DIMENSIONS IN SURGERY

EMPHASIS:
The hip is the most commonly luxated joint in small animals. Hip luxations are usually due to trauma from a motor vehicle accident. The trauma results in tearing of the joint capsule as well as the ligament of the head of the femur. Occasionally, an avulsion fracture of the insertion of the ligament at the fovea capitus occurs. Most commonly, the direction of luxation is craniodorsal due to the contraction of the gluteal muscles. Caudoventral luxation may occur subsequently to a fall. Medial luxation is usually associated with acetabular fractures.

This paper describes a method of closed reduction as well as surgical options for open reduction and stabilization of the acutely luxated hip joint.

PREOPERATIVE DIAGNOSTICS:
1. Physical examination.

AXIOM: As with any trauma case, be alert for other musculoskeletal, spinal, and internal injuries.

AXIOM: With craniodorsal luxations, the limb is carried in an adducted position with external rotation. Flexion and extension of the hip joint will result in pain and the palpation of crepitus.

AXIOM: The greater trochanter is dorsally displaced in relation to the tuber ischii and the iliac crest. The trochanter may seem larger than in the normal limb. When placing the hind limbs in caudal extension, the luxated hip will make the affected limb appear shorter.

AXIOM: During external rotation of a normal hip, impingement of the thumb occurs when placed between the greater trochanter and ischial tuberosity. This impingement does not occur with palpation of a luxated hip.

2. Radiography
   a. Two-view radiographs of the pelvis
   b. Two-view radiographs of the thorax and abdomen

AXIOM: If there is any question about the integrity of the urinary tract, a positive contrast study can be performed.

AXIOM: Resist the urge to reduce the hip until you have taken radiographs. An avulsion fracture of the femoral head or radiographic evidence of severe hip dysplasia is an indication for surgical treatment.


PREOPERATIVE CARE:
1. Indwelling cephalic catheter

2. Intravenous anesthetic induction protocol (Ketamine/Valium, Propofol, etc.)

3. Endotracheal intubation and inflate cuff.

4. Isofluorane inhalant anesthesia to effect.

AXIOM: General anesthesia will assist in closed reduction efforts by providing more muscle relaxation than sedation alone.

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

6. If surgery is to be performed, clip and prepare the limb for aseptic surgery.

7. If surgery is to be performed, Cefazolin 20 mg/kg IV immediately preoperatively.

SURGICAL TECHNIQUE:
Closed Reduction of the Hip:
1. To reduce the hip, apply distal traction to the affected limb and externally rotate the femoral head.

AXIOM: To avoid pulling the dog off of the table, have an assistant applying countertraction by looping a leash or towel under the leg.

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2. Once the femoral head has been pulled to the level of the acetabulum, internal rotation of the femoral head will allow reduction into the acetabulum.

3. Flex and extend the hip once it is reduced, to ensure that no remnants of joint capsule or blood clots remain within the acetabulum.

Open Reduction of the Hip:
AXIOM: Open reduction is performed if closed reduction is unsuccessful or if an avulsion fracture from the femoral head is present.

1. If there is minimal damage to the joint capsule, capsulorraphy with non-absorbable suture is often the only surgical technique necessary (See Figure 1).

2. If the joint capsule is severely damaged or additional stabilization is needed, surgical techniques such as a prosthetic capsule reconstruction with screws and heavy nonabsorbable suture, transarticular pinning, Knowles toggle pinning, and greater trochanter relocation have been used for primary fixation of the luxated hip.

AXIOM: For each of these procedures, a trochanteric osteotomy is usually needed to achieve sufficient exposure of the hip. For increased stability, the osteotomy may be reattached in a slightly more distal and caudal than its original position.

3. For prosthetic capsule reconstruction:
   a. Screws are placed in the 11:00- and 2:00-o’clock position in the dorsal acetabular rim (10:00- and 1:00-continued on page 17

Figure One: This schematic drawing depicts a capsulorrhaphy repair using interrupted non-absorbable sutures.

Figure Two: This schematic drawing depicts the creation of a synthetic capsule using non-absorbably sutures, ASIF cortical screws, and washers.

Figure Three: This schematic drawing depicts:
A) An IM pin is driven from the fovea capitis through the femoral neck exiting the femur caudally below the osteotomy site. B) The femoral head is reduced into the acetabulum. The lower limb is abducted, the chuck is reversed to the other end of the pin, and the pin is retrograded through the wall of the acetabulum into the pelvic canal.
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Figure Four: This schematic drawing depicts the initial preparation of the femoral head and acetabulum for the toggle pin procedure. A) An IM pin is driven from the fovea capitis through the femoral neck exiting the femur caudally below the osteotomy site. B) A drill is created in the acetabular fossa approximately where the round ligament attaches.

o’clock for the left hip)
(See Figure 2).

b. A hole is drilled through the femoral neck and large non-absorbable sutures are placed through the hole and around the screws
(See Figure 2).

AXIOM: Washers may be used to secure the sutures around the screw head.

4. Transarticular pinning consists of placement of a Steinmann pin through the femoral head into the acetabulum.

a. The pin is placed from the fovea capitus laterally through the neck.

b. Once the hip is reduced, the pin is then driven forward through the acetabular wall into the pelvic canal (See Figure 3).

AXIOM: Complications of this technique include breakage of the pin or perforation of the colon/rectum.

AXIOM: This method of surgical repair is protected with an Ehmer sling. The sling and pins are removed in 2-3 weeks.

5. Toggle-pin fixation is the most anatomic fixation of the hip. This method creates a synthetic round ligament.

a. A hole is drilled from the fovea capitus laterally through the neck, as in the transarticular pinning. A hole is then drilled through the acetabular fossa (See Figure 4).

AXIOM: Toggle pins are commercially available, or can be made by twisting a Kirschner wire. Two strands of nonabsorbable suture are placed through the toggle pin.

b. The toggle pin is placed through the hole in the acetabular fossa and then rotated 90 degrees by pulling of the suture ends.

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Figure Five: This schematic drawing depicts the placement of the toggle pin. A) A needle holder grasps the toggle pin with the sutures pre-threaded. The needle holder is used to force the toggle and sutures through the drill hole in the acetabular fossa. Once through the hole, the toggle rests in the pelvic canal. B) The sutures are pulled taut tightening the toggle against the medial side of the acetabulum. C) A rigid wire is directed through the femoral neck exiting the femoral head. The wire has a loop on one end to capture the sutures. D) The sutures are withdrawn using the rigid wire, and the loose ends of the suture are threaded through a button. The lower leg is abducted and the sutures are pulled up tightly and tied securely over the button creating a round ligament fixation.
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c. The suture ends are placed through the hole in the femoral neck and tied through a button on the caudal aspect of the greater trochanter (See Figure 5).

AXIOM: If there is poor dorsal coverage of the hip after reduction due to preexistent hip dysplasia, a triple pelvic osteotomy can be performed to increase stability of the hip joint.

AXIOM: With recurrent luxation, a salvage procedure such as a femoral head osteotomy or a total hip replacement is indicated.

POSTOPERATIVE CARE:
1. An Ehmer sling may be used following any open or closed reduction technique. The sling is left on for 2 weeks.

AXIOM: We do not routinely place a sling if a hip luxation or fracture is present on the opposite limb.

2. Postoperative antibiotic therapy (Cephalexin 20mg/kg PO tid).

3. Pain management as needed, using oral, injectable, or transdermal analgesics.

4. Short leash walks only for the next 6 weeks; no running, jumping, playing, going up and down stairs, etc.

5. Suture removal and sling removal two weeks postoperatively.

6. Follow-up radiographs, with patient sedated, four weeks postoperatively.

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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