, change in urination or pale gums are noted.

Please contact us immediately if any of the following are noted:

- Swelling or discharge from the incision
- Increase in lameness occurs
- Change in position or angle of the limb
- Bandage problems occur

Please schedule an appointment for recheck & suture removal (if applicable) 14 days after surgery & follow-up radiographs need to be scheduled ~4-6 weeks (puppy/kitten) & 8-10 weeks (adult) after surgery.

PROGNOSIS

The prognosis for fracture repair with internal fixation is generally good, but depends on the severity & location of the fracture.

Potential complications may include wound infection, osteomyelitis (bone infection/inflammation), delayed union, non-union, arthritis, implant loosening or breakdown of the surgical repair from excessive early activity of the patient.

Your pet's recovery & well-being are our primary concerns, so please do NOT hesitate to call us immediately.

PHYSICAL THERAPY

When a bone is fractured, many things happen that make a leg function poorly over the fracture healing period. Muscles, nerves & blood vessels are damaged; the result is pain & poor muscle function. If a leg is weak &/or hurts to stand on, an animal won't use it properly. When a leg is NOT used for several days to weeks, joints stiffen up, muscles get smaller & bone healing is delayed as well.

Physical therapy during fracture healing uses methods aimed at improving comfort & leg use without harming bone healing. Some of the simpler methods can be used at home; the more advanced techniques are used by veterinary physical therapists under the guidance of your veterinary surgeon. Careful coordination between your pet's veterinary surgeon & physical therapist can result in excellent outcomes & an efficient return to normal leg function.

Simpler methods that can be used at home include:

- *Cold Therapy:* In the first week after injury, applying cold packs to the fracture site will reduce inflammation, swelling & pain; this will make your pet more comfortable & allow him/her to use the leg earlier.
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- *Range of Motion Therapy:* In the first month after injury, flexing & extending the joints of the injured leg will maintain joint health while your pet is NOT using the leg fully. Initially this range of flexion & extension will be quite small; the goal is to move the joint without creating pain. As healing progresses, more stretching can be applied to reach toward a more normal range of joint flexion & extension.
-
- *Massage therapy:* After the initial stage of painful inflammation subsides, you may be instructed to begin massage therapy on the skin & muscles around the injured bone. This therapy will prevent tough scar tissue from developing that will later prevent normal movement of the leg & it also offers pain relief in the intermediate period of healing.
-
- -SEE BELOW for a CHART: At Home Physical Rehabilitation Exercises Program

Bone healing is dependent upon some of the same factors listed in the chart above. Young dog & cat bones heal faster than old dog & cat bones. Bones that have lots of muscle & blood vessel tissues disrupted from the trauma heal slower than bones surrounded by healthy tissues. Bones that are repaired with minimal surgical trauma (no or small surgical incision) heal faster than those with a lot of surgical trauma. These facts are why we consider all of these factors when choosing repair options.

Your veterinary surgeon should be able to tell you what to expect with healing. As a general statement, fractures need a minimum of 4-6 weeks in young puppies & 8-10 weeks in adult to older pets to heal sufficiently & begin to progress to normal activities

We don't have the luxury of telling our patients to "take it easy" & "stay off of it," so **we must rely on you to impose the restrictions even when your pet is begging to romp & play.** It is a long 2-3 months when the sun is shining & the squirrels are asking to be chased; just know that catastrophe can happen if the fracture repair is stressed too soon. But fractures do heal & bones can resume near normal shape & strength. With close attention & appropriate follow-up & physical therapy, our broken pets can return to completely normal lives.

Home Preparation For Your Pet's Home Recovery

HOME PREPARATION

Prior to your pet coming home, you should determine where you are going to confine your dog or cat during this post-operative period. Making your dog or cat as comfortable as possible is as important as having a good rehabilitation/recovery plan.

As your dog's or cat's mobility is to be restricted, we recommend that you utilize the following:

- Dog or cat crate that is large enough that he/she can stand up & turn around
(only pets that are NOT self-destructive or anxious being kennel for long period of time).
- Gated off area such as the kitchen, laundry room or etc.
(room(s) should NOT have furniture to jump on or windows to look out).
- Confinement to a safe, injured proof room

Surfaces such as hardwood floors, tile, linoleum, etc. can be very slippery. We suggest that you place some throw rugs with rubber backing or yoga mats on these surfaces to make it easier for your dog or cat to walk around.

HOUSE RULES

- NO jumping at all! No jumping on/off the bed/couch/furniture/windows! No jumping on you! Overextension of the knee could compromise the repair of your dog's or cat's leg & delay the healing time.

- NO active play! Refrain from active play with your dog or cat & do NOT allow him/her to play with other dogs or cats until your veterinarian tells you otherwise (likely after the 6 weeks (juvenile) or 12 weeks (adult) post-operative x-rays to confirm bone healing).

- Stairs: For the first 3 – 6 weeks following surgery, stairs should be limited to a short flight to get in or out of the house. Your pet needs to be on a short leash & slowly guided up & down 2 – 3 stairs. If you have stairs in your home, limit your dog's or cat's access to them with something like a baby gate to prevent unsupervised use of stairs. Longer flights of stairs should NOT be used for strength training but are allowed with supervision after the 4 weeks (juvenile) or 8 weeks (adult) post-surgery as long as your dog or cat is consistently using their leg & is NOT allowed to run or jump up the stairs.

POST FRACTURE SURGERY
Home Recovery Program

Rehabilitation Protocol for Patient With Long Bone Fractures

Treatments/Modalities	Day 1-7	Day 7-21	3-8 Wk	8-12 Wk and Beyond
Pain medications	As directed	As directed	PRN	PRN
Cryotherapy	10-15 min 3 times daily before walks or exercises First session immediately after surgery	Use after exercise for 15 min	PRN after exercises	PRN after exercises
Heat therapy		Apply heat to the adjacent muscles 10 min before PROM or exercise	As before 10 min twice daily	PRN
Massage	Twice daily for edema from toes toward heart	Continue twice daily	Massage adjacent muscles before active exercise	Massage adjacent muscles before active exercise

PROM	Gentle joint flexion/extension 10 reps, 3–4 times daily Elicit flexor reflex by toe pinching	Continue flexion and extension with mild resistance 10–15 reps 3 times daily	Continue PROM as previously described up to 4 wk	
Laser therapy	Daily or every other day for first week	Every other day for first week then twice weekly	PRN	
Walks	At 5 d start slow controlled leash walks for 5 min twice daily to encourage active ROM	Increase each walk by 1–3 min each week	Gradually increase to 10–15 min twice daily	20– to 30-min walks twice daily including 10 min of incline work as long as healing has taken place

Underwater Treadmill ^a		10–15 min once daily after day 10— incision healed	15–20 min daily	20–30 min 3 times weekly
Stairs ^a			Likely 6+ weeks after surgery Start with one flight and add one flight per week	Work up to 5 flights twice daily
Cavalettis ^a			5–10 reps over 5 rails once daily	10–15 reps over 5 rails twice daily
Swimming ^a			10–15 min with breaks daily	20–30 min once to twice daily
<p>Please see special instructions for Distal Femoral Physeal Fractures regarding bandaging and rehabilitation. <i>PRN</i>, As needed; <i>PROM</i>, passive range of motion; <i>ROM</i>, range of motion.</p>				

If you would like assistance with your pet’s exercise recovery, please let your veterinary team know so we can provide a referral to a local veterinary physical rehabilitation center. If you have any questions, please feel free to ask your primary veterinarian &/or veterinary surgeon.

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