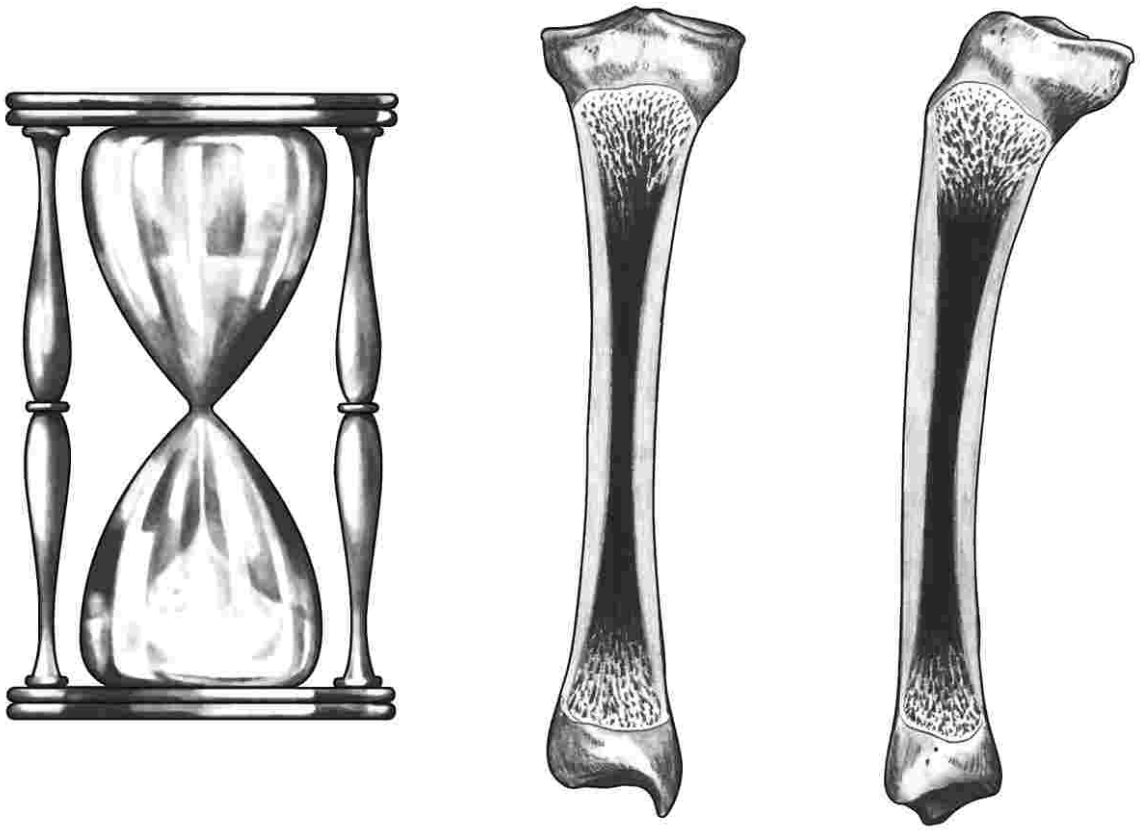
16
TIBIA



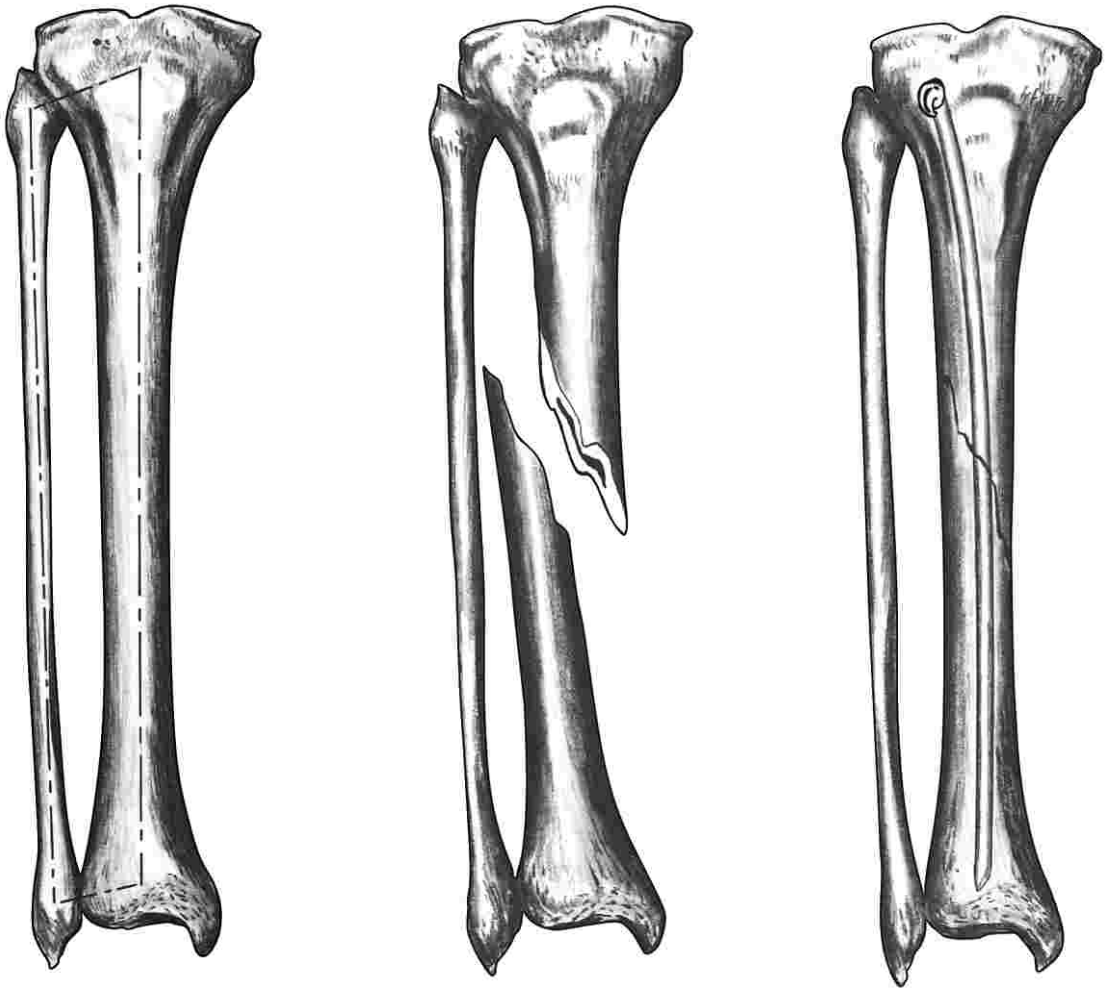
The tibia is not too unlike an elongated hour glass.

This is an ideal bone for medullary pinning. Those inexperienced in the technic will find the mid-shaft of the tibia an excellent place for the initiation.

The tibia is not too unlike an elongated hour glass. It is acted upon by muscle pull to less degree than most long bones. The displacement is largely due to the force of violence, although the general tendency is toward anterior bowing because of the pull of the gastrocnemius and soleus muscles. Flexion of the knee relaxes the gastrocnemius and simplifies both reduction and pinning.

Since the bone is superficial and reduction is usually accomplished easily, closed pinning is very often indicated. Yet, semi-open reduction can here be carried out so simply and with so little trauma that repeated attempts at closed pinning are seldom justified.

After initiation one will find many and varied methods of single or multiple pinning advantageous in certain injuries. But basically, the single curved pin best serves the purpose in the majority of fractures of the mid-half of the tibial shaft.



Don’t Sell the Fibula Short

At the ankle the fibula is of great importance and pinning in this region is invaluable. It has not been our custom to pin the fibula shaft.

The fibula can exert a profound influence for good or evil. We know that the normal leg can do very well without the mid-shaft of the fibula. Yet with the fractured tibia, the intact fibula can be a marvelous stabilizing force.

The fracture shown above can be made thoroughly stable without need for external fixation, if the tibio-fibulal parallelogram is completely reconstructed. With complete reduction and adequate transfixation good healing is to be expected.

On the other hand, the intact or rapidly healing fibula can produce non-union by maintaining distraction of a fracture in the tibia. In such case, the chip bone graft of the tibia is far superior to osteotomy of the fibula. Chip bone grafting of the tibia is a simple procedure and should not be delayed too long if healing appears sluggish.

To encourage the tibia to heal quickly one must be kind to the bone and soft tissue envelope. We must not forget that the weight of a plaster cast can produce distraction.

Function must be restored quickly but weight bearing cautiously. Rotary stress or rocking for injudicious weight bearing can precipitate non-union.

Mid Shaft

The gastrocnemius and soleus muscles act as a bow string so that the tibia tends toward anterior bowing. The purpose here is to resist this intrinsic force in the application of the pin.

Technic: Reduction is accomplished by traction with the knee flexed. Choose a pin of proper length and diameter (usually one-fourth inch) and give it a gentle curve with the bending iron.

Make a one inch incision slightly above and either medial or lateral to the insertion of the patella tendon.

An opening is made with the awl-reamer the same size as the pin chosen. The pin is pushed through this opening with the hook directed anteriorly. The sled runner strikes the posterior cortex and is deflected so that the rod travels down the medullary canal to the fracture site. Strong traction is made on the foot and the fragments manipulated manually if necessary.

If reduction is good, the pin can be driven across the fracture line uneventfully as a closed procedure. As the pin passes the fracture line, one can usually tell from palpation if it has entered the distal segment. If the bone is felt to widen, it means the point has emerged through the fracture line. It should be partially withdrawn, the head rotated 90° to 180° and redriven.

Should difficulty be encountered crossing the fracture line, make a one-inch incision medial to the tibia and insert the index finger as a guide to secure a more accurate reduction.

Mid Shaft
(CONTINUED)

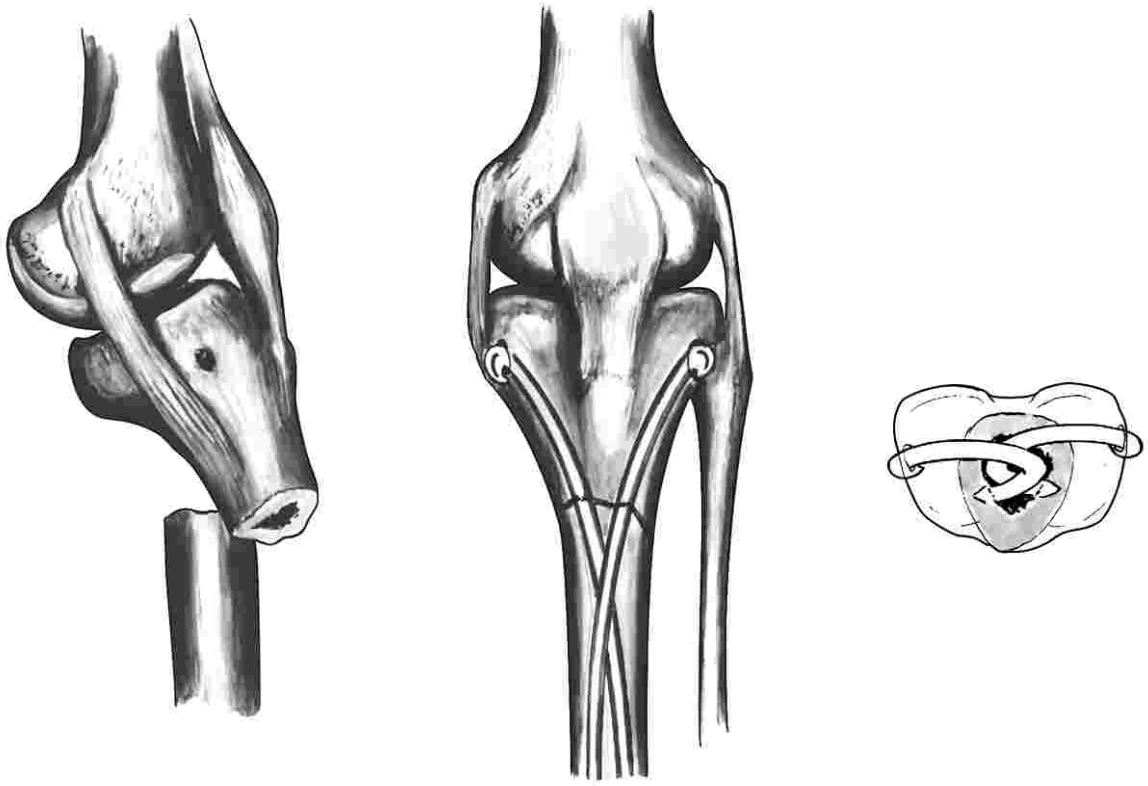
Make roentgenograms in both planes before setting the head. The hook of the pin should be directed anteriorly. If a straight pin has been used, stress relieve the head slightly to prevent its migration into the bone from pressure. Too much bend will lessen the stability of fixation.

Test leg for stability. External splinting may or may not be needed. If there is tendency of rocking or rotation, apply K E S dressing from mid thigh to toes. After two weeks this can be replaced with a walking cast if desired. When the fibula is intact the pinned tibia is usually stable enough that splinting can be omitted.

The pins used are of two diameters. The smaller (3/16 inch) is indicated in children and small adults. It is the easier of the two to direct and manipulate because it has greater flexibility. However, because of this, additional plaster splints are more often necessary than with the 1/4 inch pin.

The curved pin is more efficient than the straight pin in most fractures, but cannot be directed across the fracture line as easily in a closed procedure.

The 1/4 inch pin is indicated in most adult males.



High Shaft Fractures

Here again we must deal with the same problem as in the supracondylar fracture of the femur. It is interesting to note the similarity of the problems in the different regions of the extremities.

It is obvious that in this fracture the proximal fragment is short and a single pin cannot secure three-point pressure. So with a single pin, angulation and insecure fixation are to be expected.

Double pins (3/16 inch) accomplish the purpose here in the same manner as in the supracondylar femoral fracture. The technic is essentially the same.

Technic: Upward counter traction beneath femoral condyles. Knee flexed 35 degrees to 45 degrees. Strong traction on foot.

The lateral joint margins of the tibia can now be palpated.

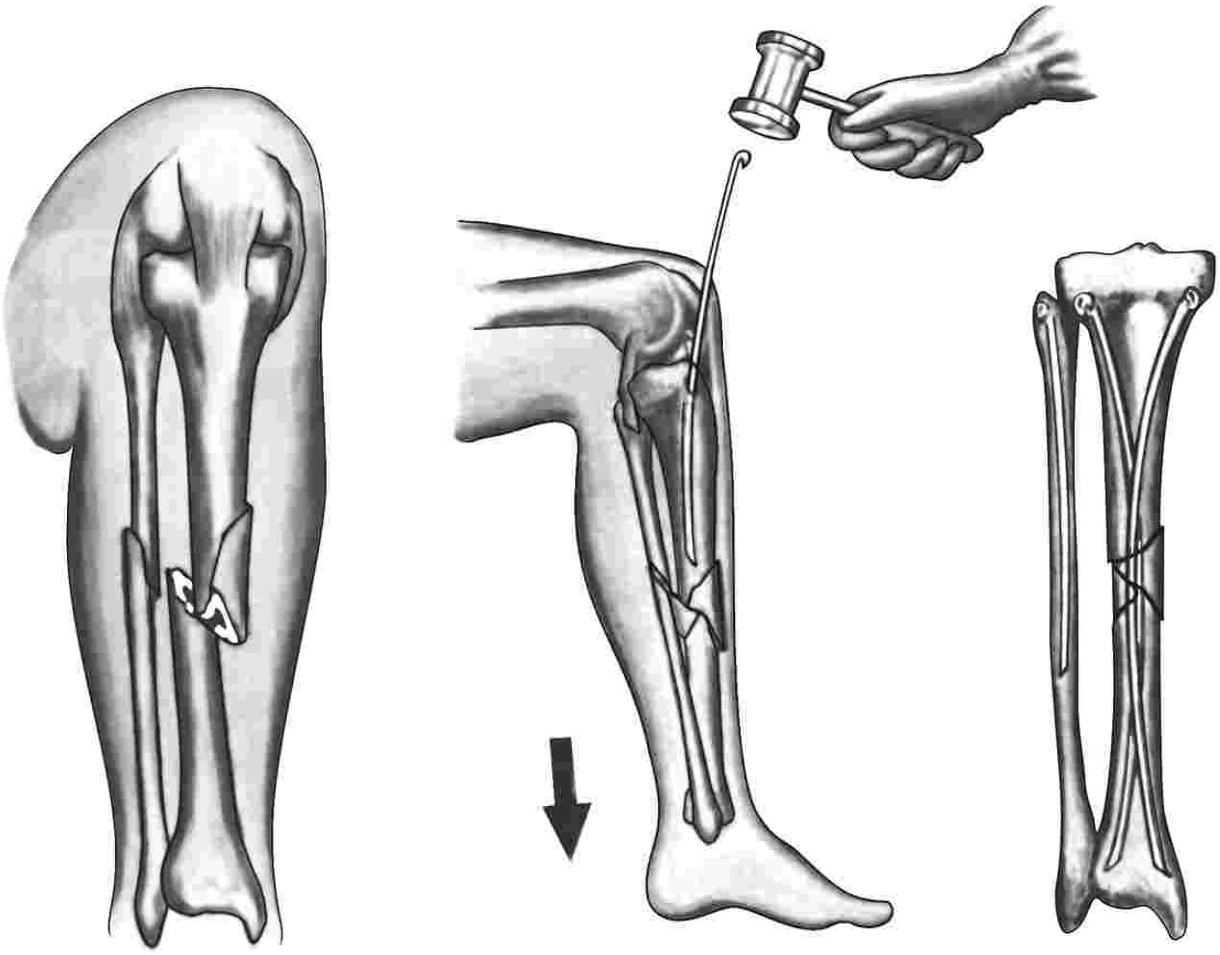
Make 3/4 inch stab wound laterally over each tibial condyle. Start opening with awl-reamer directing it at a point on the tibial crest about five inches below the knee joint.

Insert a straight 3/16 inch pin about nine or ten inches in length. Push into bone. Repeat procedure in other condyle.

The lateral condyle can prove troublesome in some patients. It is shelf-like.

The hooked head is always directed laterally so sled runner engages opposite cortex. Drive pins simultaneously with alternate tapping with mallet. There is a characteristic feel to the resistance encountered. If the pin drives hard, it has been placed at the wrong angle (too transversely). If it drives too easily, the point has emerged through the fracture line. In this event, the direction of the opening should be changed and if necessary the pointed end of the pin can be bent slightly.

The operation is usually done as a closed procedure, but when necessary a small incision can be made medial to the bone to allow finger manipulation. The heads of the pins should be stress relieved.



Double Pins for Shaft

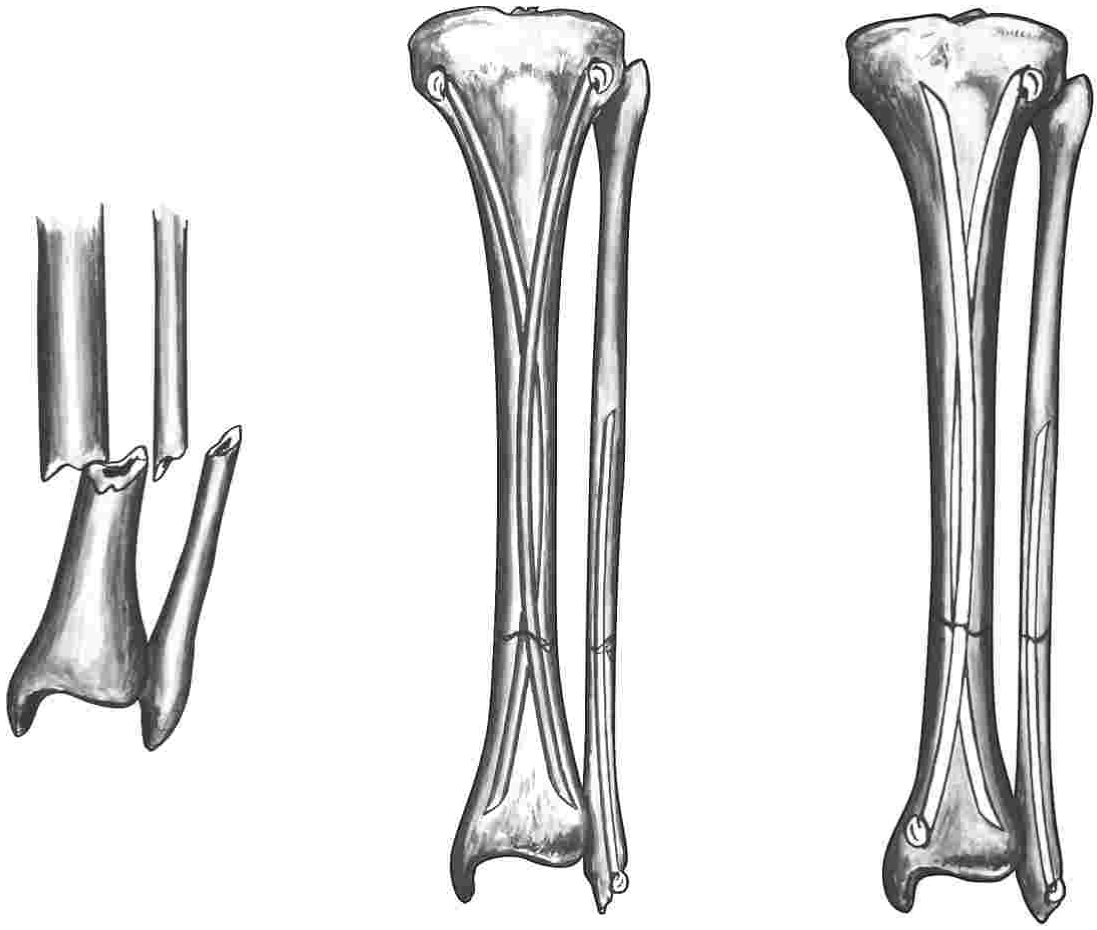
This same procedure can be modified for certain shaft fractures. When the medullary cavity is extremely large, especially in the elderly, a single medullary rod will not give stable fixation. And comminution of the fragments intensifies the problem.

The tendency in this operation is to choose pins which are too short. Some extra length must be allowed to compensate for the curve.

In a case of this sort, closed pinning or semi-open reduction is far superior to open operation. The latter destroys the soft tissue envelope about the fragments which is necessary to maintain apposition.

Here the operation is done with the knee flexed 35 degrees to 90 degrees with traction on the foot. The fracture table can be valuable here. When the fracture line is this low, the pins can be introduced with little difficulty. Special length pins may be required in large individuals. Circular wires might be used.

Apply K E S from mid-thigh to toes with knee in almost complete extension.



Lower Shaft

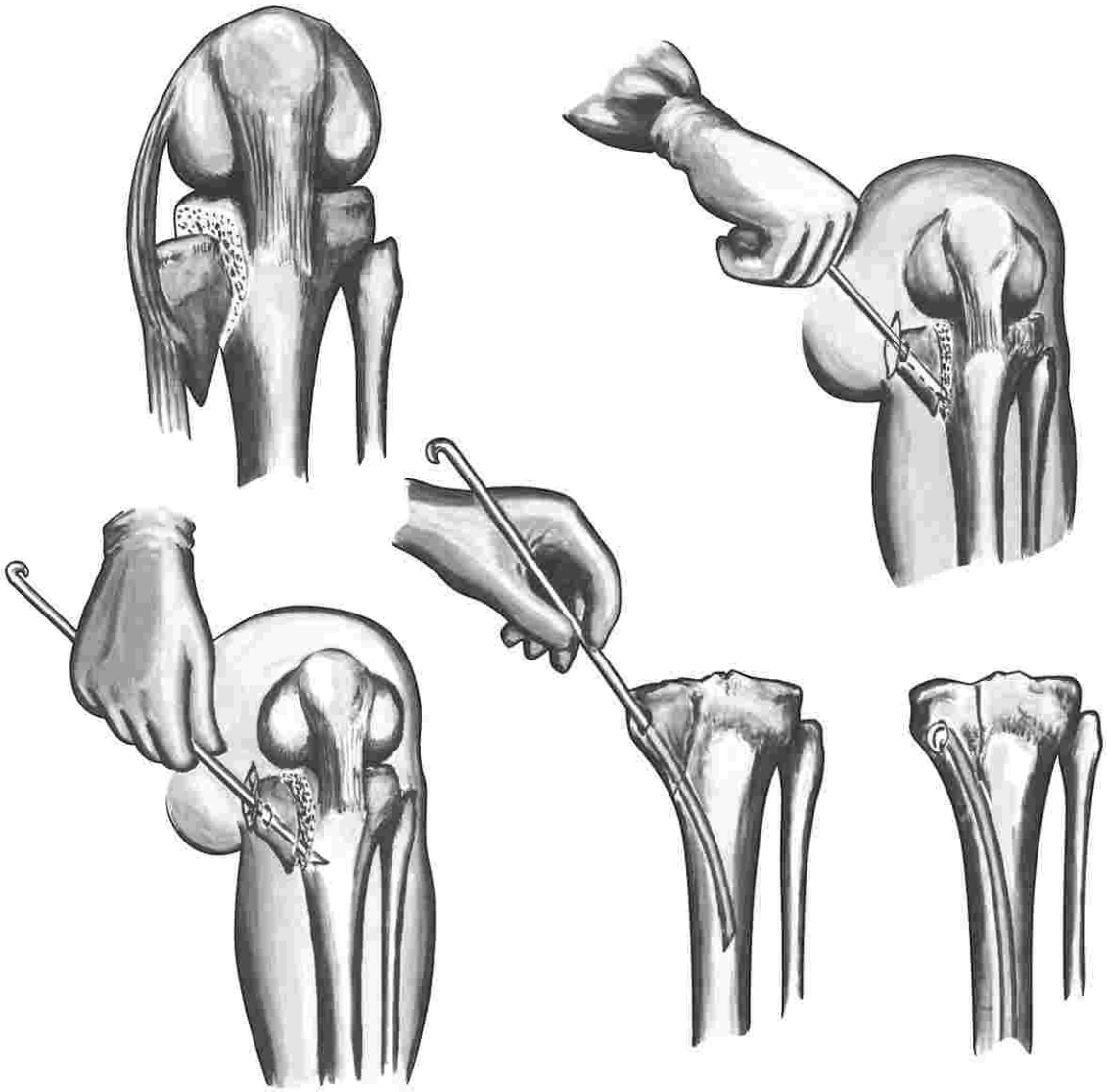
This is a real problem. The single pin technic will not always stabilize the lower fragment.

The technic just described is excellent for this fracture. Or, as shown, the curved pin from the external condyle may be used combined with a similar one driven upward from the lower portion of the distal fragment.

Driving a pin upward from the lower fragment can be a frustrating procedure. The opening for the pin should **not** be in the medial malleolus. It should be above and anterior to this point and high enough above the ankle joint to safeguard against migration of the head into the joint. A pin which migrates into the ankle is painful and difficult to remove.

If a single straight pin is driven upward through this short lower fragment, angulation will occur unless the proximal portion of the pin is shaped with the bending iron to fit the contour of the bone. And by this procedure some stability can be lost.

In this region of the tibia, slow healing is to be expected. Use plaster splints to guard against "rocking" from motion of the foot. The pin shown in the fibula is 1/8 inch in diameter. The fibula usually requires open reduction at this level, but this additional pin markedly enhances stability.



Tibial Condyles

These can often be fixed as a closed procedure. Reduction is accomplished as in the high shaft fracture. The problem here is similar to that in the condyles of the femur.

The awl-reamer makes an opening in the fragment near the articular margin and parallel to the outer cortex of the fragment. The pin (3/16 inch) is introduced and pushed through this opening. The fragment can often be manipulated into position by the pin. In older patients when the bone is osteoporotic or badly comminuted, the special condyle pin with the loop head should be used to prevent migration into the bone.

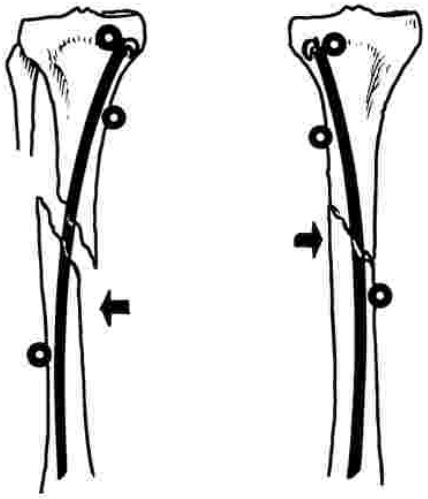
The point of the pin is made to engage the fracture surface of the shaft. Sometimes the fragment can be “walked up” slightly by engaging the tapered point at the highest possible level and axially rotating the pin 180 degrees.

As the pin is driven obliquely into the shaft, the sled runner engages the far cortex and is deflected as the pin travels down the medullary canal. The vase of flowers principle comes into play as the head of the pin swings medially to compress the fracture surfaces.

This procedure can be repeated on the other condyle in case of double fracture. The transverse pin may be used if necessary to preserve the integrity of the articular surface as shown in the femoral condyle fractures.

Oblique Fractures Upper Tibia Shaft

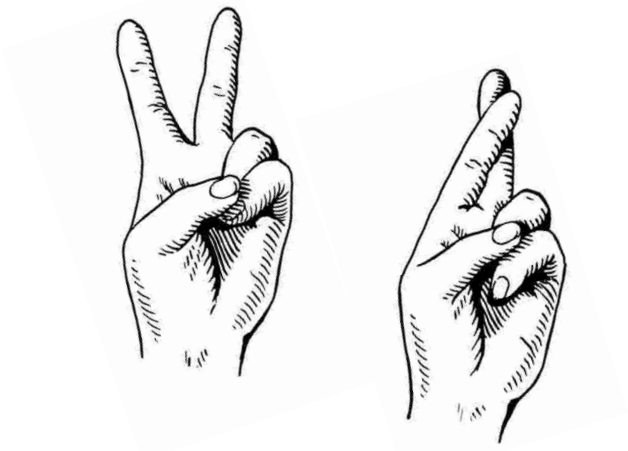
WRONG RIGHT



When the pin is driven obliquely into the bone, it exerts pressure at three points. These points are indicated by circles in the above drawings. When properly directed these dynamic forces will produce firm bone compression to encourage healing but when wrongly directed will produce distraction and delayed healing.

WRONG: In this illustration, note the direction of the fracture line. The pin has been inserted from a point medial to the tibial tubercle and the shaft of the pin crosses the fracture line at such an angle that the axis of the pin and the axis of the fracture line form an “X”. The lower pressure point is such as to distract the fracture.

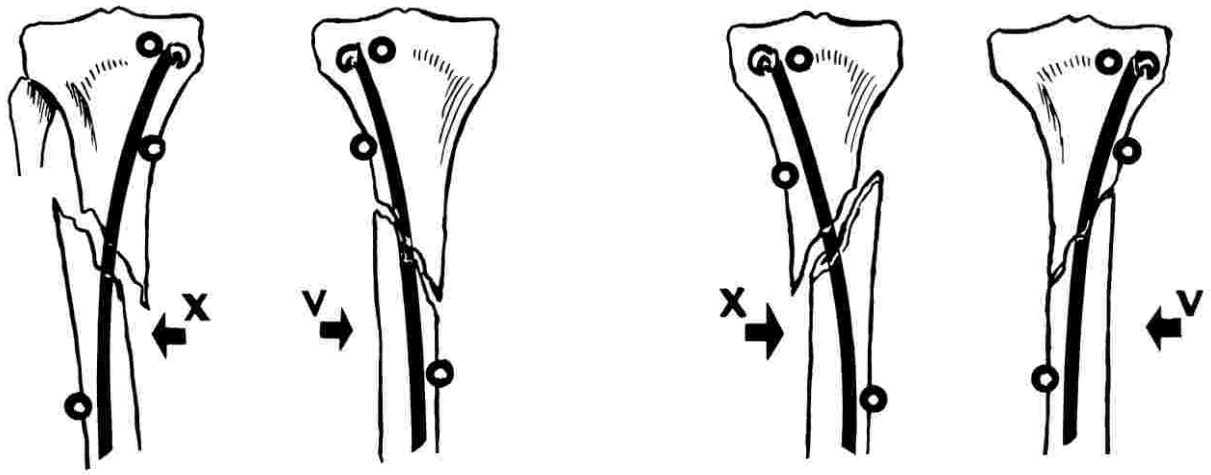
RIGHT: The pin has been inserted from a point lateral to the patella tendon. The axis of the pin is in the same general direction as the axis of the fracture line, the two axes making a “V”. The lower pressure point then produces bone compression.



The Formula

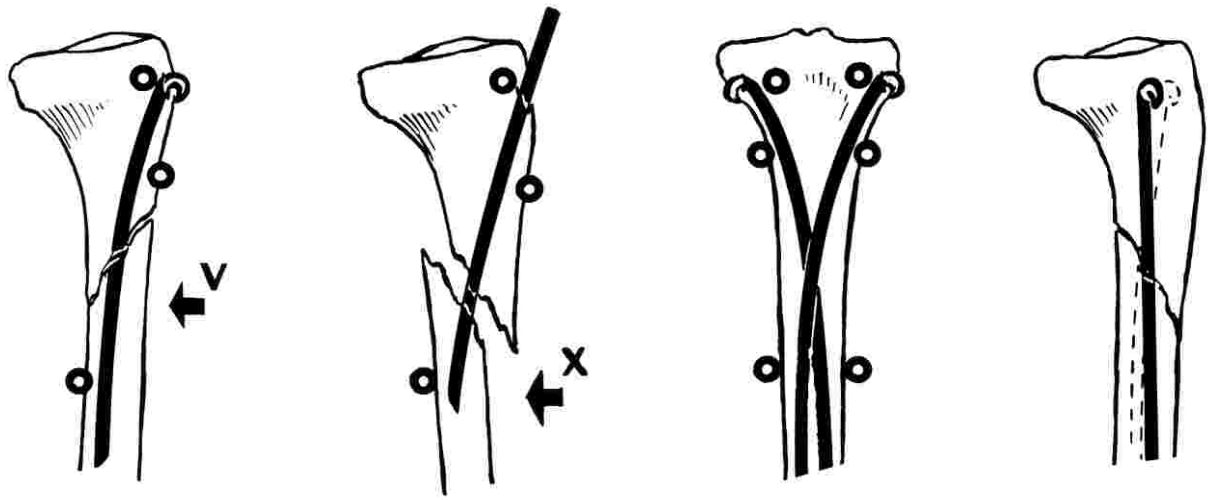
When a pin is inserted in a short fragment to transfix an oblique fracture near the extremity of a bone, if possible, the pin should be so directed that the axis of the shaft of the pin tends to parallel the axis of the fracture line. **REMEMBER:** V FOR VICTORY. X FOR NO GOOD.

Tibia



Obliquities In The Antero-Posterior View

Note the direction of the fracture lines, the points from which the pins were inserted and the points of pressure thus created. Here the formula “V for Victory” tells us the direction for insertion of the pin in the proximal fragment.



Obliquities In The Lateral View

The oblique fracture shown at left can be compressed by a single pin introduced from the anterior surface of the bone. In the fracture (right) the direction of the fracture line is such that two pins are required to be introduced from the antero-lateral and antero-medial aspects of the respective condyles.

After Care Femur and Tibia

Be careful. Intramedullary pins can break!

Fracture of the pin, of proper size, in a normally healing bone is extremely unlikely if caution is exercised in the after care of the patient. When fixation of the fracture is stable, early active motion of the extremity can be permitted to prevent stiffness of the contiguous joints and to maintain normal circulation of the extremity and muscular tone.

Excessive weight bearing or excessive muscular activity before healing occurs can delay healing, precipitate non-union and cause stress fatigue in the pin at the fracture site with eventual fracture of the pin at this level. In the event of non-union, with persistent rocking at the fracture site fracture of the pin is inevitable! Frequent post-operative x-rays are necessary. The presence of the extension of the fracture line into the new forming peripheral callus is indicative of excessive weight bearing or motion at the fracture site. Pain at the fracture site on weight bearing also strongly suggests that this activity should be delayed. When in doubt SPLINT.

The after care of each patient must be individualized. We have found the hip spica cast rarely indicated. Most simple fractures of the femur and tibia shafts can be fixed stably enough that external splinting is not necessary. Comminuted fractures and fractures near the knee joint might require a long leg cast or KES dressing. Our inclination, frequently, is to apply a long leg KES dressing in such cases, which is worn during the swelling period and when the sutures are removed, again assess the situation to decide whether further casting is indicated.

Weight bearing is begun gradually and increased as favorable circumstances permit. The presence of the intramedullary pin in the bone gives some patients a sense of false security and they are prone to excessive activities which sometimes prove disastrous.

Pins should not be reused because of possible stress fatigue being present.