DOWNLOAD PDF EXTERNAL SKELETAL FIXATION

Chapter 1 : External Skeletal Fixation Application (IMEX)

External Skeletal Fixation Click each image for an enlarged view. Print in landscape mode for optimum results. External skeletal fixation of long bones consists of inserting two or more pins each in the proximal and distal bone fracture fragments.

From the Clinic of Dr. Marc Smithâ€¦ An external skeletal fixation device consists of multiple pins and external bars that hold a fractured bone in place while healing takes place. The best benefit of using an external skeletal fixation device to correct a broken leg is the ease of at home maintenance. External Skeletal Fixation Device Home Care Instructions When you take your pet home from the hospital, there are three main things that the owner needs to be aware of: It is very important to confine your dog to avoid additional injury. In a few short days, your dog will start bearing weight on the broken leg. This is a risk factor for further injury as the leg is stable yet the fracture is not healed. Be aware of this and take all precautions to keep your pet under control. Return to our clinic every week for the next six weeks to have the bolts tightened. The external skeletal fixation device is secured together by a series of nuts and bolts. These nuts and bolts can loosen over time with activity. Therefore, it is essential that you return every week for the next six weeks for us to tighten the nuts and bolts and make sure that the device is secure. Clean the device daily. Your job is to clean the device daily. The simplest way to do this is to apply a small amount of warm water and Ivory soap or alcohol to the external parts of the device all the way to where the device touches the skin. Alcohol may cause a mild degree of pain; however, it will be the best at preventing a superficial skin infection. One of the more common times that an external skeletal fixation device is used is with an open fracture. Open fractures present an increased rate of infection. An external skeletal fixator allows fixation; however, you do not have to cross the exact fracture site as you do when using a bone plate or other forms of fixation. Again, return to our hospital in one week so that we can secure and examine the skeletal fixation device. This appointment will take about 10 minutes and there will be no charge for this service. Clean the device as noted above. This cleaning is mandatory to prevent and curtail any developing infection. Also, give the medicines as directed to control infection and prevent pain.

Chapter 2 : External Fixation of the Tibia | Musculoskeletal Key

Linear External Skeletal Fixation Linear ESF is the most common form of external skeletal fixation and consists of percutaneous transfixation pins attached to one or more external bars. Specialized pin gripping clamps are typically utilized to connect external bars and pins.

Other indications include the stabilization of closed fractures with high-grade soft tissue injury or compartment syndrome. For patients with multiple long bone fractures, external fixation has been used as a method for temporary, if not definitive, stabilization. Simple monolateral four-pin frame with a double-stack connecting bar to increase frame stability. X-ray demonstrating ability to connect the fixation pins to each limb segment in a variety of ways to achieve a congruent reduction. Large monotube fixator spanning the ankle for a severe pilon fracture. This was applied to temporize the soft tissues before definitive open stabilization of the injury. Fixation is achieved either using large threaded pins, which are screwed into the bone, or by drilling smalldiameter transfixion wires through the bone. The pins or wires are then connected to one another through the use of longitudinal bars or circular rings. Acute trauma applications primarily use monolateral frame configurations and are the focus of techniques described here. The first type of monolateral frame is modular with individual components: Small tensioned wire circular fixator used for definitive management of a distal tibial periarticular fracture with proximal shaft extension. The versatility of these frames allows for spanning into the foot to maintain a plantigrade position. A hexapod frame attached to the bone with large Schanz pins. This frame allows for gradual correction of fracture displacement over time by adjusting the six distractors. The second type of monolateral frame is a more constrained type of fixator that comes preassembled with a multipin clamp at each end of a long rigid tubular body. The telescoping tube allows for axial compression or distraction of this so-called monotube-type fixator FIG 1C. For diaphyseal injuries, the most common type of fixator application is the monolateral frame using large pins for skeletal stabilization. Simple monolateral fixators have the distinct advantage of allowing individual pins to be placed at different angles and varying obliquities while still connecting to the bar. This is helpful when altering the pin position to avoid areas of soft tissue compromise ie, open wounds or severe contusion. Pin placement is predetermined by the multipin clamps. Loosening the universal articulations between the body and the clamps allows these frames to be easily manipulated to reduce a fracture. Many high-energy fractures involve the metaphyseal regions, and transfixion techniques using small tensioned wires are ideally suited to this region. They have better mechanical stability and longevity than traditional half-pin techniques. Small tensioned wire circular frames or hybrid frames frames using a combination of large half-pins and transfixion wires can be useful in patients with severe tibial metaphyseal injuries that occur in concert with other conditions such as soft tissue compromise or compartment syndrome or in patients with multiple injuries FIG 1D,E. Hexapod fixators are ring fixators consisting of six distractors and 12 ball joints which allow for 6 degrees of freedom of bone fragment displacement. By adjusting the simple distractors, gradual three-dimensional corrections or acute reductions are possible without the need for complicated frame mechanisms FIG 1F. The hard cortical bone found in this location is ideally suited to the placement of large Schanz pins, which achieves excellent mechanical fixation. The cross-sectional anatomy of the diaphysis and the lateral location of the muscular compartments allow placement of half-pins in a wide range of subcutaneous locations. The proximal and distal periarticular metaphyseal regions of the tibia are also subcutaneous except for their lateral surfaces. The bone in these locations is primarily cancellous, with thin cortical walls. Cross-sectional anatomy of the tibia at all levels. The proximal cross-section demonstrates the ability to achieve at least degrees of pin divergence in this region with progressively smaller diversion angles as the pins are placed distally. It is important to avoid tethering of any musculotendinous structures. To accomplish this, pins are placed primarily along the subcutaneous border of the tibia. Model showing similar pin placement avoiding the anterolateral and posterior muscular compartments. Posterior cortex pin protrusion is minimal to avoid damaging any posterior neurovascular structures. The mechanical stability achieved with half-pins depends on cortical purchase and therefore may not be adequate for fixation in this cortex-deficient region. Excellent stability is afforded in

these areas by using smalldiameter tensioned transfixion wires in conjunction with circular external fixators. Metaphyseal transfixion wires can be combined with diaphyseal half-pins can be combined to produce frames for periarticular fracture fixation for complex pilon and plateau fractures. External fixation is favored when there is significant contamination and severe soft tissue injury or when the fracture configuration extends into the metaphyseal-diaphyseal junction or the joint itself, making intramedullary nailing problematic. The choice of external fixator type depends on the location and complexity of the fracture as well as the type of wound present when dealing with open injuries. The less stable the fracture pattern ie, the more comminution , the more complex a frame needs to be applied to control motion at the bone ends. If possible, weight bearing should be a consideration. If periarticular extension or involvement is present, the ability to bridge the joint with the frame provides satisfactory stability for both hard and soft tissues. This demands that the pins are placed away from the zone of injury to avoid potential pin site contamination with the operative field. Fractures treated with external fixation heal with external bridging callus. External bridging callus is largely under the control of mechanical and other humoral factors and is highly dependent on the integrity of the surrounding soft tissue envelope. This type of fracture healing has the ability to bridge large gaps and is very tolerant of movement. Micromotion with the external fixator construct has been found to accentuate fracture union. It results in the development of a large callus with formation of cartilage due to the greater inflammatory response caused by increased micromovement of the fragments. There appears to be a threshold at which the degree of micromotion becomes inhibitory to this overall remodeling process, however, so hypertrophic nonunion can result from an unstable external frame. Temporary spanning fixation for complex articular injuries is used routinely. The ability to achieve an initial ligamentotaxis reduction substantially decreases the amount of injuryrelated swelling and edema by reducing large fracture gaps. It is important to achieve an early ligamentotaxis reduction: A delay of more than a few days will result in an inability to disimpact and adequately reduce displaced metaphyseal fragments with distraction alone. Once the soft tissues have recovered, definitive open reconstruction can be accomplished with relative ease as the operative tactic can be directed to the area of articular involvement. Simple monolateral or monotube fixators can be placed rapidly across long bone injuries, providing adequate stabilization to facilitate the management and resuscitation of the polytrauma patient FIG 3. On loading, these pins act as cantilevers and produce eccentric loading characteristics. Shear forces are regarded as inhibitory to fracture healing and bone formation, and this may be accentuated with pins placed in all the same orientation. External fixation on the right side spans bicondylar tibial plateau fracture with an ipsilateral pilon fracture. The left knee is bridged to stabilize a tibial plateau fracture and a severe bimalleolar ankle fracture. The left leg injury is complicated by a compartment syndrome with open fasciotomy wounds. After stable frame application, the soft tissue injury can be addressed. Once the soft tissues have healed, conversion to definitive internal fixation can be safely accomplished. In some cases, the external device is the definitive treatment. Dynamic weight bearing is initiated at an early stage once the fracture is deemed stable. In fractures that are highly comminuted, weight bearing is delayed until visible callus is achieved and sufficient stability has been maintained. As healing progresses, active dynamization of the frame may be required to achieve solid union. Dynamization converts a static fixator, which seeks to neutralize all forces including axial motion, and allows the passage of forces across the fracture site. As the elasticity of the callus decreases, bone stiffness and strength increase and larger loads can be supported. Bony healing is not complete until remodeling of the fracture has been achieved. At this stage, the visible fracture lines in the callus decrease and subsequently disappear. The fixator can be removed at this point. Determining whether the injury was high energy versus low energy gives the surgeon an idea of the extent of the soft tissue zone of injury and will help determine the possible location of fixation pins. Determining the location of the accident is helpful in cases of open fracture ie, open field with soil contamination vs. Extensive open grade 3b injury with bone and soft tissue loss dictates judicious pin placement to avoid placing pins directly into the open wound. An intercalary antibiotic spacer was inserted in the skeletal defect to augment the overall frame stability. The frame was spanned across the ankle to control the hindfoot due to a partial heel pad avulsion. The neurovascular status should be documented, specifically the presence or absence of the anterior and posterior tibial pulses at the ankle. A weak or absent pulse may be

an indication of vascular injury and may dictate further evaluation with ankle-brachial indices, compartment pressure evaluation, or a formal arteriogram. Evaluation of compartment pressures is often indicated in open fractures and closed high-energy fractures with severe soft tissue contusion. Evaluation of soft tissues and grading of the open fracture with regard to the size, orientation, and location of the open wounds aid in decision making about pin placement and the configuration of the fixator to allow access to open wounds FIG 4. Injury and post external fixation films demonstrating an ankle-spanning frame stabilizing a complex pilon fracture. Log In or Register to continue Share this:

Chapter 3 : Mandibular Fractures | ACVS

External fixation is a surgical treatment used to stabilize bone and soft tissues at a distance from the operative or injury focus. They provide unobstructed access to the relevant skeletal and soft tissue structures for their initial assessment and also for secondary interventions needed to restore bony continuity and a functional soft tissue cover.

Due to the of the discomfort associated with this injury your veterinarian may recommend sedation or anesthesia for your pet prior to palpating the injured area and performing further testing. Due to the minimal amount of soft tissue that covers the mandible, it is common for these fractures to be open. An open fracture is a fracture that has resulted in loss of integrity of the protective layer of soft tissue around the bone, exposing the disrupted bone edges to the external environment Figure 2. After your veterinarian determines that your pet is stable enough to focus on tests for and treatment of the mandibular injury, X-rays of the mandible will be recommended to confirm the presence of a fracture and to guide treatment recommendations Figure 3. Due to the complex anatomy of the mandible, teeth, and skull, radiographs are usually performed under heavy sedation or general anesthesia. This will decrease stress on your pet and allow for optimal positioning to interpret the complicated images. External immobilization may be placed. Reduction entails manipulating the bone fragments into alignment to minimize discomfort. External immobilization is usually some form of a muzzle, either custom made from medical tape or a commercial muzzle. In some cases, external immobilization is all that is required for treatment. Surgery is performed to restore proper occlusion normal scissor-like interaction of the teeth of the teeth, improve comfort and cosmetic appearance, and provide early return to function. Multiple methods of treating mandibular fractures are available and your surgeon will determine which method is most appropriate for your pet. Internal reduction and stabilization with bone plates and screws is a widely utilized surgical treatment Figure 4. This entails making an incision in the region of the fracture, reducing re-aligning the fracture segments and then stabilizing the fragments with a surgical bone plate and screws. Advantages include early return to function and the minimal postoperative care required compared to other techniques. Another common surgical treatment involves the use of external skeletal fixation ESF Figure 5. ESF involves placing pins through the skin into the bone fragments and then connecting these pins to a connecting rod that provides stability so that proper healing can occur. The majority of the ESF construct is on the outside of the animal and some postoperative care is required. Advantages of ESF are that the construct may be placed in a less invasive fashion and once the fracture is healed, the implants are completely removed. Other accepted surgical treatments include use of intraoral splints, interosseous or interfragmentary wiring, interdental wiring, or interarcade wiring Figure 6a, 6b, 6c. In some cases, placement of a feeding tube may be recommended for nutritional support while the fracture is healing.

Chapter 4 : Care of External Fixator Pin Sites

External Skeletal Fixation (ESF) is an effective method of fracture repair that is minimally invasive. ESF is a device which secures the fracture fragments with pins fixed outside the body to a rigid frame.

Chapter 5 : External Skeletal Fixation (ESF) - Veterinary Surgery

Introduction and History. External skeletal fixation can be used for primary or secondary stabilization of various open or closed long bone fractures, certain spinal fractures and luxations, luxations or arthrodesis of certain joints, and to provide support following ligament or tendon reconstruction.

Chapter 6 : Veterinary Supply and Orthopedic Resources | IMEX Veterinary, Inc.

External skeletal fixators provide good fracture alignment and rigid fixation. They are designed for fast application. It can be applied in closed reduction fashion using minimally invasive technique.

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Chapter 7 : External Skeletal Fixation | Veterian Key

Ilizarov external skeletal fixation and minimal internal fixation of distal tibial pilon fractures is a good method for treating all types of intra-articular pilon fracture. Management of distal tibial intra-articular fractures [tibial plafond] by various methods: a prospective study.

Chapter 8 : External Skeletal Fixation for dog fracture repair - CO canine orthopedics

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Chapter 9 : External Skeletal Fixation

An external skeletal fixator is a device the consists of pins that pass through the skin, underlying tissues and through the bone The pins are connected to a external bridging bar (see photo below) Types of external fixators.