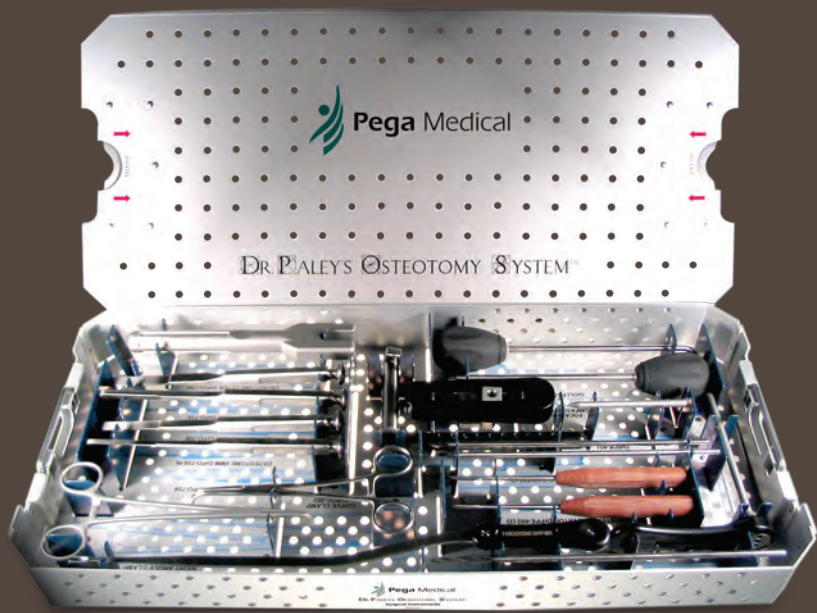




Pega Medical

DR.
PALEY'S
OSTEOTOMY
SYSTEM™



Set of surgical instruments
for deformity correction
procedures selected and
optimized by Dr. Dror Paley

PRODUCT MANUAL

DR. PALEY'S OSTEOTOMY SYSTEM™

Dr. Paley's Osteotomy system is a set of surgical instruments especially selected and optimized by Dr. Dror Paley (Baltimore, USA) to avail other orthopaedic surgeons of all the necessary instrumentation during deformity correction procedures. Based on Dr. Paley's own "ideal set" used regularly in the OR and manufactured by demand of LLD specialists, the set concentrates all the small details that makes surgery that much simpler.

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DR. PALEY'S OSTEOTOMY SYSTEM™

Developed in collaboration with:

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Orthopedics
Co-Director, International Center for Limb
Lengthening
Sinai Hospital of Baltimore, MD USA



INSTRUMENTATION

Description	Reference #
Focal Dome Beam Compass	DrPBC-101
Femoral Outrigger	DrPFO-102
Right Angle clamp	DrPRAC-201
Curve Clamp	DrPCC-202
Drill Guide	DrPDG-301
Drill	DrPCD-448
Gigli Passer	DrPGP-501 and DrPGP-502
Fasciotome	DrPF-601
Periosteal Elevator	DrPPE-602
Osteotome 4 mm	DrPO-704
Osteotome 6 mm with guide	DrPO-706-W
Osteotome 8 mm	DrPO-708
Osteotome 10 mm	DrPO-710
Osteotome Lever	DrPOL-700
CORA Pin	DrPCP-801
Auxiliary Pins	DRPAP- 902
Instrument Case	DrP-Case
Full Instrument Kit	DrP-INSTSET



PRELIMINARIES FOCAL DOME OSTEOTOMY

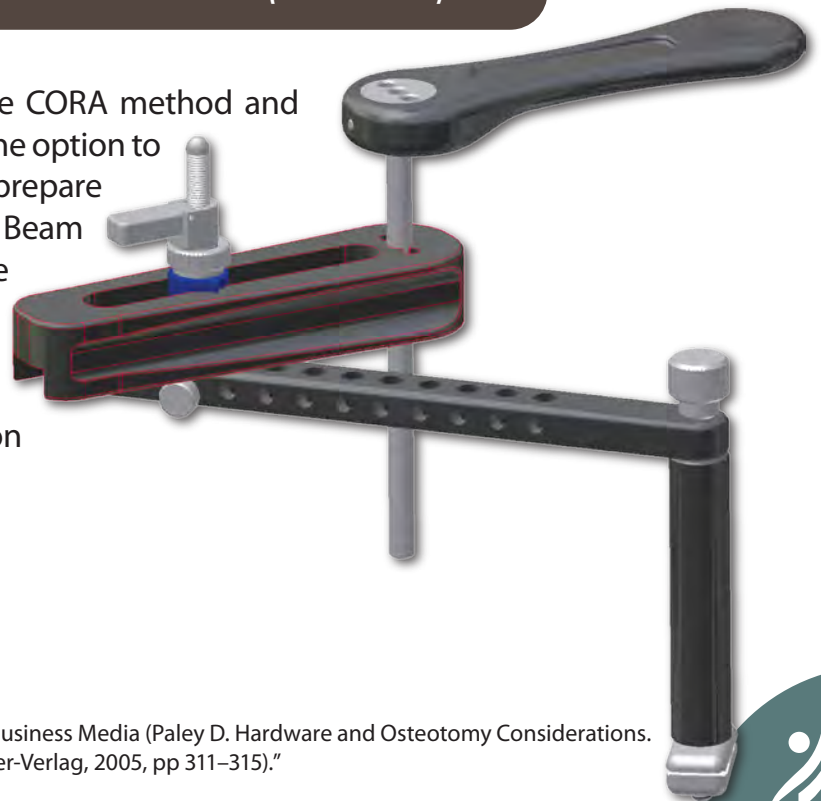
The so-called dome osteotomy is not shaped like a dome at all but rather like an arch (a dome has a spherical surface, whereas an arch has a cylindrical surface). This cylindrical bone cut is corrected by rotating around the central axis of the cylinder. If the axis of the cylindrical bone cut is not matched to the CORA (Center of Rotation of Angulation), a secondary translation deformity will result. If the axis of the cylindrical osteotomy and the CORA correspond, the correction will follow osteotomy rule 2, with no secondary translation of the axis lines but with angulation and translation of the bone ends. The dome osteotomy is an a-t osteotomy with better bone contact than that provided by the straight cut variant. It is much more difficult to produce a dome osteotomy than a straight cut. There are many ways to make dome osteotomies. Special curved saws and osteotomes are available for domes of a small radius, such as in the metatarsals. In larger bones, multiple drill holes are made in a circular pattern and connected with an osteotome. With the multiple drill hole method, any radius of curvature can be made. Although templates can be used for different radii, it is preferable to use a central pivot point to guide the drill holes, similar to the way a compass is used to draw concentric circles. If the central pivot point is matched to the CORA, the axis of the cylindrical cut is centered on the CORA. This is called focal dome osteotomy.

METHOD OF OSTEOTOMY

The technique of focal dome osteotomy is illustrated in Figures 1, 2 and 3*. These examples focus on less well-known osteotomy techniques, many of which were developed or modified by Dr. Dror Paley and most of which can be performed percutaneously in a low energy fashion using osteotome, multiple drill hole and osteotome, or Gigli saw techniques shown in figures 4, 5, 6, 7, 8 and 9*. These osteotomies are especially useful with external fixation but can also be used with limited exposure or minimally invasive internal fixation methods (Collinge and Sanders, 2000)

Focal dome beam compass (DrPBC-101) and Constraint Drill Guide (DrPDG-301)

The focal dome Beam Compass is based on the CORA method and utilizes a continuously variable radius that gives the option to select a precise radius from the CORA point and prepare the focal dome osteotomy. The Focal Dome Beam Compass and Drill Guide allow to attain accurate placement and alignment of the contiguous drill holes in a polar array of excellent precision. The complementary use of German-made osteotomes or Gigli saw assures the safe creation of the osteotomy dome with minimal bone loss.

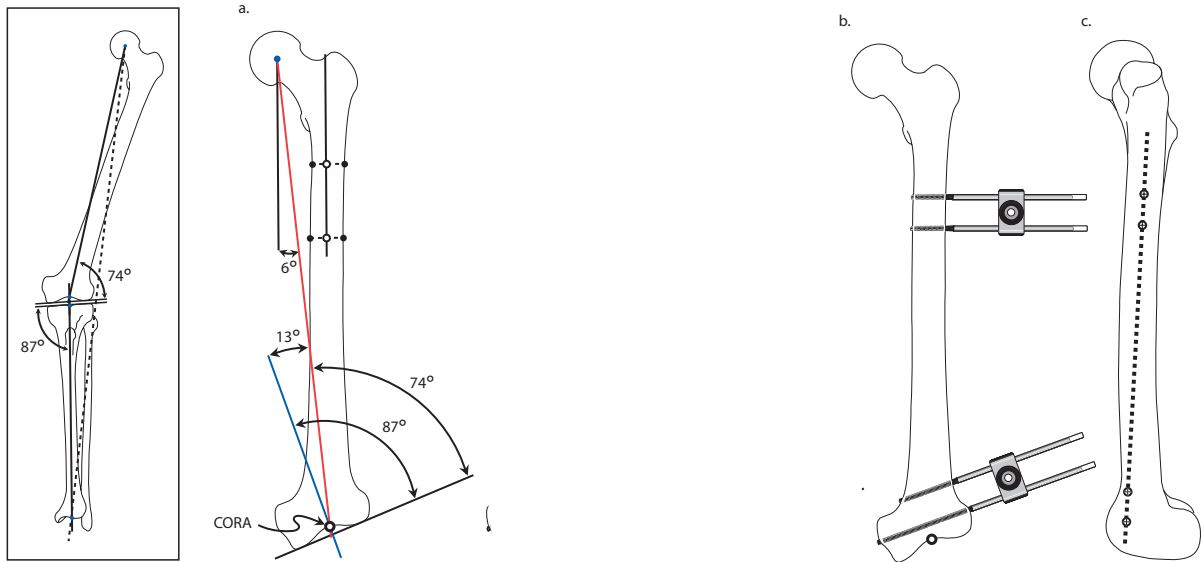


* All figures modified with kind permission of Springer Science and Business Media (Paley D. Hardware and Osteotomy Considerations. In: Paley D. Principles of Deformity Correction. Rev ed. Berlin: Springer-Verlag, 2005, pp 311–315)."



FIXATOR-ASSISTED NAILING OF A DISTAL FEMORAL VALGUS DEFORMITY: RETROGRADE TECHNIQUE

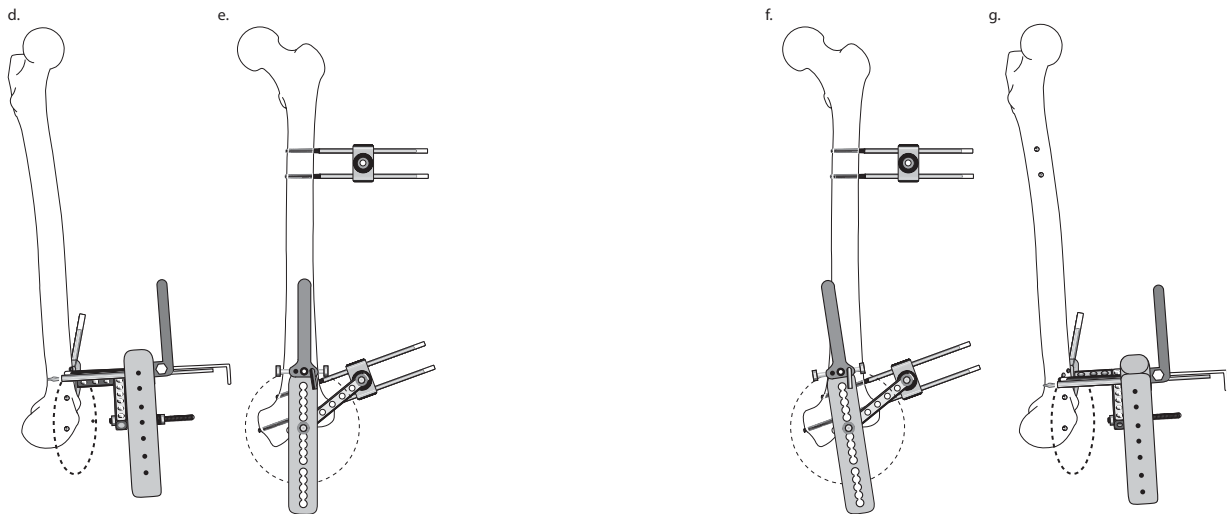
Fig. 1 a-s



a Valgus deformity of the distal femur (13°), with the center of rotation of angulation (CORA) at the joint line level.

b Insertion of two pairs of external fixation pins from the lateral side.

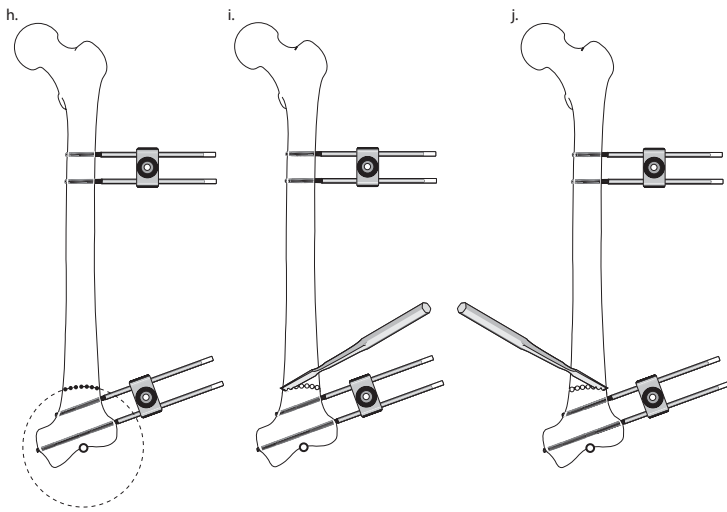
c Distally, the pins are anterior in the femur to keep them out of the planned nail path. Proximally, the pins are mid-diaphyseal because the retrograde nail will stop short of the pins.



d The focal dome drill guide is attached to the distal pair of pins. The drill guide is suspended above the soft tissues of the thigh.

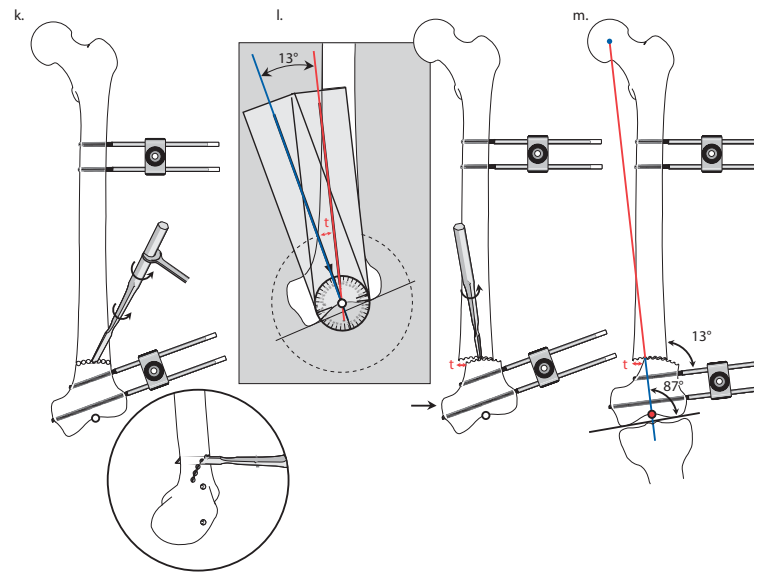
e Frontal view of the focal dome drill guide assembly. The pivot point of the guide is over the CORA. The outrigger (DrPFO-102) shown here and in the previous figure creates this pivot point in space. The outrigger is adjusted, using the image intensifier, until the pivot point on the outrigger matches the CORA. The focal dome drill guide can rotate side to side on the CORA. The hole chosen for the osteotomy must leave a sufficiently large segment distally to allow for locking screw fixation. A transverse incision is made in the skin, and a longitudinal split is made in the quadriceps muscle. Using a drill guide for protection, multiple drill holes are drilled into the femur with a 4.8 mm drill bit. These follow a circular pattern of a set radius as determined by the focal dome drill guide. Constrained guide system inserts a blunt probe into the previous hole drilled, minimizing any movement of the guide while the next hole is drilled. This also ensures more even spacing between drill holes.

f,g It is difficult to drill the edge holes. The drill bit tends to walk on the sloping surface of the bone. By using the constrained guide probe it is easier to drill the edge holes.



h The circular pattern of holes after completion of the drilling.

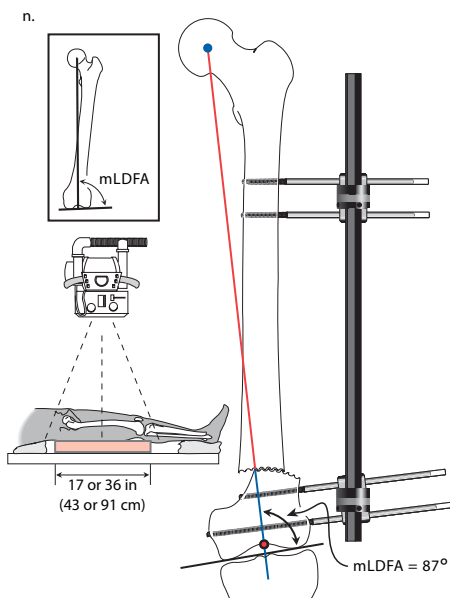
i,j An osteotome is used to cut the medial and lateral edges of the bone.



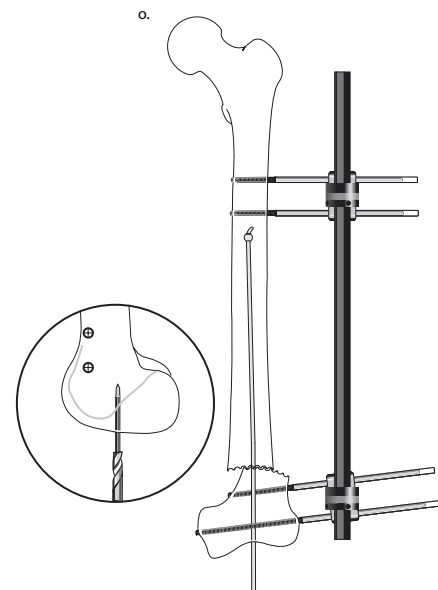
k The osteotome is then inserted into the center of the bone, going through both cortices. The osteotome is twisted to spread and crack the bone. The direction of twisting is based on the direction of displacement desired. For medial translation of a left femur, the osteotome is twisted clockwise, and for lateral translation, it is twisted counterclockwise.

l The osteotomy is displaced laterally before any angulation is performed. The amount of translation (t) is determined preoperatively using a goniometer. Center the goniometer over the CORA, opened up to the desired degrees of correction. The necessary translation at the level of the osteotomy is the distance between the two arms of the goniometer at that level.

m The osteotomy is then angulated.

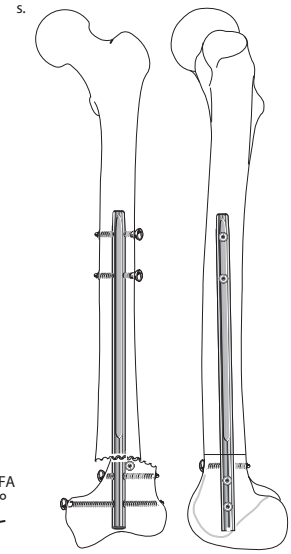
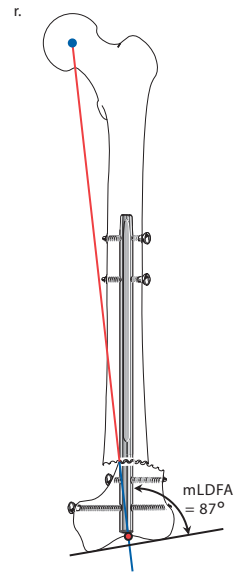
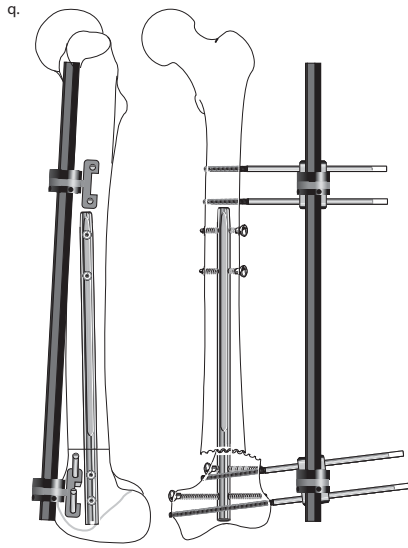
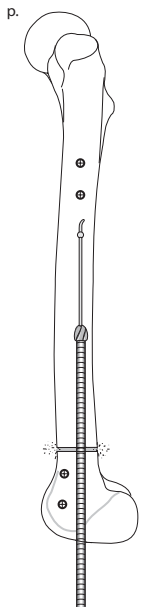


n To confirm that the desired correction has been achieved, an intraoperative radiograph is obtained and the mLDFA (mechanical lateral distal femoral angle) measured. If the desired correction has been achieved, nailing can begin. If the correction obtained provides an mLDFA of more than 1° from the goal, the fixator needs to be readjusted and the radiography repeated.



o The supracondylar nail is then inserted. The starting point is at the edge of Blumensaat's line in the intercondylar notch region. A wire is inserted percutaneously into the correct starting site and checked on the anteroposterior and lateral view images. The wire is over-reamed with a 4.8-mm cannulated drill bit. The reamer ball-tipped guidewire is then inserted through the hole.



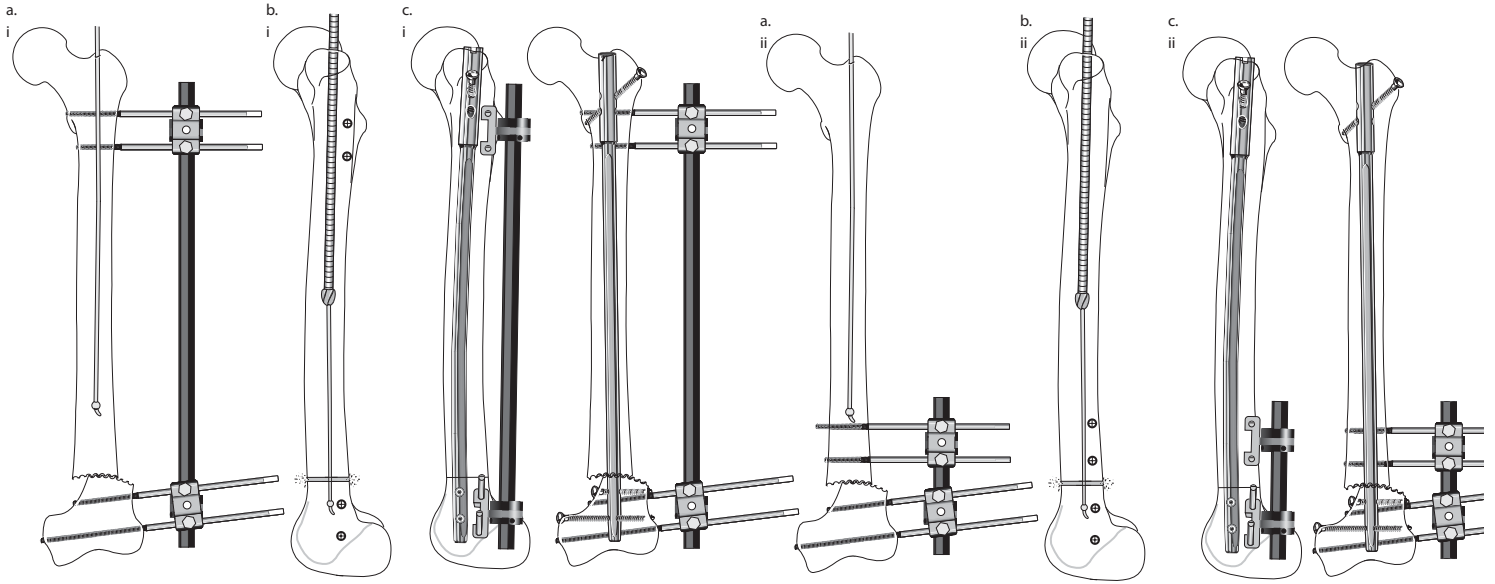


p The femur is reamed in a retrograde direction. The reamings exit the osteotomy site and serve as an auto bone graft.

q The nail is then inserted and locked proximally and distally. The distal screws are easier to insert from the medial side to avoid collision between the locking guide and the fixator. The fixator body is anterior to the femur so that it does not obstruct visualization of the femur by the image intensifier.

r The fixator is then removed, and the nail maintains the correction.

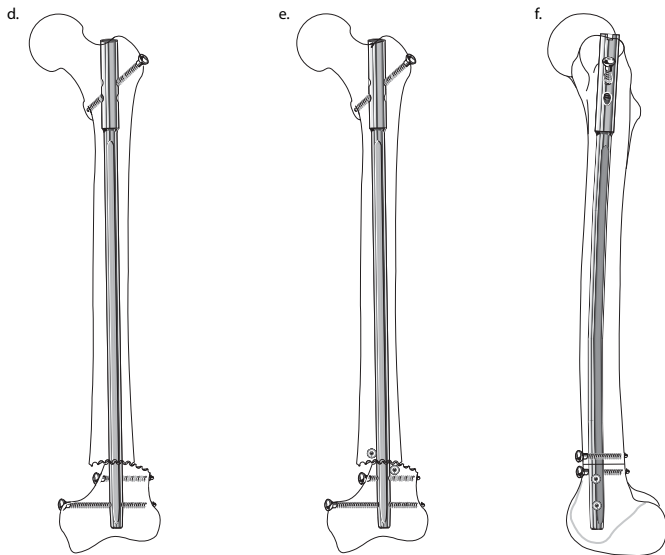
s For additional stability, interference screws can be inserted to narrow the medullary canal. This should ideally be done before removing the external fixator.



a Same deformity as that shown in Fig. 11-18. The osteotomy is performed in the same way. **i**, The fixator pins are placed around the lesser trochanter proximally and around the femoral condyles distally. **ii**, An alternative is to place the fixator pins on either side of the planned osteotomy site in the distal flare of the femur. The guidewire is introduced from the piriformis fossa.

b The fixator pin location is posterior. Antegrade reaming is performed. The reamings pour out the osteotomy site (**i** and **ii**).

c The nail is inserted and locked at both ends. The fixator body is posterior to the femur to keep it out of the way for imaging and locking. Locking is performed from the medial side (**i** and **ii**).



d The fixator is removed, and the nail maintains the correction.

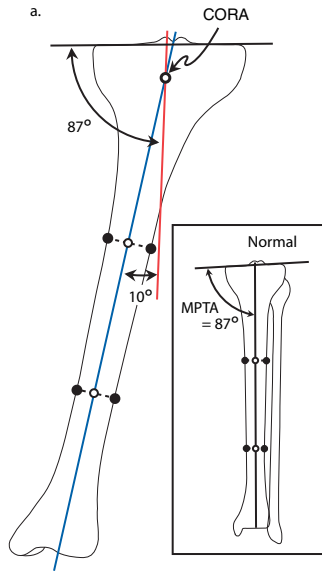
e Interference screws may be used for added stability.

f Interference screws are shown in the lateral projection.

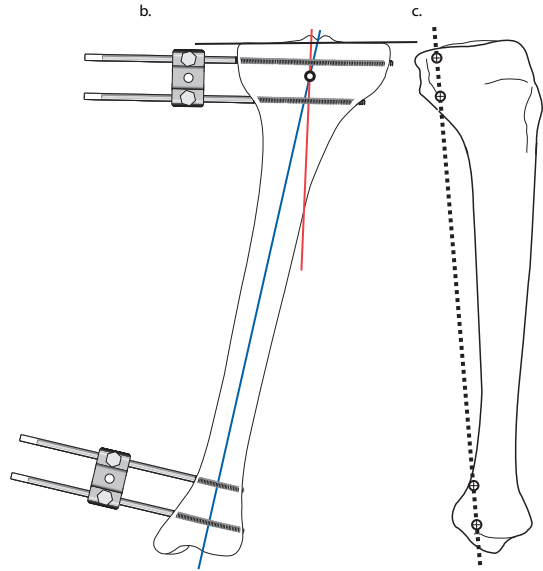


FIXATOR-ASSISTED NAILING OF A TIBIAL VARUS DEFORMITY

Fig. 3 a-o

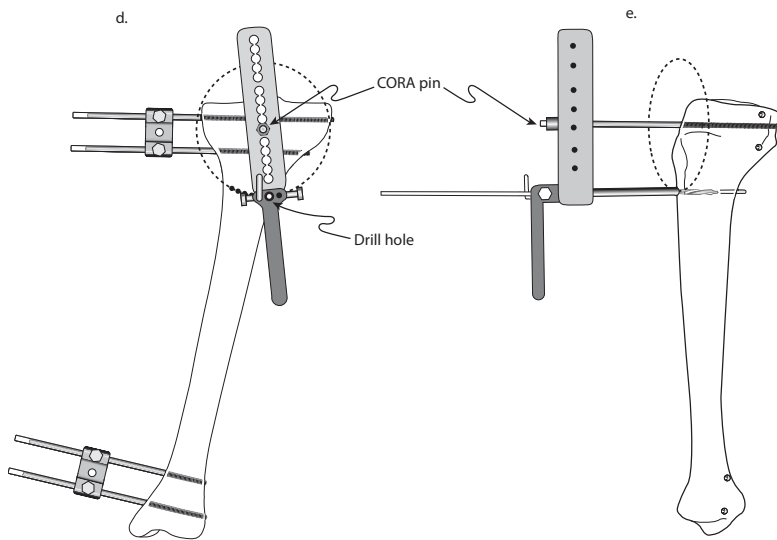


a Tibial varus deformity planned by using the anatomic axis method. The CORA is in the proximal metaphysis. The magnitude of angulation is 10°. The normal opposite tibia shows the anatomic axis (mid-diaphyseal line). Because the nail must follow the mid-diaphyseal line, the point at which this line intersects the knee joint is the optimal starting point (in this case, the medial tibial spine). MPTA (Medial Proximal Tibial Angle).



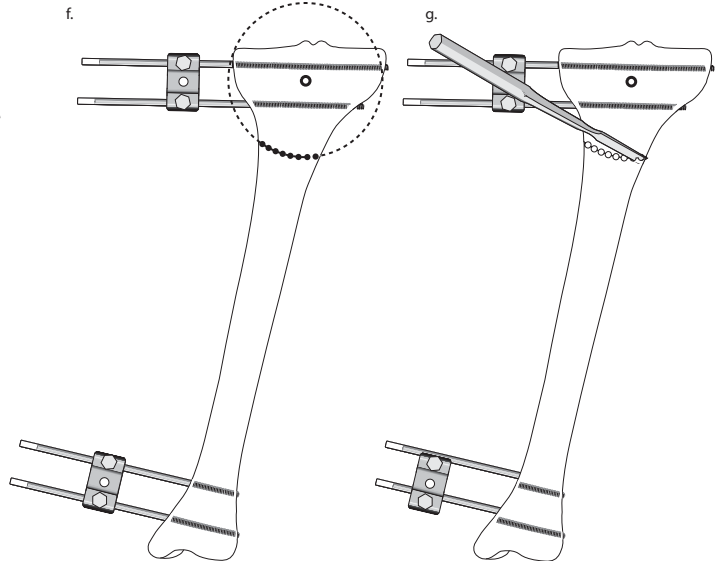
b Two pairs of fixator pins are inserted very proximal and very distal in the tibia.

c The pins are located posteriorly in the tibia, outside the path of the intramedullary nail.



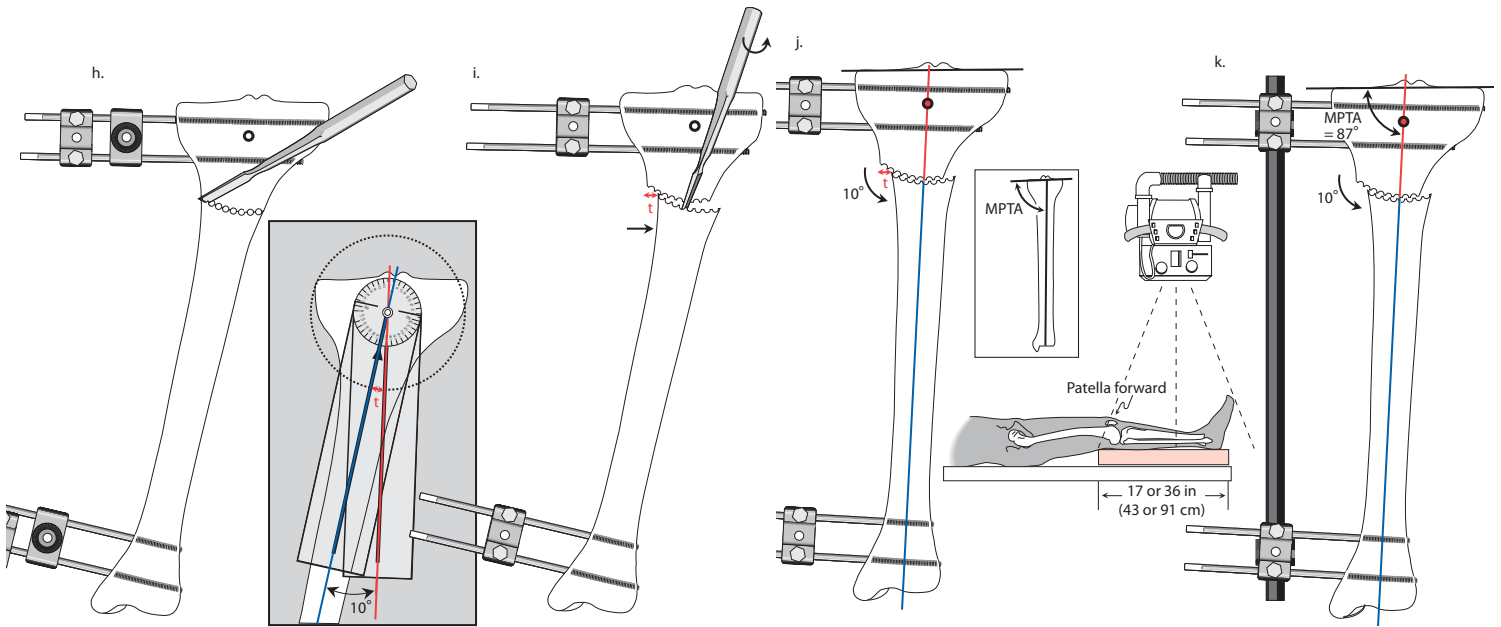
d A half-pin is inserted into the CORA, perpendicular to the frontal plane. The focal dome drill hole guide pivots around the pin. Multiple drill holes are made in a circular pattern.

e Lateral view of focal dome construct.



f The circular pattern of the drill holes after completion.

g The edge holes are cut first with the osteotome.

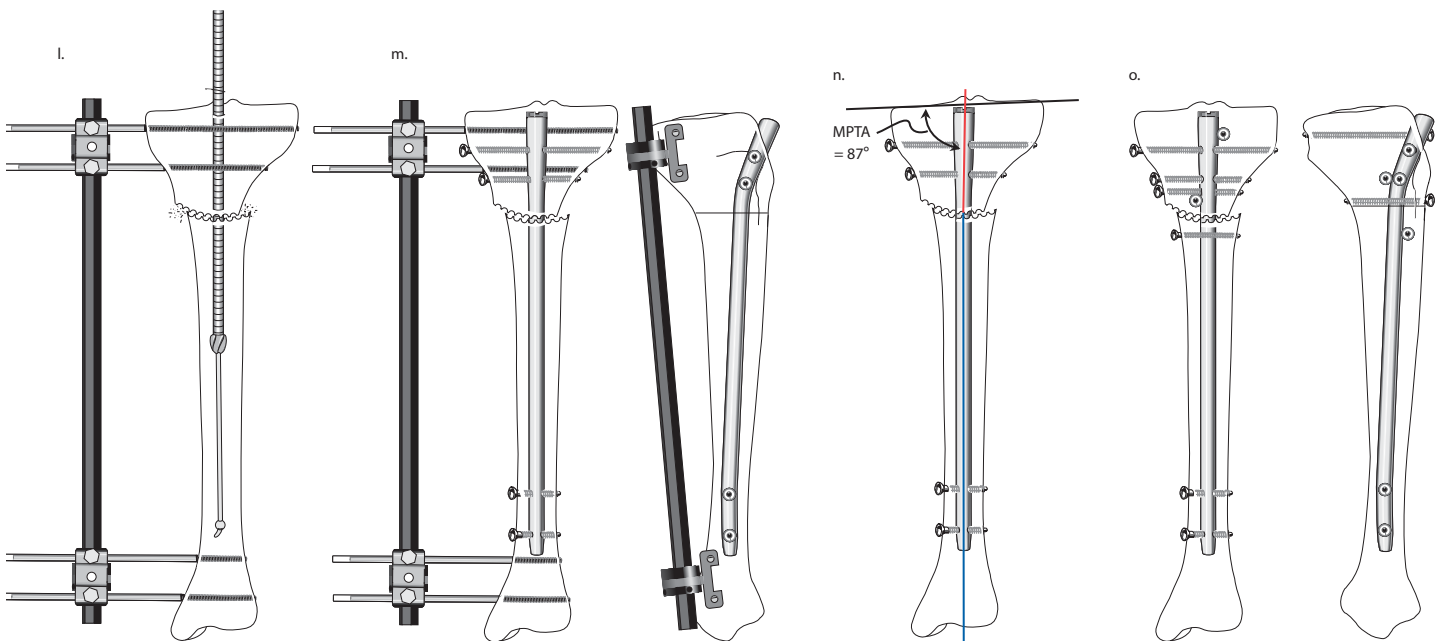


h The osteotome is inserted into the center and then twisted to complete the osteotomy. The osteotome is twisted counterclockwise to translate the bone laterally. The amount of initial translation required can be estimated by using the goniometer method preoperatively (see Fig. 11-18 l). t, translation.

i The edge holes are cut first with the osteotome.

j The osteotomy is then angulated. MPTA, Medial proximal tibial angle.

k The fixator is applied to the pins to hold the correction. An anteroposterior view radiograph of the tibia is obtained and the MPTA (medial proximal tibial angle) measured. If the desired correction has been achieved, the nail is inserted. If the desired correction has not been achieved, the fixator is adjusted and the radiography repeated.



l The tibia is then reamed.

m The nail is inserted and locked proximally and distally. The fixator body is posterior to the pins to avoid interfering with the locking screws and the image intensifier view.

n The fixator is removed, and the nail maintains the correction.

o For added stability, interference screws may be inserted to narrow the medullary canal. This is more important for proximal tibial FAN (Fixator-Assisted Nailing) than for distal femoral FAN. These interference screws may be inserted before removing the fixator.



PERCUTANEOUS GIGLI OSTEOTOMIES

Percutaneous Gigli Osteotomies Incisions are facilitated by two methods: a Gigli saw passer, or a clamp set which allows to minimize soft tissue damage at any level of the long bones. The technique is illustrated in figures 4,5,6,7,8 and 9*.

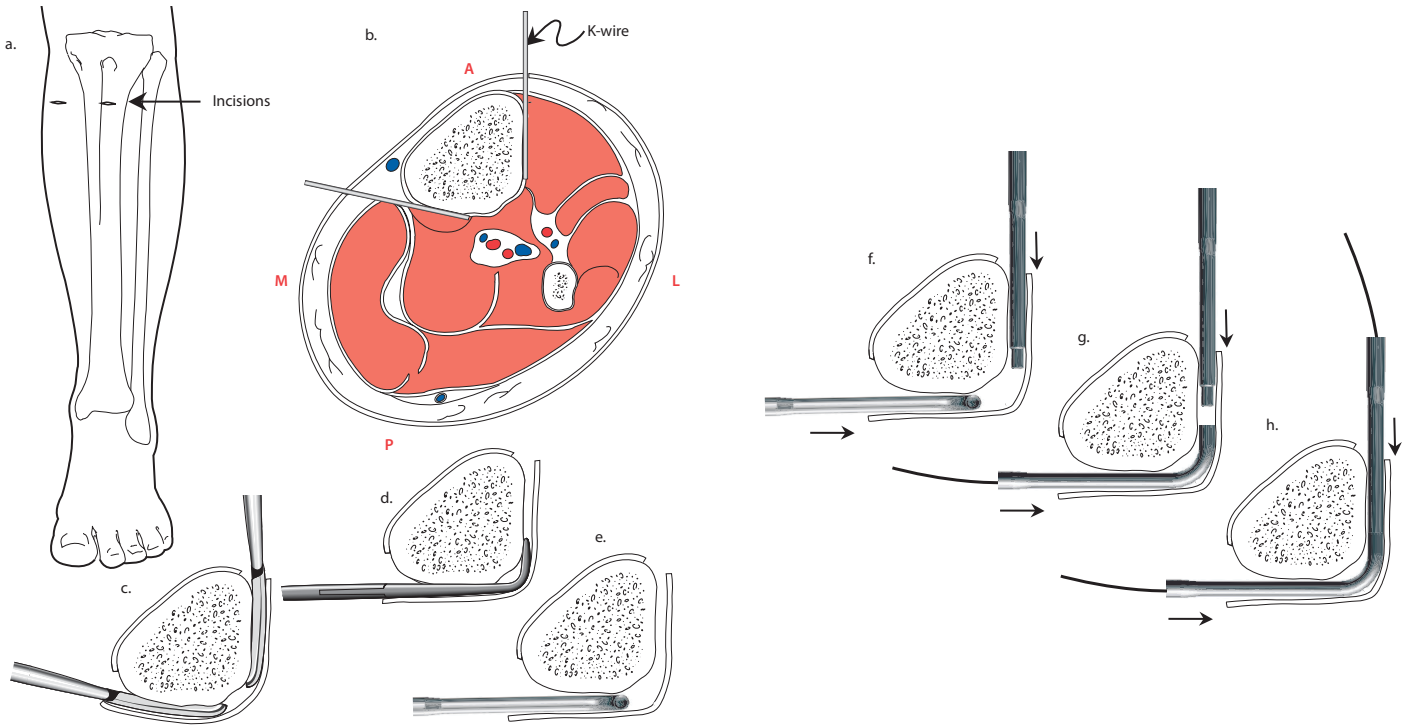
Right angle (DrPrac-201) and curve clamps (DrPCC-202)



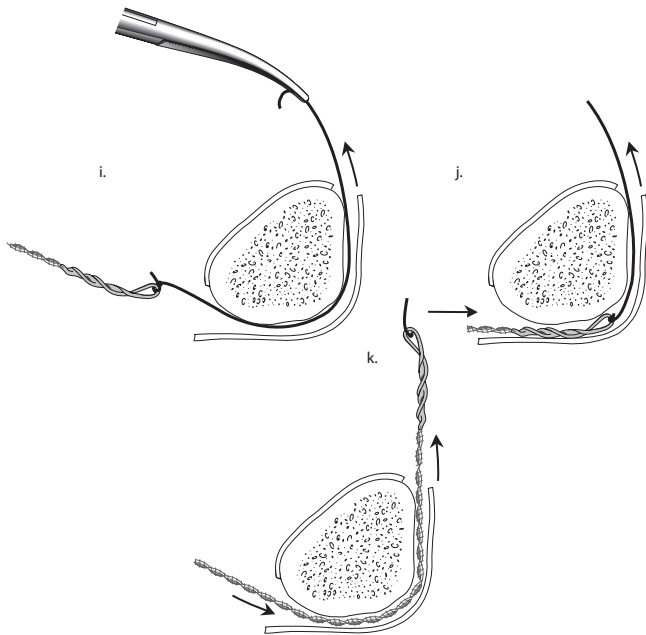
Gigli passers (DrPGP-501 and DrPGP-502)



* All figures modified with kind permission of Springer Science and Business Media (Paley D. Hardware and Osteotomy Considerations. In: Paley D. Principles of Deformity Correction. Rev ed. Berlin: Springer-Verlag, 2005, pp 311–315)."

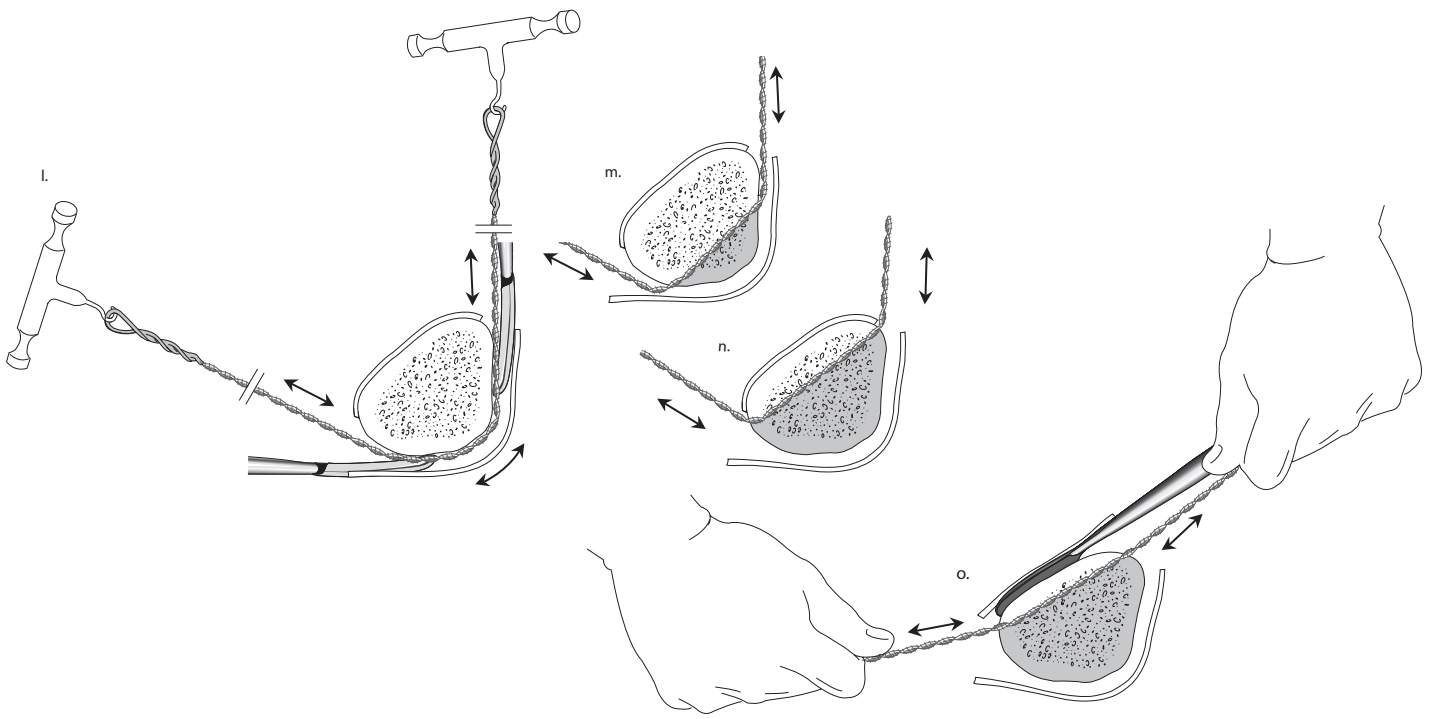


a–b Two transverse incisions are made, and a suture is passed subperiosteally from posteromedial to anterolateral using either a right angle and a curved clamp or the set of Gigli passers. When using the Gigli passers, after elevating the periosteum, the angle clamp should be used to dissect the soft tissue and make room for the angled Gigli passer. A, Anterior; P, posterior; M, medial; L, lateral.



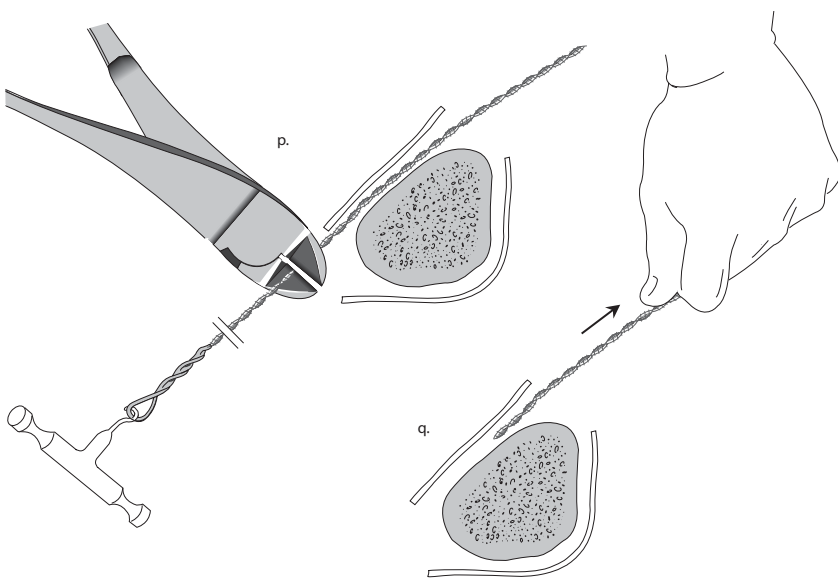
i–k The Gigli saw is tied to the suture and is pulled through from posterior to anterior. It is helpful to make a slight bend on the leading edge of the Gigli saw to allow it to pass more easily around the sharp posterolateral corner of the tibia.



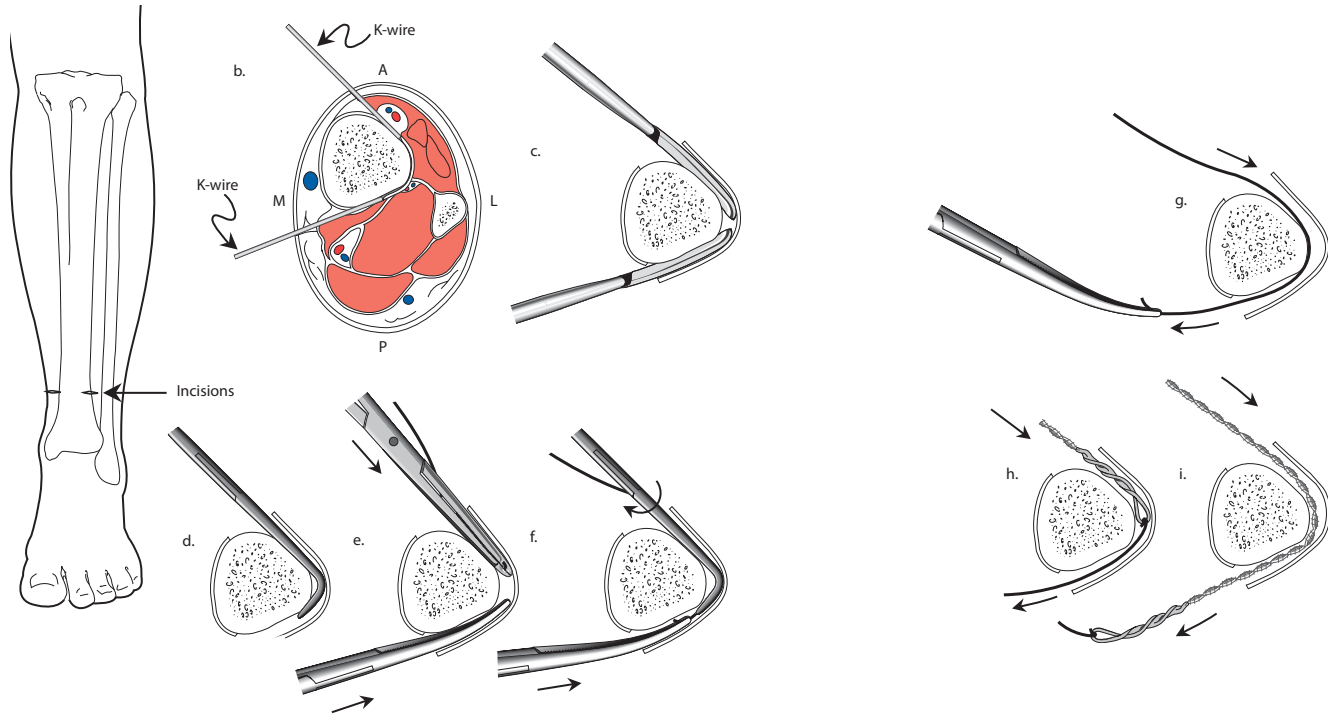


l-n The posterior and lateral cortices and the medullary canal are cut with the saw under the protection of two Periosteal elevators (DrPPE-602).

m The medial cortex periosteum is then elevated and the medial cortex cut by flattening out the direction of the pull of the saw.



p,q The saw is then cut and pulled out.

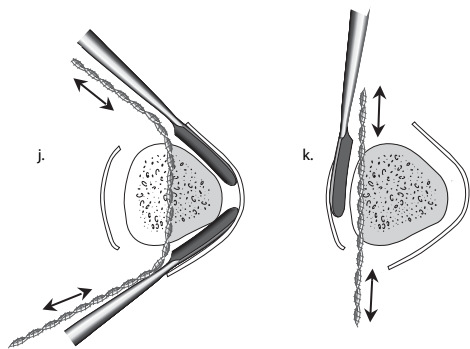


Note that the Gigli saw technique should be avoided where there is thick diaphyseal cortical bone.

a-g Two transverse incisions are made, and a suture is passed subperiosteally from anterolateral to posteromedial using either a right angle and a curved clamp or the set of Gigli passers. When using the Gigli passers, after elevating the periosteum, the angle clamp should be used to dissect the soft tissue and make room for the angled Gigli passer. (This direction is opposite that used for the

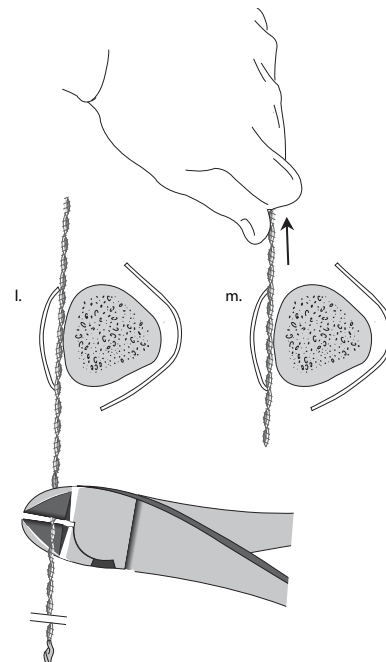
proximal tibia). A, Anterior; P, posterior; M, medial; L, lateral.

b, i The Gigli saw is tied to the suture and is pulled through from anterior to posterior.



j The posterior and lateral cortices and the medullary canal are cut with the saw under the protection of two elevators.

k The medial cortex periosteum is then elevated and the medial cortex cut by flattening out the direction of the pull of the saw.

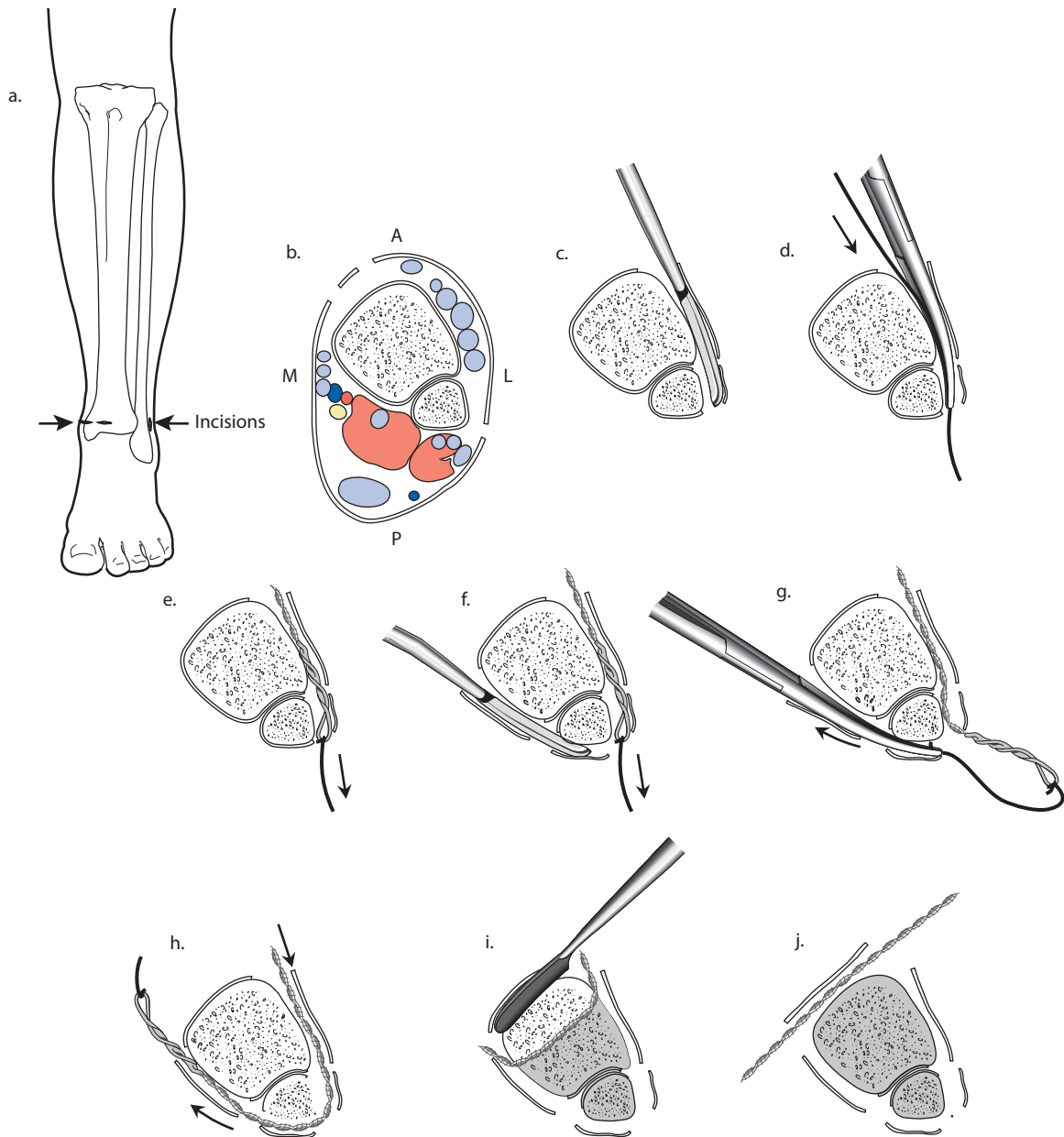


l,m The saw is then cut and pulled out.



PERCUTANEOUS GIGLI SAW OSTEOTOMY IN THE SUPRAMALLEOLAR REGION OF THE TIBIA AND FIBULA

Fig. 6 a-j



At this level, there is no space between the tibia and the fibula through which to pass a suture. Both the tibia and the fibula are cut together, and the Gigli saw is passed around both bones.

a,b Three small incisions are used. The two medial incisions are transverse, and the lateral incision is longitudinal. A, Anterior; P, posterior; M, medial; L, lateral.

c The periosteum on the anterior aspect of the tibia and fibula is elevated. From the anteromedial side, the fibular incision is made over the tip of the protruding elevator over the fibula.

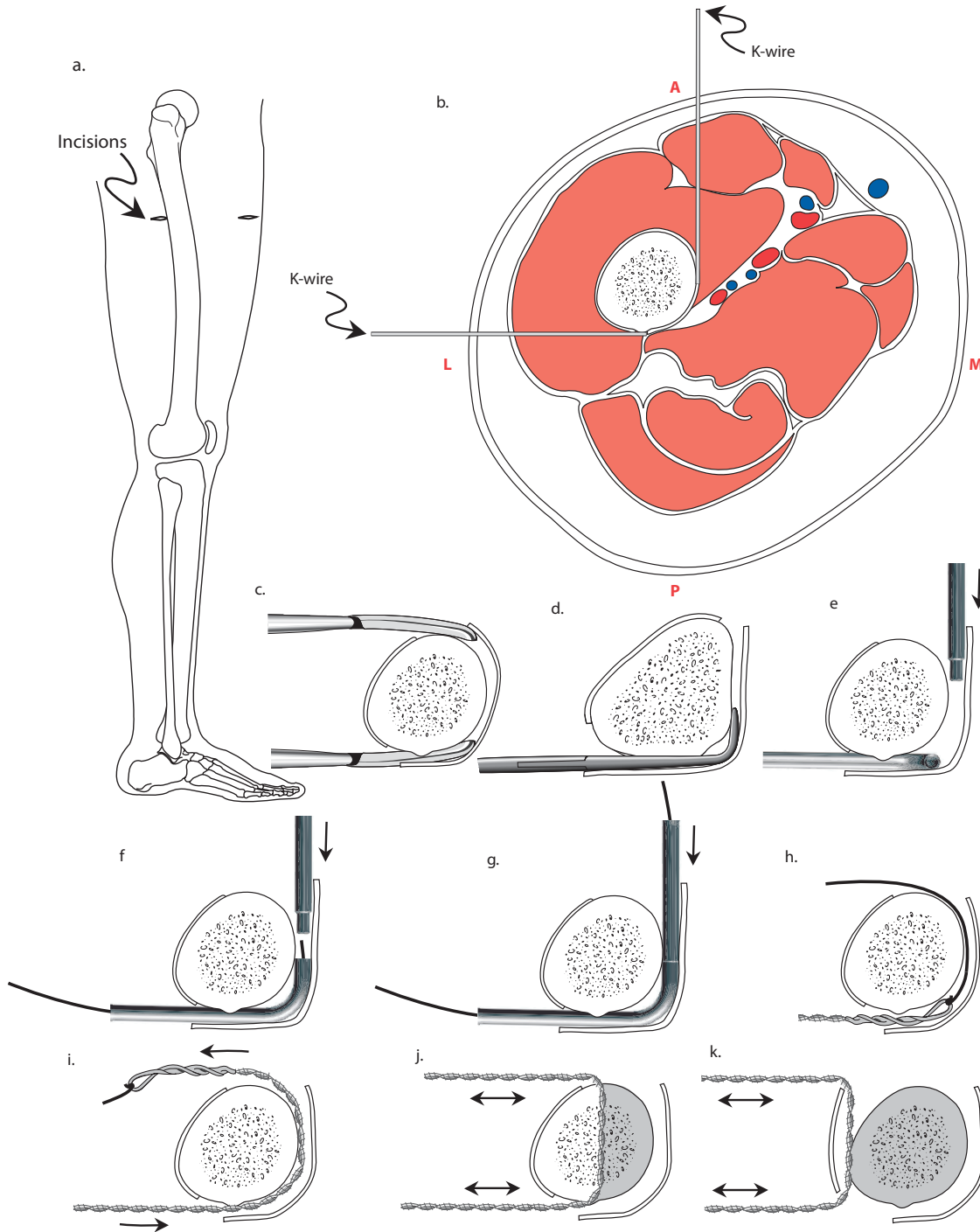
d A long curved clamp is used to pass a suture from anteromedial to the lateral side.

e The Gigli saw is tied to the suture and pulled through from medial to lateral.

f,g The periosteum is elevated on the posterior side of the tibia and fibula and the suture passed from the lateral incision to the posteromedial one.

h The Gigli saw is pulled through to the posteromedial side.

i,j The medial periosteum is elevated, and the Gigli saw is used to cut the fibula and tibia from lateral to medial. The saw is then cut and removed.



This method is especially useful for cutting the medial cortex only of the femur when an intramedullary saw is already in place. For breaking the entire femur, the multiple drill hole and osteotome technique is much easier, faster, and less traumatic

a,b Two lateral transverse incisions are made to pass the Gigli saw. A, Anterior; P, posterior; M, medial; L, lateral.

c The periosteum is elevated from the lateral side, both posterior and anterior to the femur.

d-g Using either the set of Gigli passers or the right angle clamp and a long curved clamp, a suture is passed around the femur subperiosteally. When using the Gigli passers, after elevating the periosteum, the angle clamp should be used to dissect the soft tissue and make room for the angled Gigli passer.

h,i The Gigli saw is tied to the suture and passed around the femur.

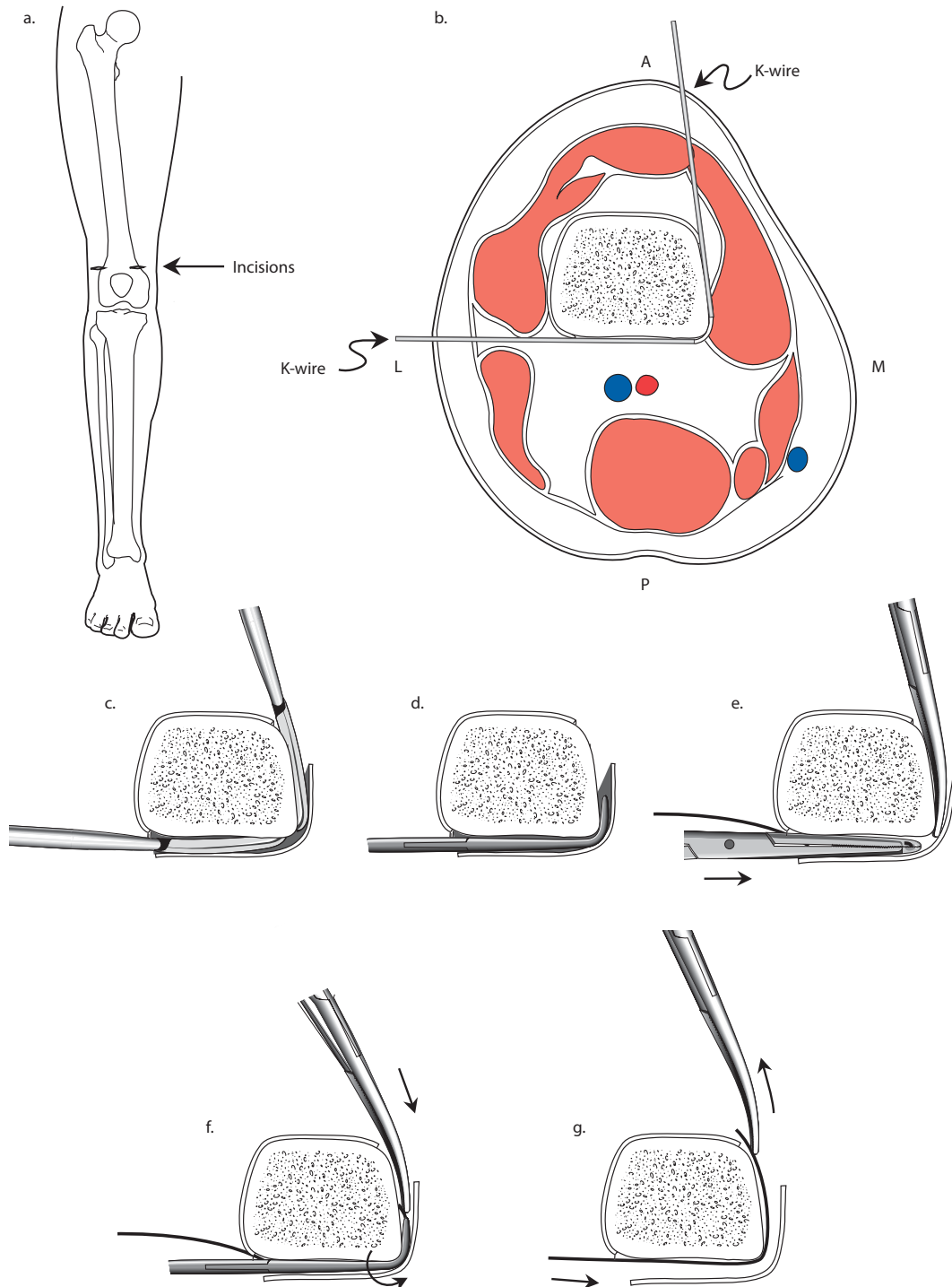
j,k The femur is cut from medial to lateral with the Gigli saw.



PERCUTANEOUS GIGLI SAW OSTEOTOMY OF THE DISTAL FEMUR

Fig. 8 a-l

This osteotomy is rarely indicated because the multiple drill hole and osteotome technique is more easily performed.



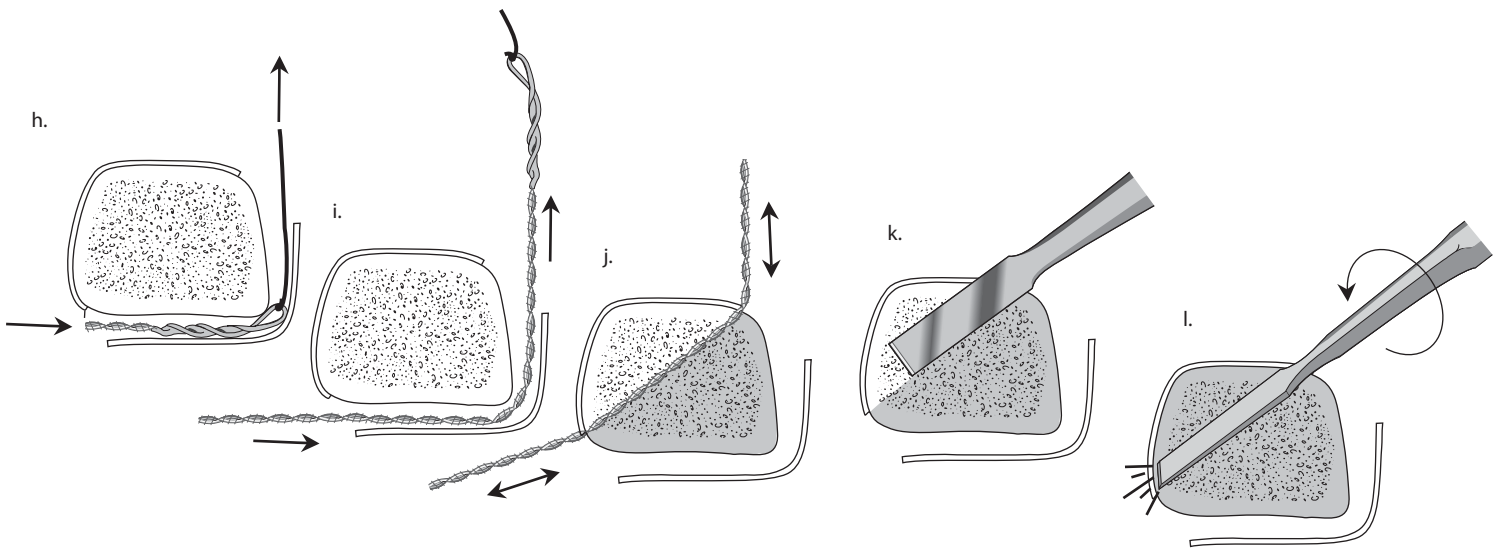
a Two transverse small incisions are used: one anteromedial and one posterolateral.

b The location of the cortex is found using K-wires and the incisions made at that point. A, Anterior; P, posterior; M, medial; L, lateral.

c The periosteum is elevated posteriorly and medially.

d A right angle clamp is used to make space for passage of the suture.

e-g Using either the set of Gigli passers or the right angle clamp and a long curved clamp, a suture is passed around the femur from posterolateral to anteromedial. When using the Gigli passers, after elevating the periosteum, the angle clamp should be used to dissect the soft tissue and make room for the angled Gigli passer.



h,i The Gigli saw is tied to the suture and pulled around the femur.

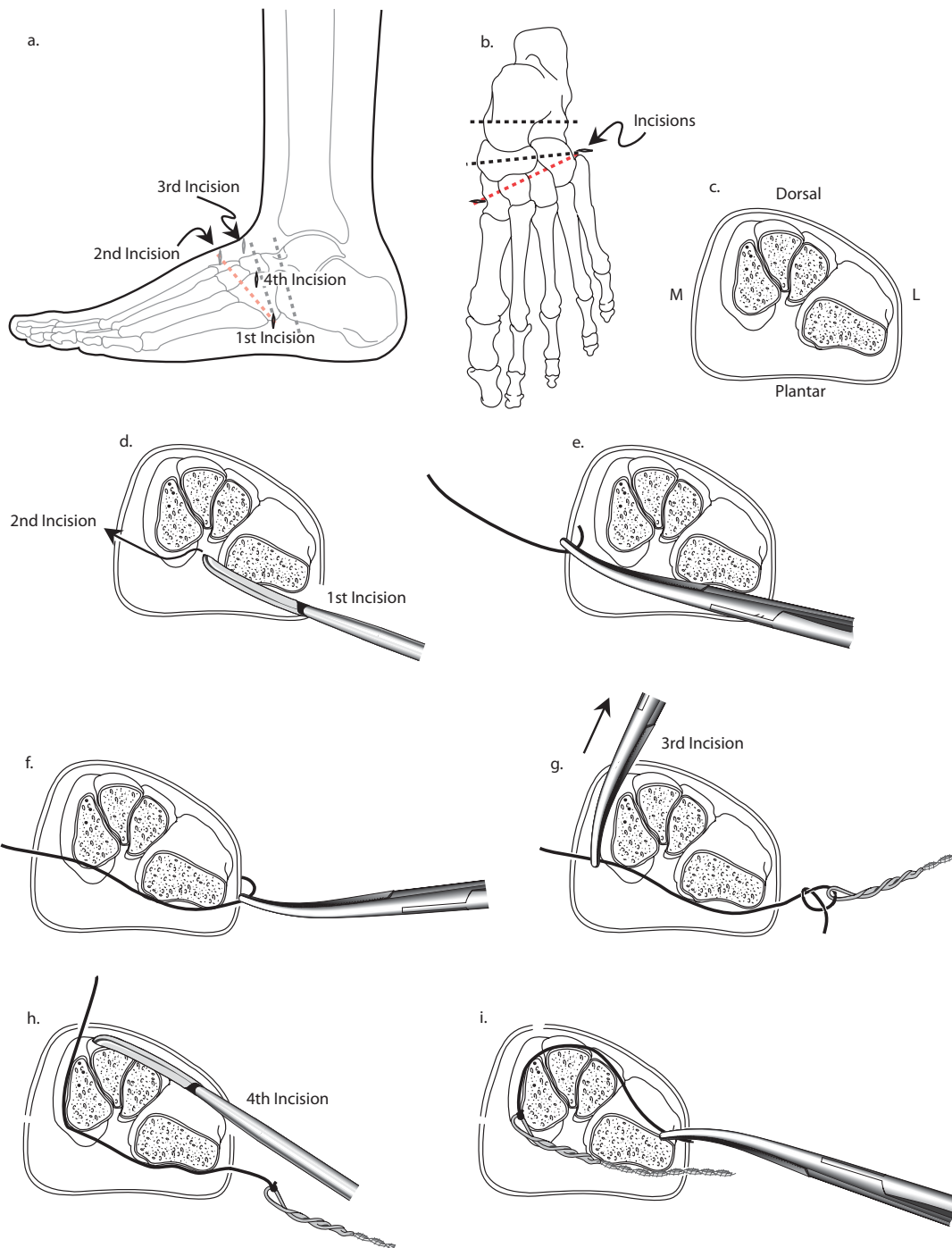
j Only the posterior and medial cortices can be cut with the saw. Further cutting will damage the quadriceps muscle and tendon.

k,l An osteotome is used to complete the bone cut. The osteotome can be twisted to crack the bone.



PERCUTANEOUS GIGLI SAW OSTEOTOMY OF THE MIDFOOT

Fig. 9 a-i



a,b There are three levels in the midfoot at which a Gigli saw can be safely passed percutaneously: the talocalcaneal neck, cuboid-navicular, and cuboid cuneiform bones. Four small incisions are used to pass the saw: medial, lateral, and two dorsal incisions.

c,d Because of the concavity of the transverse arch and the multiple bones present, the plantar periosteal elevation often weaves in and out of the subperiosteal space. M, Medial; L, lateral.

e A suture is passed from lateral to medial (the reverse can also be done).

f The Gigli saw is passed from lateral to medial under the foot.

g Through a third incision, which is made on the dorsomedial aspect of the foot, the suture and Gigli saw are passed to the dorsum of the foot.

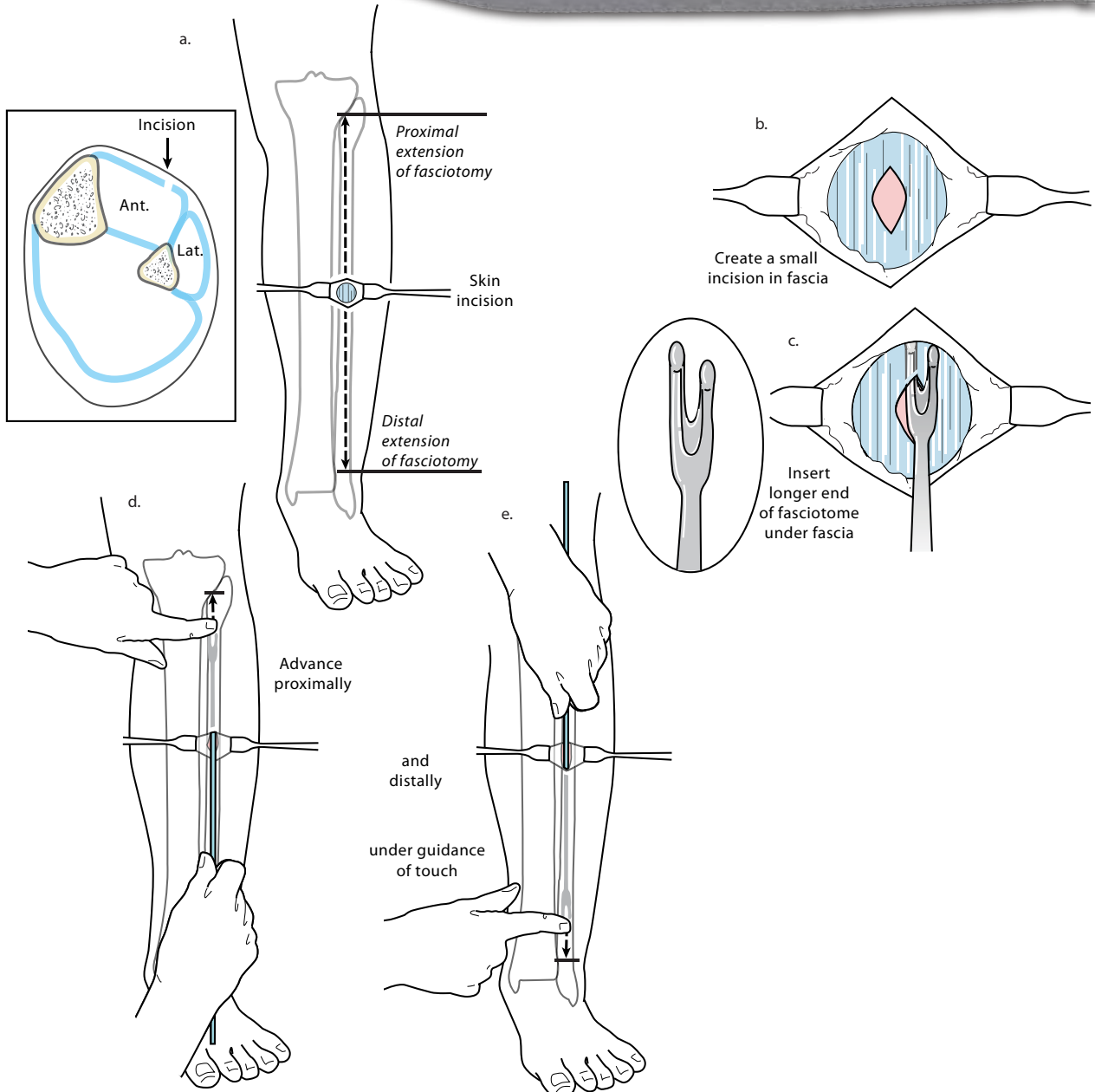
h A fourth incision is made on the dorsolateral side and the periosteum elevated on the dorsum of the foot.

i The suture and Gigli saw are passed around the foot from plantar to dorsal, exiting on the dorsolateral side opposite the entrance site on the plantar lateral side.

Under the protection of periosteal elevators, the bone is cut by the saw.

PERCUTANEOUS ANTERIOR COMPARTMENT FASCIOTOMY

Fasciotome (DrPF-601)



Anterior compartment fasciotomy is performed in four steps.

a A small midline anterior longitudinal incision is made just lateral to the tibial crest. Ant., Anterior compartment; Lat., lateral compartment.

b The fascia is exposed using blunt dissection, and a small incision is created.

c A fasciotome is then inserted under the fascia.

d The fasciotome is advanced proximally and care is taken not to invade the muscle. Note that the opposite index finger follows the leading edge of the fasciotome.

e The same technique is used when passing the fasciotome distally.





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