Arthrodesis of the Stifle, Tarsus, and Interphalangeal Joints

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- Arthrodesis of the Stifle
- Arthrodesis of the Talocrural Joint
- Tarsometatarsal Arthrodesis
- Interphalangeal Joint Arthrodesis

ARTHRODESIS OF THE STIFLE
Arthrodesis of the stifle is not commonly performed. Usually only disease or instability at its very end stage requires such a procedure. Total knee dislocation may require arthrodesis if corrective ligamentous procedures fail. End-stage cruciate disease, patellar luxation, or degenerative joint disease may also require arthrodesis.

PLATE AND SCREW FIXATION
Surgical exposure of the stifle is accomplished by a standard lateral parapatellar skin incision. Both medial and lateral parapatellar arthrotomies are performed to allow complete retraction of the quadriceps muscles and total visualization of the joint.

The stifle is positioned at the desired angle of arthrodesis, and flat surfaces are cut on the femoral condyles and the proximal tibia using a saw. These surfaces will appose one another in the arthrodesis. Cutting the bone surfaces also removes all intra-articular structures, namely, cruciates and menisci. When cutting these surfaces, the surgeon must remember that bone shortening is occurring and must be compensated for by extending the stifle more than expected. The trochlear lips must also be removed with a saw to produce a flat cranial surface on which the bone plate can lie.

The stifle should be positioned and held in temporary alignment with a transfixing Kirschner wire. An eight to ten-hole plate should be bent to fit the cranial surface of the femur, stifle, and tibia. Once bending is complete, the plate should be attached to the tibia. Cancellous bone graft may be necessary depending upon the fit of the cut tibial and femoral surfaces. If doubt exists, graft should be added. If possible, the graft material should be packed over the cranial surface of the joint.

Following grafting, the proximal plate is screwed to the femoral shaft. Additional interfragmentary screws may be added between the femoral and tibial condyles in very large dogs, if necessary. Following plate attachment, the tibial tuberosity must be reattached. It is usually attached to the lateral side of the arthrodesis site with a single interfragmentary screw (Figs. 47-1 and 47-2).

FIG. 47-1 Plate placement for stifle arthrodesis.
FULL-PIN KIRSCHER-EHMER DEVICE
Full-pin devices have been used routinely for human knee arthrodesis. A device similar to a full-pin Kirschner-Ehmer is the Charnley device. The dog and cat may be similarly fixed. Following complete joint debridement and packing with cancellous bone, the stifle is positioned at an appropriate angle. Two pins are placed through the distal half of the femoral shaft and two are placed through the proximal half of the tibial shaft. The full pins are connected externally. This form of fixation provides very rigid stability and should proceed to an uneventful arthrodesis.

TRANSFIXATION PINS OR SCREWS
Transfixation pins or screws may be used in very small animals in whom plates or full-pin devices are considered too large. Following joint debridement and grafting, either two pins or two screws are crossed through the stifle. The resulting fixation is rigid but more prone to failure than plates or full-pin devices. Transfixation pins or screws should be used as a third choice and then only in cats or dogs weighing less than 20 lb.

POSTOPERATIVE CARE
As with all arthrodeses, the surgical site must be placed into external fixation for 6 to 8 weeks. The external device is best if it includes a hip spica so that the entire limb is rigidly immobilized.

COMPLICATIONS
Complications are rare in stifle arthrodesis, since the cut surfaces of the femur and tibia readily unite. Problems may be seen, however, in the hock or hip as the animal begins to walk with a new and different gait. The animal may also be forced to bear more weight on another limb during the recovery period, thus exacerbating problems in the other limbs.

Dogs do well on an arthrodesed knee. Most learn to walk well and are able to resume normal nonathletic activity. It may be more difficult for the animal to rise or lie down. Bilateral stifle arthrodesis is not compatible with normal function. Animals cannot rise, lie down, negotiate stairs, or perform most simple functions. Walking is possible. Bilateral knee arthrodesis should not be performed.

ARTHRODESIS OF THE TALOCRURAL JOINT
Most injuries to the ligamentous structures of the talocrural joint are amenable to repair. Occasionally when repairs fail or secondary degenerative joint disease is severe, arthrodesis becomes necessary. Severe intra-articular fracture may require talocrural arthrodesis as a primary procedure.

PLATE AND SCREW FIXATION
Surgical exposure is provided by a lateral skin incision from midtibia over the tarsus to midmetatarsus. Further caudal exposure of the joint is accomplished by calcaneal osteotomy. This allows complete retraction of the gastrocnemius muscle and exposes the joint. Periosteal elevation of muscles over the posterior tissues and metatarsus is also necessary. The distal tibia and the tibial tarsal bone must be completely debrided of cartilage. The joint is fixed temporarily at the desired angle of arthrodesis with a transfixing Kirschner wire. A six- to eight-hole plate is bent to fit the caudal surface of the tibia, tarsus, and metatarsal III. The plate is first attached to the caudal surface of the tibia. The transfixation pin is then removed and
Cancerous bone is packed into the arthrodesis site. Care must be taken to place bone over the cranial surface of the joint. Finally the joint is aligned and the plate is fixed to metatarsal III. Any remaining holes in the plate that are over the tarsal bones are also filled. The tuber calcis is reattached on the side of the arthrodesis site (Fig. 47-3). (7)

**FIG. 47-3 Plate placement for talocrural arthrodesis.**

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**SCREW FIXATION**

A technique requiring less surgical exposure utilizes a transfixation screw. Following joint debridement and grafting, a single cancellous screw is placed from caudally through the tibial tarsal bone, across the arthrodesis site, and seated in the distal tibia. An additional tension band wire is placed between the tuber calcis and the tibia to protect the screw. (3, 5, 9)

This method is preferable in cats and smaller dogs. In large dogs, plate fixation affords more stability.

**PIN TRANSFIXATION AND GRAFT**

A sample technique first described by Leonard has been modified. Following joint debridement and cancerous grafting, a pin, which slides the length of the tibia, is introduced through the proximal medial tibia. The pin is advanced through the talocrural joint and penetrates to the caudal surface of the tibial tarsal bone. A Hall drill is used to create one or more troughs across the arthrodesis site from tibia to tibial tarsal bone. Segments of corticocancellous bone from the ilial wing are pounded into the troughs to provide further fixation and graft material (Figs. 47-4 and 47-5). I have had a great deal of success with this method.

**FIG. 47-4 Pin transfixation and a corticocancellous bone graft for talocrural arthrodesis.**

**FIG. 47-5 Medial-lateral radiograph demonstrates fusion of a dog talocrural joint 6 months following pin transfixation and a corticocancellous bone graft.**

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**POSTOPERATIVE CARE**

External fixation is necessary for at least 6 to 8 weeks. Plaster or fiberglass casts work very well. Plastic cranial half casts can be used as well.

**COMPLICATIONS**

Most talocrural arthrodeses are uneventful. Dogs and cats compensate well for the loss of motion by altering their use of stifle and hip.
INTERTARSAL ARTHRODESIS
Intertarsal arthrodesis is usually necessitated by traumatic luxation or subluxation of the intertarsal joint. While trauma is usually responsible for luxation, rheumatoid arthritis or arthritis due to lupus erythematosus may also be responsible.

PLATE AND SCREW FIXATION
Plate and screw fixation may be used for intertarsal arthrodesis but is rarely the method of choice because of the need for extensive surgical exposure. Exposure is usually accomplished by a lateral incision over the site of the arthrodesis and blunt elevation and retraction of the overlying plantar muscles and ligaments. The arthrodesis site is debrided and packed with cancerous bone. A six- or seven-hole plate is applied either laterally, down to the lateral surface of the fibular tarsal bone and the lateral surface of metatarsal V, (2,5,6) or caudally, over the caudal surface of the fibular tarsal bone and the caudal surface of metatarsal III (Fig. 47-6). (7)

TENSION BAND WIRE
The tension band wire is the preferred method of fixation for intertarsal arthrodesis. Following joint debridement and grafting, two Steinmann pins are placed through the length of the fibular tarsal bone, across the arthrodesis site, and seated into the metatarsal bones. A tension wire is placed over the caudal surface of the fixation by passing the wire proximally around the pins and distally through a transverse hole in tarsal bone IV. This fixation requires minimal surgical exposure yet results in complete stability. (3,6,8) Some surgeons prefer a screw to pins but still use a tension band wire. (4)

TRANSFIXATION PINS
Transfixation pins afford the least amount of internal fixation but may prove useful in small cats and dogs. After joint debridement and grafting, the arthrodesis site is aligned and two Steinmann pins are passed through the joint. It is best if the pins pass obliquely from medial to lateral as they transfix the joint.

FULL-PIN SPLINTS
Full-pin Kirschner-Ehmer splints work very well as a method of fixation. (1) Two pins must be placed through the fibular tarsal bone, medial to lateral, and two through the metatarsals. It is impossible to pin all metatarsals II through V because the bones curve. Any two will afford good fixation. Following intertarsal alignment, the external pins are connected to provide stability.

POSTOPERATIVE CARE
Animals require external fixation despite the solid internal fixation that has been used. Cranial half casts or full encircling casts of plaster or fiberglass work well. They must remain in place for at least 6 to 8 weeks.

TARSOMETATARSAL ARTHRODESIS
The causes of tarsometatarsal disease are identical to those of intertarsal problems. Arthrodesis is commonly performed for trauma and subsequent luxation or subluxation that does not respond to conservative treatment.

PLATE AND SCREW FIXATION
As in intertarsal arthrodesis, plate and screw fraction is used very successfully. It requires substantial surgical exposure, which may be a drawback. The plate is placed either laterally or caudally over the arthrodesis site (Fig. 47-6).

FIG. 47-6 Plate and screw placement for intertarsal arthrodesis.
TENSION BAND WIRE
It is difficult to tension band a site as distal as the tarsometatarsal joint. Pins may be passed; however, the wire is difficult to place into the metatarsal bones. The technique can be used, but difficulty should be anticipated.

TRANSFIXATION PINS
Transfixation pins seem to be the method of choice due to their ease of application. Following debridement and grafting one large pin is placed through the fibular tarsal bone, through the tarsal bones, and into metatarsal III. This provides the primary fixation. Two additional Steinmann pins are placed beginning at the base of metatarsal II and metatarsal V and crossing through the arthrodesis site. This method of fixation provides excellent stability (Fig. 47-7).

FIG. 47-7 Transfixation pin placement for intertarsal arthrodesis.

POSTOPERATIVE CARE
External fixation in a half cast or full cast is necessary for at least 6 to 8 weeks or until there is radiographic evidence of fusion.

INTERPHALANGEAL JOINT ARTHRODESIS
Interphalangeal joint arthrodeses are not commonly performed; however, athletic dogs may require this surgery. Indications are interphalangeal dislocations or fractures resulting in pain, discomfort, and lack of ability to perform.

INTERNAL FIXATION
There are no proven methods of interphalangeal arthrodesis; however, many rational methods used elsewhere seem to have application. Following exposure of the joint, debridement of the cartilage, and grafting of cancellous bone, the joint must be positioned anatomically. Transfixation pins may prove useful, especially if a tension band wire is placed around the pins over the tension surface of the joint. In larger joints of large dogs, the addition of an on-edge iliac graft placed into a groove cut in the joint may prove beneficial.

POSTOPERATIVE CARE
Complete cage rest is more likely than a cast to prove beneficial, since most dogs still move their toes even in casts. The cast is still necessary, but all activity must be curtailed as well until fusion has occurred.

REFERENCES

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