Rotational Deformities

Rotational deformities of the femur are a common indication for derotational osteotomies in the dog. Most deformities are the result of inadequate fixation of femoral shaft fractures. Many times when femoral fractures occur, treatment is instituted using a splint or an intramedullary rod. When femoral shaft fractures are allowed to rotate in relation to each other, the proximal fragment will always rotate externally, pulled by the fibers of the iliopsoas muscle. This muscle attaches to the lesser trochanter of the femur and normally functions to flex and externally rotate the femur. If casts or splints are used in the treatment of these fractures, careful attention must be paid to the relationship of the ends of the femur to prevent rotational deformities. Chapter 15 describes in detail the method of application of a Schroeder-Thomas splint for fractures of the femur. The same concerns are present with other casting methods, as well as with internal fixation using round intramedullary pins. Since rotation can and does occur if the pin is not sized properly, rotational deformities are common, especially after delayed unions.

Increased developmental anteversion is another rotational deformity of the femur. This condition usually occurs in large breed dogs but has been described in small breeds as well.(7,10) In large breeds the condition has been treated by intertrochanteric derotational osteotomy using an angled blade plate (Fig. 43-1).(7)
Occasionally rotational deformities are also seen in the tibia. Here the deformity is usually one of external rotation, and only severe deformities require treatment by osteotomy.

The diagnosis of a rotational deformity is not difficult. The common external rotational deformity of the proximal femur will present with the dog showing an internal rotation deformity of the knee with the hock out and the foot rotated internally. This occurs because the dog makes an attempt to cover the head of the femur with the acetabulum. If, however, the external rotational deformity of the femur is extreme, the hip may subluxate cranially and the dog cannot bring the hip back into position, and the animal will present with an overall external rotational deformity with the paw pointing outward. Physical examination of the limb will determine the problem. Internal rotation of the hip to its normal position will give marked external rotation of the point of the hock if an abnormal amount of anteversion of the femur is present. Comparisons with the contralateral side will help make the determination of normal and abnormal. Radiographic examination will show the level of the deformity and may be useful in determining the extent of the angular or rotational deformity. Plain films as well as anteversion films may be taken. Femoral anteversion may be measured directly using image intensification and spot films with the femur held perpendicular to the film or may be measured using two views and a special chart to calculate the angles of anteversion. (1,8)

Treatment of the condition is by a transverse osteotomy, derotation, and stabilization, usually with a plate and screws to ensure that the rotation will not recur. (7) To accomplish the osteotomy correctly, the cut should be made at the level of the deformity. The amount of denotation necessary can be calculated before surgery using the radiographs, and a small line is cut longitudinally in the shaft of the femur at the level of the osteotomy to act as a marker so that when the osteotomy is made the original position will be known and denotation can be accomplished accurately.

Angular deformity

When malunions occur in the shaft of the femur and tibia, angular limb deformities may result. Most of the deformities in the tibia will be in valgus configurations, but any position is possible, especially in the femur. There exists a possibility to correct any deformity that is seen. The problem consists of determining which deformities need correction. Purely cosmetic surgeries are done for dogs that must perform in the show ring. Surgical corrections should be reserved for dogs that have a functional disability that is correctable by osteotomy (Fig. 43-2).

The osteotomy is performed at the level of the deformity. Since angulation is involved, it is important to have planned the procedure, (See Chapter 40.) A preoperative drawing should be made using tracings of the radiographs to correct the angulation. Cutting out the proper wedge on paper will help determine the result of surgery. The three-dimensional nature of any angular deformity must be kept in mind. Rarely is the deformity in just one plane, and the wedge osteotomy must consider all planes. Although the paper representation of the osteotomy may allow for two separate wedges, one in each plane, the surgical plan should incorporate the shape of these two wedges into a single three-dimensional wedge. The fixation

**FIG. 43-1** This young Saint Bernard was brought for treatment with hind limb pain and disability. Physical examination showed excessive internal rotation of the hip joint bilaterally (A). Following anteversion radiographs, a derotational osteotomy was performed unilaterally (B,C). The dog improved to the point that the owners did not wish to have the other bad leg operated upon. The dog could now rise easily from the sitting position.

**FIG. 43-2** This small breed dog fractured its leg while in Saudi Arabia. The treatment that was instituted resulted in an angular deformity (A,B). A midshaft osteotomy was performed to straighten the deformity, using a plate and screws for fixation (C,D).
of the bone following the osteotomy represents the least difficult part of this procedure.

Soft tissue contracture may represent a serious problem when treating a deformity of long standing. The selection of opening wedge versus closing wedge osteotomy will depend on these soft tissue considerations as well as on the relative bone length. It should be remembered that if the angular deformity is corrected, the useful leg length of the patient will be increased even if a closing wedge osteotomy is chosen.

COMBINATION DEFORMITIES
Very often, angular limb deformities will be combined with rotational deformities in the femur and tibia. When this occurs the treatment may involve osteotomy, but one must keep in mind all of the points discussed above. The three-dimensional integration of angular and rotational deformities that is necessary for adequate treatment can be difficult.

Malunions may occur that will influence adjacent joints. These cases are usually combinations of angular and rotational deformities and provide a problem for adequate treatment. When this occurs two options exist: either the lesion in the joint can be repaired or the bone can be straightened. The usual choice is to accomplish the result with the lesser surgical procedure.

SPECIAL OSTEOTOMIES OF THE HIP
Derotational or varus derotational osteotomy of the canine hip has been approached in two ways. ASIF instrumentation, that is, the child's blade osteotomy plate and the special double-hook plate, has been used for intertrochanteric osteotomy in the dog.(7,9) The technique for the double-hook plate for use in the dog is described by the manufacturer.(9) The child's blade osteotomy plate has been described for use in the dog (Fig. 43-3)(7)

FIG. 43-3 The child's blade osteotomy plate is inserted in the dog by the following procedure: First, because the head and neck of the dog's femur contains hard dense bone, a hole is predrilled into the neck perpendicular to the proximal lateral metaphyseal cortex (A). A 3.2-mm drill bit is used, but the hole is not drilled through the head. The chisel guide is then placed in position so that the chisel will track down the guide hole (B). Kirschner wires may be placed as guide wires before the osteotomy. The chisel is seated to the proper depth. The osteotomy is performed just proximal to the lesser trochanter in a transverse plane (c) The angle blade plate is then inserted and the plate fastened to the femoral shaft using the tension device (D). Position of the denotation is ensured and the tension device is removed following placement of the screws in the plate (E). The final screw is placed into the plate and the procedure is completed.

Osteotomies have been performed for increased anteversion to improve hip joint stability and for hip dysplasia to improve the congruency of the hip by variation or derotation (Fig. 43-4). The efficacy of the procedures for either condition has not been well established in the veterinary literature. Treatment of increased anteversion does seem to help the dogs I have operated upon, but the total case number is small. The same can be said for the treatment of painful hip dysplasia (not of the extreme type). Here the position of the hip seems less important than the osteotomy itself. My limited experience shows that pain relief is accomplished by the osteotomy even if subluxation and degenerative joint disease remain. The vascularity or intraosseous pressure seem to be changed by the osteotomy, and the results of improved function at a perceived lower pain level can be impressive. The proposed biomechanical improvement of the hip joint due to improved contact area has yet to be proven in the dog. At 6 months most postoperative radiographs of the hip joint look very similar to the preoperative films.
FEMORAL HEAD AND NECK EXCISION
Excision arthroplasty, femoral head and neck ostectomy, femoral head and neck excision, and femoral head and neck resection are all terms that refer to the removal of the head and neck of the femur for the relief of pain.

The procedure is modeled after that described for humans.(5) It is for salvage solely and should be used only when there is severe, unrelenting pain. The procedure makes the hip joint unstable but allows for scar formation at the juncture of the level of the previous hip joint. Therefore the range of motion is diminished and the limb is shortened. Gait abnormalities are not corrected by excision, and certain dogs may have a pronounced limp associated with this procedure. It seems best suited for small dogs under 40 pounds, but good results have been seen in large dogs as well. The indications are similar to those for total hip joint replacement. In fact, failed hip joint prostheses are revised to excision arthroplasties and vice versa. The most inappropriate indication is in the older dog with painful hip disease and a superimposed neurologic deficit of the hind limbs. Results of excision arthroplasty are variable, but improvement can be seen up to 6 months following surgery. Many small dogs will have an excellent result with no perceived gait abnormality.

The procedure is carried out through one of the four approaches to the hip joint described in Chapter 28. The cranial approach is used most commonly. Following dissection to the level of the joint capsule, incision into the capsule is made parallel to the rim of the acetabulum. The round ligament is severed with a sharp periosteal elevator or Mayo scissors by abducting and externally rotating the femur and inserting the instrument ventrally into the acetabulum. Following the section of the ligament, the joint capsule is freed around the acetabulum and the femoral head is luxated to the cranial dorsal position. Further external rotation of the femur will present the proximal femur out of the wound. In some dogs the manipulation can continue until the external rotation of the femur is complete, thereby placing the draped foot just dorsal and posterior to the head of the animal. In this way the femoral head and neck are presented vertically. The head and neck are then removed using an osteotome or cutting wire. The excision should start above the lesser trochanter and remove all of the neck. The ventral aspect of the osteotomy is most important, since this is the area that will come to lie against the dorsal rim of the acetabulum and will represent the closest bone-to-bone juncture of the finished procedure. The joint capsule is closed if accomplished easily; however, since the new joint will be dorsal and cranial to the acetabulum, it is not mandatory that the capsule be closed. The closure is completed according to the approach that is made (Fig. 43-5).

Postoperatively the animal is restricted in movement until the skin sutures are removed. At this time exercise is begun and continued. Best results seem to be associated with higher levels of exercise at this time.
REFERENCES