Understanding Leg Fractures: Does it need to be fixed?

Overview *"I have no medical background; what do I need to know to participate in the medical decision-making regarding my pet's fracture?"*

The leg bones of dogs and cats are almost identical to the bones of the legs and arms of people, and just like people, dogs and cats can break these bones.

Leg anatomy—

Front feet:	phalanges (toes; three bones each toe) metacarpal bones (hand; four main bones) carpal bones (wrist)
Forearm:	radius and ulna
Upper arm:	humerus and 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) and fibula
Thigh:	femur
Pelvis:	ilium, acetabulum (hip socket), ischium
Joints:	carpus (wrist)—made up of small carpal bones and radius elbow—made up of radius, ulna and humerus shoulder—made up of humerus and scapula tarsus (ankle)—made up of small tarsal bones and tibia stifle (knee)—made up of tibia and femur hip—made up of femur and pelvis (acetabulum)

Bone anatomy—

Periosteum: outer bone covering of soft tissue that is necessary for bone growth and bone repair after injury.
Cortical bone: layer of boney tissue that makes up the hard, outer shell of a bone; cortical bone is usually 2-3mm thick.
Cancellous bone: soft, mesh-like boney tissue found in the interior of longbones at each end.
Bone marrow: fatty tissue that fills the hollow interior of bones; it is made up of blood cells and other cells and chemicals important to bone health and healing.

<u>Fracture anatomy—</u>

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

Greenstick: an incomplete fracture that is more like a bend in the bone; the cortical bone may only be broken partway around the circumference of the bone; most commonly seen in young animals.

Salter: a fracture thru a growth plate located at the top or bottom of a longbone; seen only in immature animals who are still growing; the trauma that created the fracture and the trauma of fracture repair can both interrupt normal bone growth at this site.

Complete: the longbone is broken thru its full circumference and two or more bone pieces (fragments) are created.

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

Transverse: the break is straight across the bone at a right angle to the length of the bone

Oblique: the break is at a diagonal across the bone, creating two bone fragments with sharp points.

Comminuted: the break is in three or more pieces of varying shapes.

Open vs. closed: 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 thru the skin and breaks the bone (ex: bullet); if there is no open wound near the fracture, it is called a "closed" fracture.

Initial Fracture Management *"What should I do before I can get to a veterinary surgeon for fracture repair?"*

Right after a bone breaks, the first thing 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 and the sharp ends of the bone fragments will not cause further damage to the muscles, nerves and 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; a bone fracture is very painful and 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 a veterinary professional.

After an animal has been evaluated by a veterinary professional and determined to be otherwise stable, pain medications and sedation can be given to allow proper, initial fracture therapy to be applied. X-rays are usually required to fully diagnose a suspected fracture and create a treatment plan. There is usually time to carefully evaluate the fracture and have a specialist review the x-rays before making a final plan. Closed fractures are ideally treated within 2-4 days; open fractures are best treated with an initial surgery to clean the wound and 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 joint above the bone and the joint below the bone must be prevented from moving. For example, if the tibia is broken, the knee and the ankle must be well immobilized in the splint for the tibia to be secure. It is fairly easy to temporarily immobilize bones below the elbow and below the knee; the upper arm and the thigh are difficult to manage because the shoulder and hip are hard to splint. Often it is best to put the limb in a sling or simply confine a patient to a small space while plans for final treatment are made to treat a fracture involving the bones of the upper arm and thigh.

Fracture Repair Options *"Is there one best way to repair my pet's broken bone?"*

When a bone is broken, it is unable to resist the normal physical forces that act on bones when an animal 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 longbone); compression (the force that gravity puts on us when we bear weight on our legs); and 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 and good leg use

General fracture treatments:

External coaptation—a splint or cast; applied to the outside of the limb; good at resisting bending forces and poor at resisting torsion and compression forces.

External fixation—a surgically applied device that is attached to the bone with pins that thread into the bone but come out thru the skin; these pins are connected to a rigid bar with clamps to "splint" the bone on the outside; very good at resisting bending, compression and torsion forces.

Internal fixation—surgically applied device(s) implanted inside the bone or on the surface of the bone; various devices are available and offer different results against the various forces (plates, screws, nails, pins, wires).

Repair options:

Several factors go into making up a final treatment plan for a fracture. Each factor has characteristics that support easy/rapid fracture healing and characteristics that result in slow/complicated fracture healing. We use this scale of information to come up with the best repair options for an individual patient.

Fracture Scale for Repair Decisions

Easy fracture healing	*Difficult fracture healing*
Factor 1: The Patient	
Young	Old
Quiet, calm	Bouncy, active
Healthy, eating	Sick, debilitated
Small/med/large size	Giant or toy size
Single limb injury	Other injuries
Factor 2: The Fracture	
Closed	Open
Low impact break	High impact break
Transverse	Comminuted
Factor 3: The Environment	
Close supervision	Minimal supervision
Restricted activity	Freely active

After all is considered, you may be faced with choices for fracture repair; one option might be best for your home environment or time investment. Your active participation in this decision-making process will improve the overall outcome of your pet's medical condition.

After Care *"What should I expect after the final fracture treatment and my pet comes home?"*

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

Bandage care: If your pet has splint or cast for final fracture treatment or if a bandage was applied after surgery to help with pain and swelling, careful monitoring and maintenance is necessary for safe and effective bandage wear. Major problems can result from simple bandages; please do not hesitate to call your veterinarian if any problems are noted. *Never assume a splint/cast repair option is the "easiest" or "cheapest". Splints need frequent evaluations and changes and the complications may result in a longer overall healing period.*

Monitor the bandage for slipping or damage from chewing, etc. If it changes position or loses its integrity (i.e. section is chewed off), 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 two central toenails twice daily (i.e. look at or feel them). They should be close together. If they are spreading apart, this indicates toe swelling which can result in serious complications, and the bandage needs to be assessed by a veterinarian within 4-6 hours. Please call your veterinarian if any swelling is noted.

The bandage must be kept clean and dry. If the bandage gets wet or you notice any bad odor coming from the bandage, it will need to be evaluated within 4-6 hours; serious skin problems may develop.

Please know that bandages and splints can cause very serious complications. They can be an effective treatment tool for fracture healing and pain control, but careful monitoring and 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.

Restricted activity: Confine your pet as directed by your veterinary professional; this often includes confining him/her to one level/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/crate when unattended. Do not allow any playing, running or jumping. For dogs, use a short leash when going outside to urinate/defecate.

Your pet will feel like fully using the leg before the fracture is sufficiently healed. Please continue the restriction during this difficult time when he/she is feeling "too" well! Failure to do so may cause serious healing problems.

Assisting your pet: Often your pet will need assistance to stand and walk in the first few days or weeks following his/her injury. Even if he/she is able to move on his/her own, it is often wise to provide light assistance until he/she is completely stable, especially on slippery surfaces or when going up/down a short flight of stairs. Dogs will often accept help; cats rarely do. And some dogs will fight the assistance and refuse to move. Adjust your efforts as needed to help your pet without creating more difficulties for both of you. Some animals 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 two straps. One strap goes under in front of the right leg and comes out behind the left leg; the other strap goes under in front of the left leg and comes out behind the right leg. The straps should cross on the under side of the chest, and 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 and 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 available that are specifically designed to help you help your dog walk during his/her recovery. You may find some of these products online.

- Help 'em UP Harness (front and rear) **Strong recommendation.
- RuffWear Web Master Harness (front)
- WalkAbout Harness (front, rear and belly options)
- Bottom's Up Leash (rear)

Physical Therapy "*Can anything be done to improve the outcome of my pet's fracture healing?"*

When a bone is fractured, many things happen that make a leg function poorly over the fracture healing period. Muscles, nerves and blood vessels are damaged; the result is pain and poor muscle function. If a leg is weak and/or hurts to stand on, an animal won't use it properly. And when a leg is not used for several days to weeks, joints stiffen up, muscles get smaller, and bone healing is actually delayed too. Physical therapy during fracture healing uses methods aimed at improving comfort and 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 surgeon. Careful coordination between your pet's surgeon and physical therapist can result in excellent outcomes and 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 and pain; this will make your pet more comfortable and allow him/her to use the leg earlier.

Range of motion therapy—In the first month after injury, flexing and 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 and 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 and extension.

Massage therapy—After the initial stage of painful inflammation subsides, you may be instructed to begin massage therapy on the skin and muscles around the injured bone. This therapy will prevent tough scar tissue from developing that will later prevent normal movement of the leg, and it also offers pain relief in the intermediate period of healing.

Healing Time *"How long will it take for the fracture to heal?"*

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 broke from a low-impact trauma (jumping off bed) heal faster than bones that broke from a high-energy trauma (hit by car). Bones that have lots of muscle and blood vessel

tissues disrupted from the trauma (gun shot) 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 surgeon should be able to tell you what to expect with healing. As a general statement, fractures need a minimum of 4 weeks in young puppies and 8 weeks in older animals to heal sufficiently to return to normal activities. Some repair options allow the device to be reduced in size after 4-6 weeks; this is called dynamization and will stimulate more healing. With this technique and others, the activity restrictions recommended by your surgeon should be followed closely.

We don't have the luxury of telling our patients to "take it easy" and "stay off of it", so we must rely on you to impose the restrictions even when the patient is begging to romp and play. It is a long 2-3 months when the sun is shining, and 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, and bones can resume near normal shape and strength. With close attention and appropriate follow-up and physical therapy, our broken pets can return to completely normal lives.

Outpatient surgery and anesthesia can be uncomfortable, painful, disorienting, and frustrating experiences for animals; watching your pet work through the early postoperative period and recover from anesthesia and pain medications can be worrisome, scary and frustrating for pet owners. The vast majority of the time this period of difficulty is brief, and *your pet is actually more comfortable and secure at home with you*. Sometimes it doesn't feel like that at two in the morning when your pet is anxious and not consolable, and you are unsure of what to do. You always have the option of transporting your pet to a 24-hour veterinary facility postoperatively. If you do not want to have your pet home in the first few days postoperatively, please advise your primary care veterinary staff. They will provide contact information for a local 24-hour veterinary facility and help get an estimate for the ongoing care.

It is important that you have proper expectations about this procedure; your experience and you pet's outcome will benefit greatly. Please discuss this information with your veterinarian when working through the decision-making process regarding **Fracture repair**.

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(See additional materials at www.directvetsurg.com for pet owners and veterinary professionals.)