Dimensions in Surgery

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Surgical Case Report:

Distal Humeral Fractures

EMPHASIS:

Distal humeral fractures are common in small animal practice, particularly in young dogs. Typically, these involve merely the lateral humeral condyle and they heal nicely with a lag screw and K-wire repair.

However, in some patients and particularly in cats, severely comminuted distal humeral fractures may pose a much greater challenge. Anatomic reduction and interfragmentary fixation of the numerous tiny fragments can be challenging or impossible; the distal humeral fracture fragment may be too small to easily accommodate screws for plate fixation; contouring a plate over the distal humerus, particularly in a cat, is difficult. In addition, open reduction and attempts at interfragmentary fixation may devitalize the small fragments, resulting of sequestration and non-union.

External fixation provides an excellent means of stabilizing the fracture while avoiding all of these difficulties. In this paper we will describe the technique for external fixation of a severely comminuted distal humeral fracture.

PREOPERATIVE DIAGNOSIS:

1. Complete physical examination.

AXIOM: Identify all other orthopedic injuries.

7. Cefalexin 20 mg/kg IV immediately preoperatively.

SURGICAL TECHNIQUE:

1. Skin and subcutaneous incision over the lateral epicondyle.

AXIOM: The incision need not extend any further proximal, so the radial nerve is not exposed in this procedure.

2. Incise the fascia and the insertion of the anconeus muscle, and elevate the anconeus muscle to expose the caudal aspect of the distal fracture fragment.

AXIOM: Visualizing the bone in this fashion allows for more accurate pin placement, minimizing the risk of inadvertent pin placement through any of the articular surfaces. In larger patients, this exposure may not be needed.

PREOPERATIVE CARE:

1. Indwelling cephalic catheter.


3. Radiographic examination:
   a). Two view radiographs of the humerus.
   b). Two view radiographs of the thorax and abdomen, in cases where blunt trauma is suspected.

4. Isoflurane inhalant anesthesia to effect.

5. Lead II ECG and pulse oximetry monitoring during prep and surgery.

6. Clip and prepare the hemipelvis, and the limb circumferentially.

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thermal necrosis at the pin entry site, while hand-chuck placement results in slightly looser pin stability.

AXIOM: If possible, 3 or even 4 pins should be placed, for better stability.

AXIOM: The pins should be placed no closer to the fracture line than a distance equal to half the bone diameter.

AXIOM: If clamps and a connecting bar are to be used, it is important that all pins be placed in the same plane; this is not necessary if methylmethacrylate is used. For smaller patients, we find that using methacrylate to link the pins is the easiest method.

AXIOM: The pins should be spaced over the entire length of the fragment, rather than close together.

AXIOM: The pins should be placed at angles relative to each other; if they are parallel, the risk of implant pull-out is increased.

AXIOM: End-threaded pins will resist pull-out better than smooth pins.

Figure 1: This schematic drawing depicts a severely comminuted distal right humerus. Always try to place three divergent pins in the distal segment.

Figure 2: This schematic drawing depicts the reason positive-profile threaded pins should be used instead of Steinmann pins for external fixation.

Figure 3: This schematic drawing depicts the placement of at least three divergent pins in the proximal segment.
AXIOM: Positive-profile-threaded pins, rather than Steinmann pins (which have the threads cut into the pin) are preferred; the thread-pin junction of a Steinmann pin is a “stress riser,” where bending forces are concentrated and a risk of breakage exists (See Figure 2).

AXIOM: If this is a “T-condylar fracture”, where the condyles are split, lag screw fixation of the condyles should first be performed. Then, place the pins.

4. Place a minimum of three pins in the proximal humeral segment (See Figure 3).

5. If there is significant length of bone cortex available distally to hold an IM pin, then as shown in Figure 4:
   • place an IM pin retrograde through the fracture site, exiting the greater tubercle
   • drive the pin distally into the distal fragment.

6. Bend the pins as shown in Figure 5, gripping the pin with a vise-grip pliers and using a second pliers to then bend the pin.

   **DANGER:** If only one pliers is used to bend the pin, leverage occurs at the bone-pin interface and a fracture may develop there (See Figure 5).

7. With the leg held in full extension and anatomic...
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Figure 6: This schematic drawing depicts: 6A) the placement and relationship of the bent pins prior to the application of methylmethacrylate. 6B) With leg held in extension, the methylmethacrylate is applied and cured incorporating the IM pins.

alignment, apply methylmethacrylate to create a rigid connecting bar (See Figure 6).

DANGER: Keep the methacrylate at least 1 cm away from the skin level (2 cm in larger patients); otherwise post-op swelling may press the skin against the methacrylate (or connecting bar/clamps) resulting in pressure sores.

8. Routine closure of the incision.

POSTOPERATIVE CARE:
1. Pain management using oral, injectable, or transdermal analgesics.
2. Strict confinement during the next 8-12 weeks.
3. Suture removal 14 days postoperatively.
4. Postoperative radiographs 4 weeks and 8 weeks postoperatively.
5. Fixator removal once there is radiographic confirmation of bone union.

PROGNOSIS:
Optimistic, with the great majority of patients returning to excellent weight bearing.

**Coming Attractions**
Most patients with carpal hyperextension injuries have trauma to the radiocarpal joint, and panarthrodesis is advised. In some cases, however, stress view radiographs reveal that the trauma is limited to the carpometacarpal joint.

This joint normally has minimal range of motion, and it can be arthrodesed without significantly changing overall carpal function. The prognosis is excellent for a return to normal weight bearing.

Next month, we shall outline our surgical protocol for carpometacarpal arthrodesis.

*See you then!*

AUTHOR’S NOTE
If you have any questions concerning this paper, additional references, surgical supplies or sources of products mentioned or used in this protocol, please FAX us at 1-310-479-8976. We will answer your questions promptly.

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