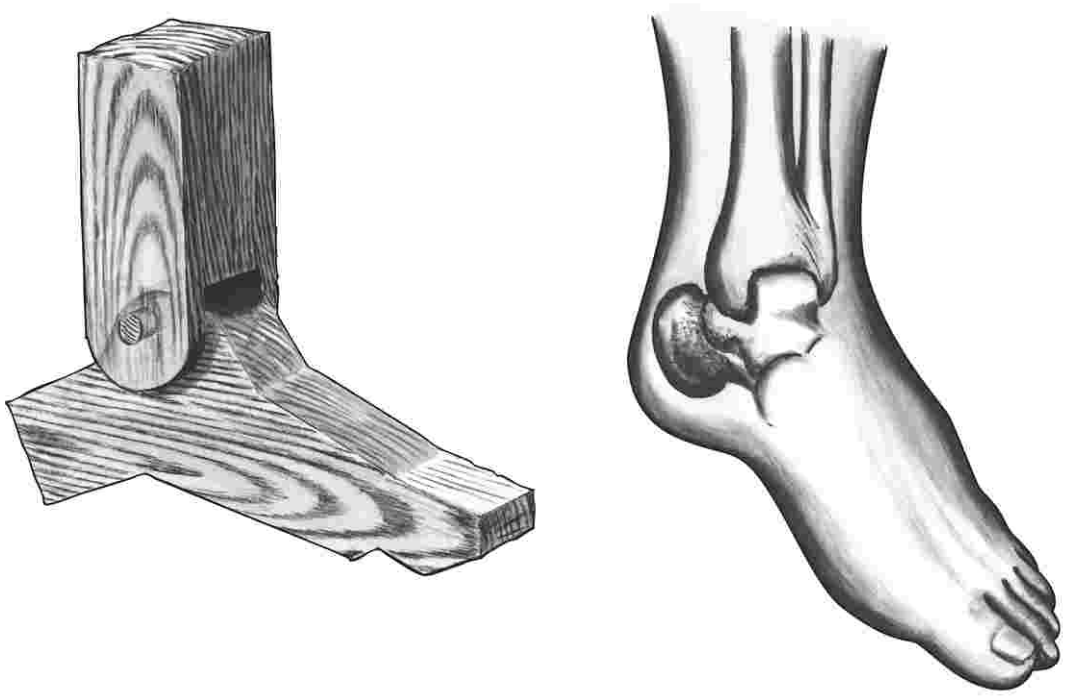
17
THE ANKLE



The ankle is a mortise joint.

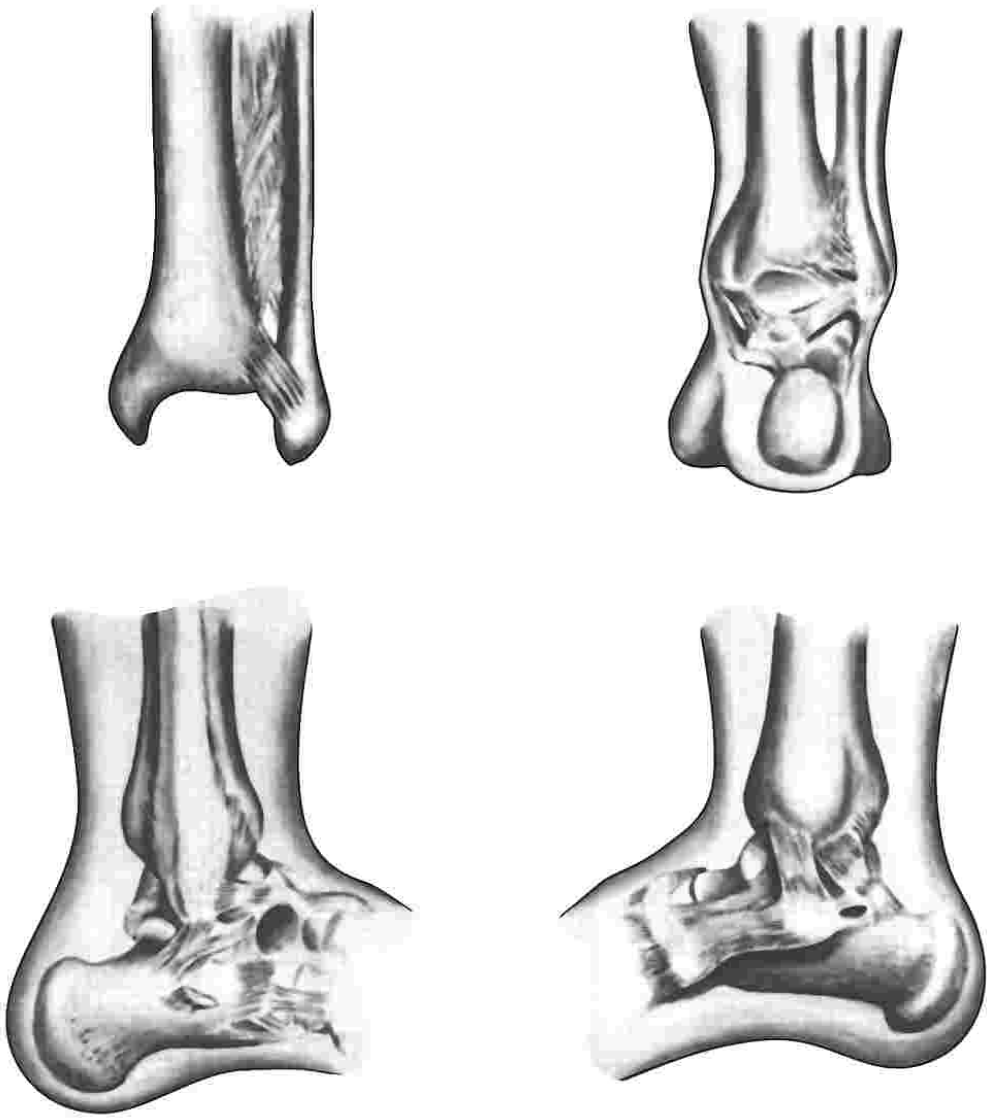
The deformity here is the result of the force of violence. There are multitudinous variations of fractures of this region which defy accurate classification and each must be treated upon its own merits.

The ankle is a mortise joint. The astragalus is the tenon of the mortise. The curved superior surface of the astragalus fits into the mortise in such fashion that motion allowed by this joint is primarily that of flexion and extension. The other motions are provided largely by the joints of the foot.

At the ankle joint, the relationship of the foot to the leg is very much like that of an inverted see-saw. The astragalus rocks upon the fulcrum. It is apparent that when violence is exerted upon it, the foot is capable of acting as a lever to transmit great force to the mortise joint. Injury here is actually produced by three-point pressure. One force is the active or passive effect of the weight of the body. The other two forces are variable. Conversely, to reduce and maintain the position of fractures of this region requires three-point pressure, whether applied externally or internally.

Simple fractures require plaster immobilization only. Pinning is not indicated unless open reduction is indicated. However, avoidable deformity must not be permitted and the remedy must be applied before healing takes place.

The most conservative treatment of the fractured ankle is that which best reconstructs the mortise joint. An unnecessary open reduction is a radical procedure, but to permit deformity to occur for no better reason than to avoid an incision is very radical surgery indeed.

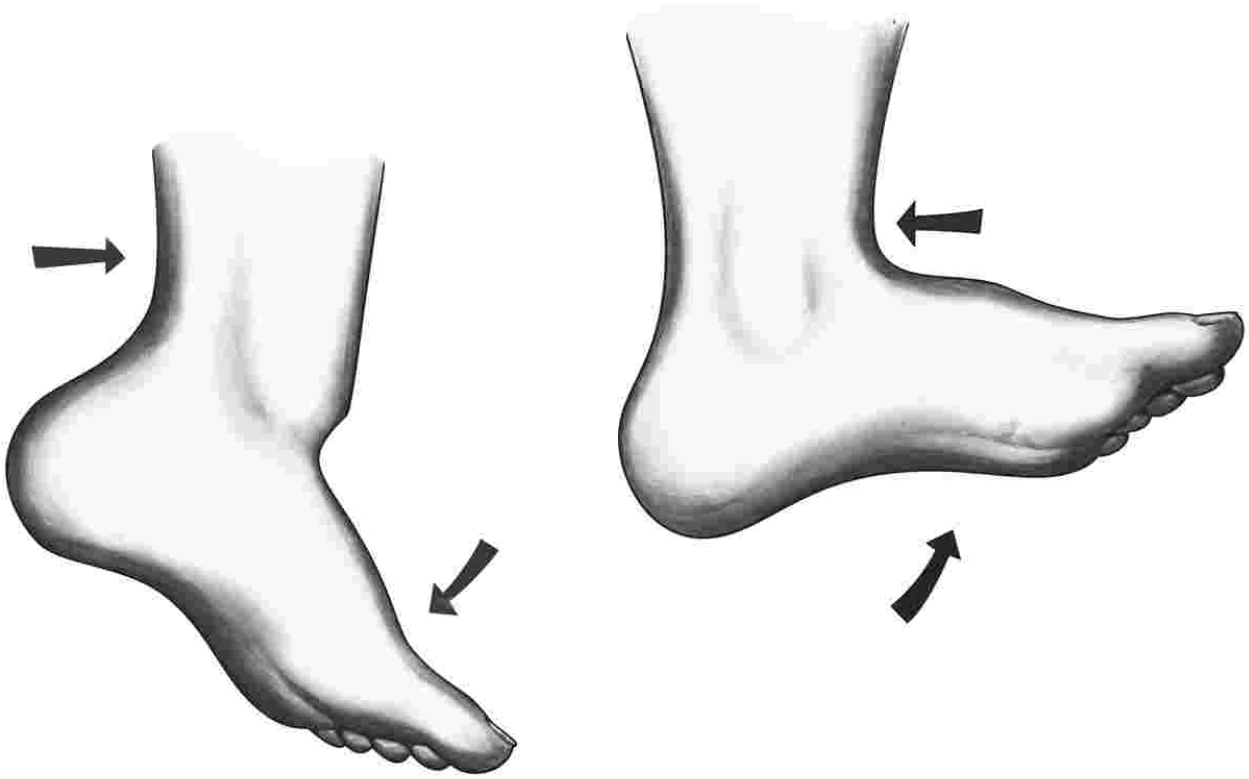


Ligaments Make the Ankle

In most regions of the body it has been the muscle pull with which we had to contend. Here it is the ligaments which do the job. Note how the mortise joint is constructed. The shaft of the fibula is firmly fixed to that of the tibia by the interosseous membrane. The external malleolus provides the lateral wall of the mortise and is snugly attached to the tibia by the tibio-fibulal ligaments.

Except for the very strong ligamentous envelope extending from the leg to the foot, this mortise joint would be insecure.

It must be borne in mind that every ankle injury is a potential dislocation, the variation being a question of degree. Violence to the ankle tends to wrench the astragalus from its mortise and when bone fragmentation occurs, these fragments usually remain attached by these ligaments to the foot and displace with the foot. Proper reconstruction of the ankle region demands complete reconstruction of the dislocation with adequate fixation of the bone fragments.



Reverse the Injury

The best way to treat the fractured ankle is by common sense. Each injury occurs in its own peculiar fashion and required individual consideration as to its treatment. Fractures of the ankle occur by:

1) Angulation

2) Rotation

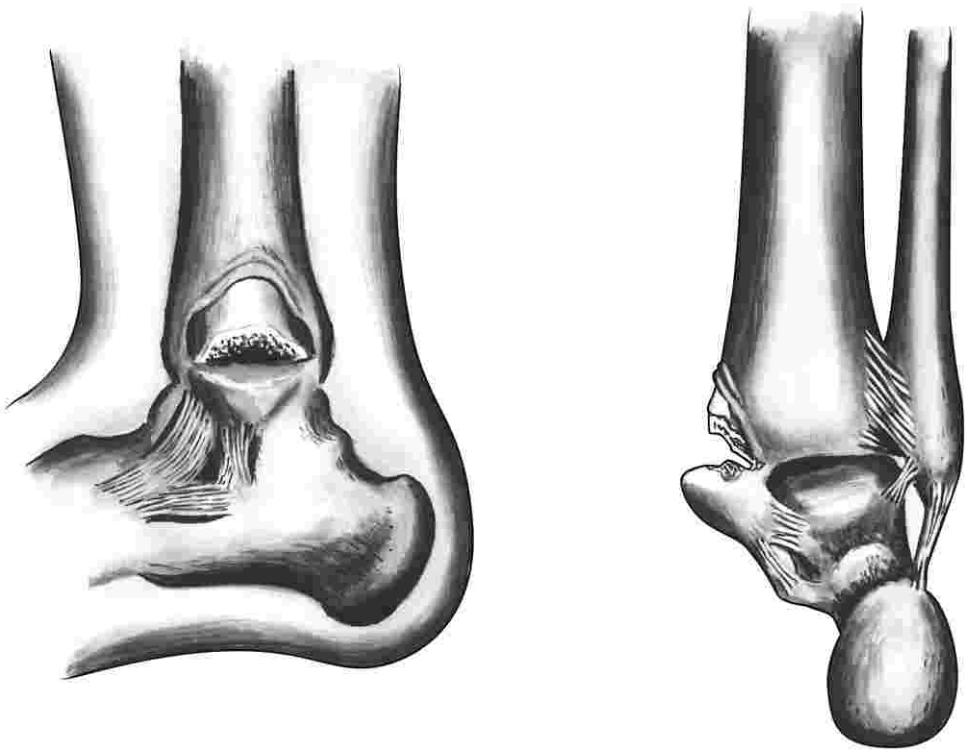
3) Impaction

4) Any combination of the above.

There is an infinite variety of positions in which the foot might be held in relationship to that of the leg at the time the force of violence is exerted. The general tendency of such injury is toward the tearing of the astragalus from its moorings. The direction of the fracture lines and the displacement of the bone fragments will be influenced directly by this force of violence, and the general tendency is towards dislocation of the ankle with displacement of the fragments with the foot.

From a study of the deformity and the roentgenograms it is not too difficult for the surgeon to visualize the direction of forces which produced the deformity.

The surgeon, then, exerts traction to disengage the fragments and reverses the forces of the injury to accomplish reduction. If the injury was caused by angulation, the reconstruction is accomplished by reversing the angulating force. If it was caused by rotation, reduction must be accomplished by reversing the rotating force.

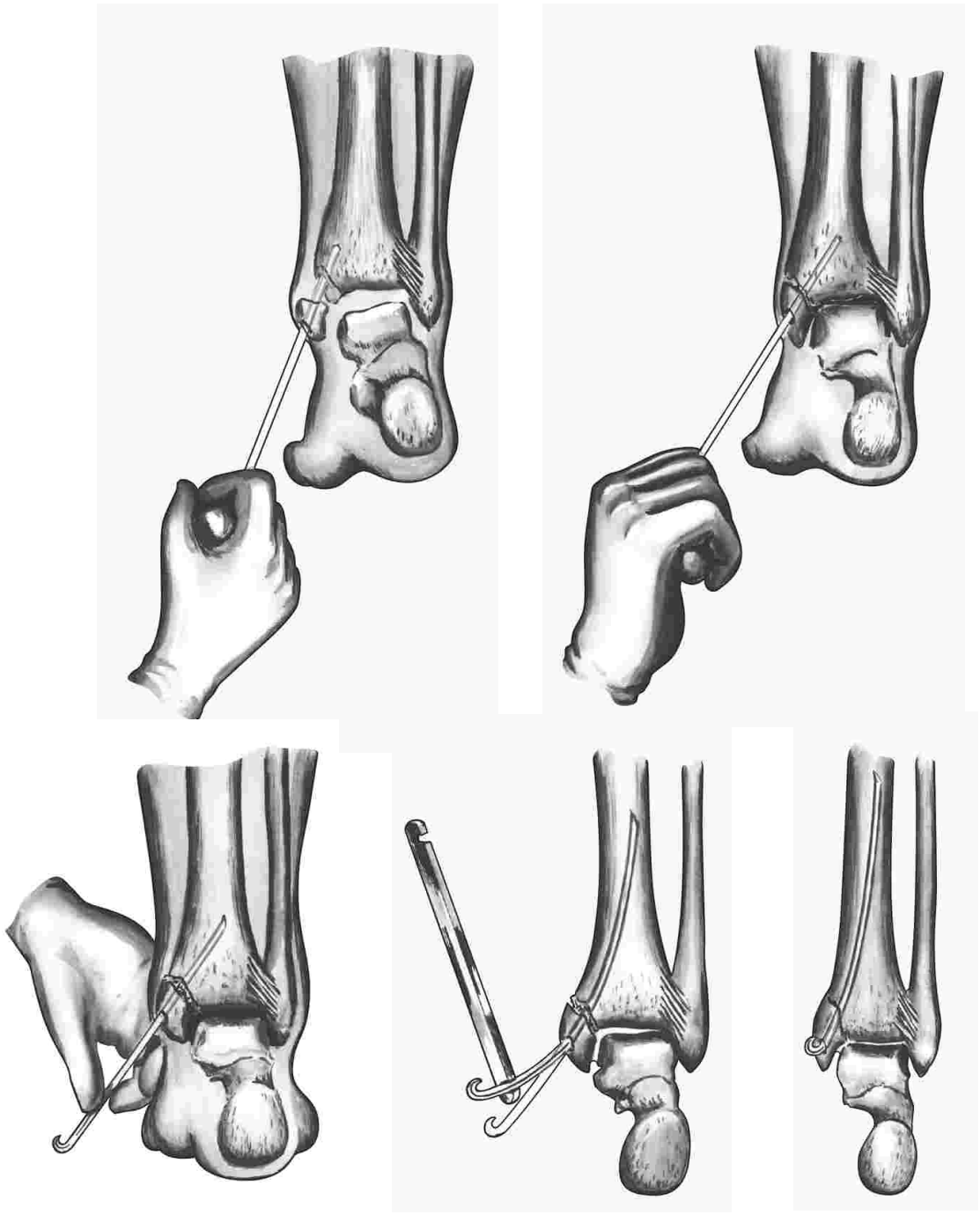


Internal Malleolus

This is primarily an angulation fracture. The deltoid ligament usually proves stronger than the internal malleolus of the tibia which fractures. As the angulating force separates the malleolus from the shaft, the ligaments with the surrounding aponeurosis and periosteum often avulse from the shaft of the tibia in such fashion that this aponeurotic layer invaginates into the fracture line. This interposition of soft tissue can both preclude accurate closed reduction and contribute to non-union. It is essential that the internal malleolus be completely reconstructed and transfixed in order that an accurately fitting mortise joint result.

Technic: A small curved incision is made over the fracture. The soft tissue is removed from the fracture line. With the awl-reamer (1/8 inch) an oblique opening is made beginning at the tip of the fragment of the internal malleolus, passing obliquely to the fracture line. Using the awl-reamer as a manipulating instrument, the fragment is repositioned and the awl-reamer is drilled into the main fragment of the tibia for a distance of about one inch. A pin, 1/8 or 3/32 inch in diameter and about three or four inches in length, is chosen. This pin then replaces the awl-reamer in the opening which has just been drilled. The fragment is replaced, and the pin driven obliquely into the tibia.

As the sled runner strikes the far cortex, it is deflected upward according to a “vase of flowers” principle in such fashion that the shaft of the pin develops very firm fixation in the shaft of the bone. But there is a tendency for the fragment of the malleolus to angulate medially in such fashion as to produce distraction. When the head of the pin lacks about one to one and one-half inches of being driven completely home, it should be given a slight curve with the bending iron. The pin is then completely driven; the fracture hiatus closes to give contact compression and firm fixation.

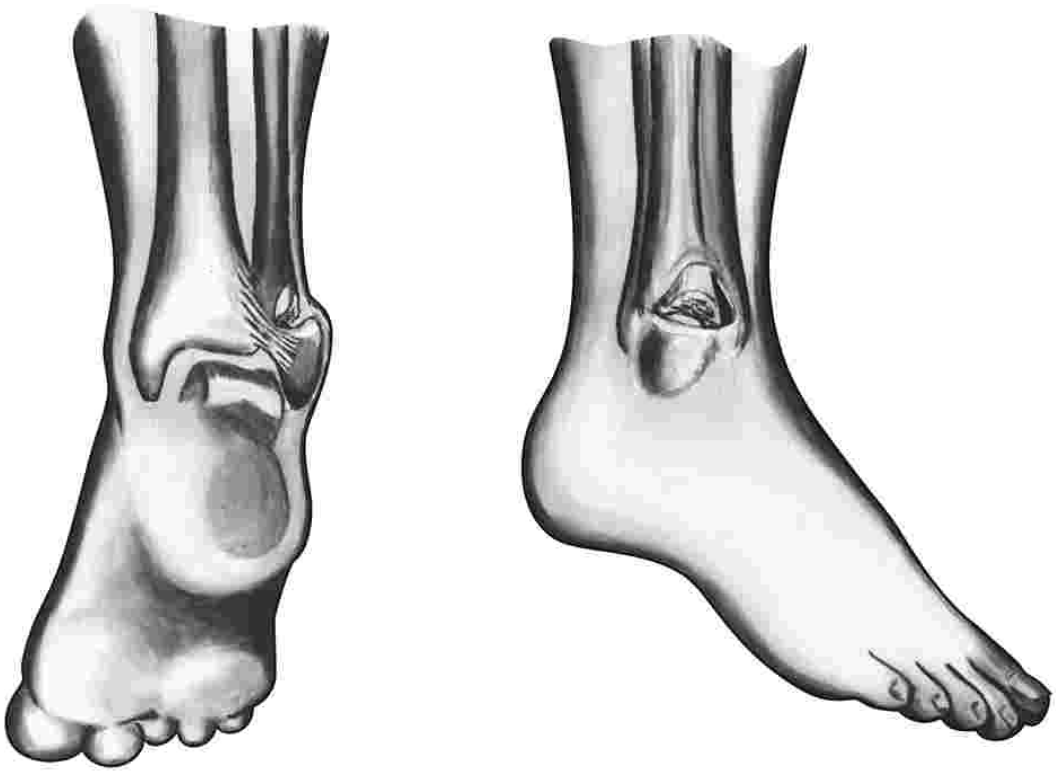


Internal Malleolus
(CONTINUED)

When the bone fragment is substantial, fixation might be sufficiently secure that external immobilization would not be necessary. But oft times the fragment is small and in the event of rotation injuries, a spiral type fracture line is present with a tendency to insecure fixation. In these cases, a short leg K E S dressing should be applied.

Attention should be called here to the fact that pinning of the knobs of the ankle is a much simpler procedure in the average adult male than in women in whom these bony prominences of the ankle are sometimes extremely small and difficult to handle.

If in doubt, SPLINT!



External Malleolus

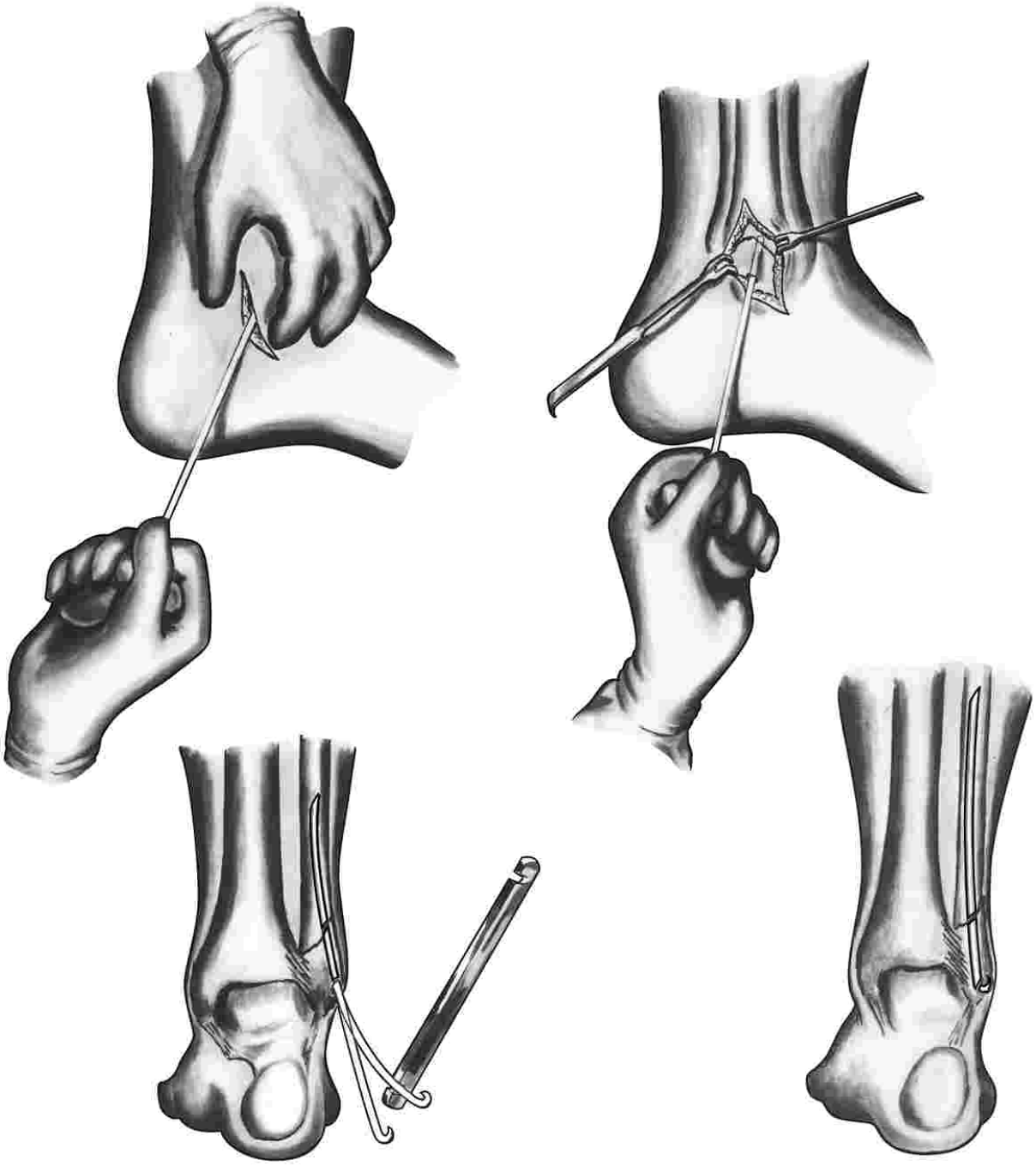
The lower end of the fibula can break and displace in a variety of ways. This bony prominence does not require pinning as frequently as does the internal malleolus. It is not unusual to see a fracture dislocation of the ankle become thoroughly stable after pinning of the internal malleolus alone.

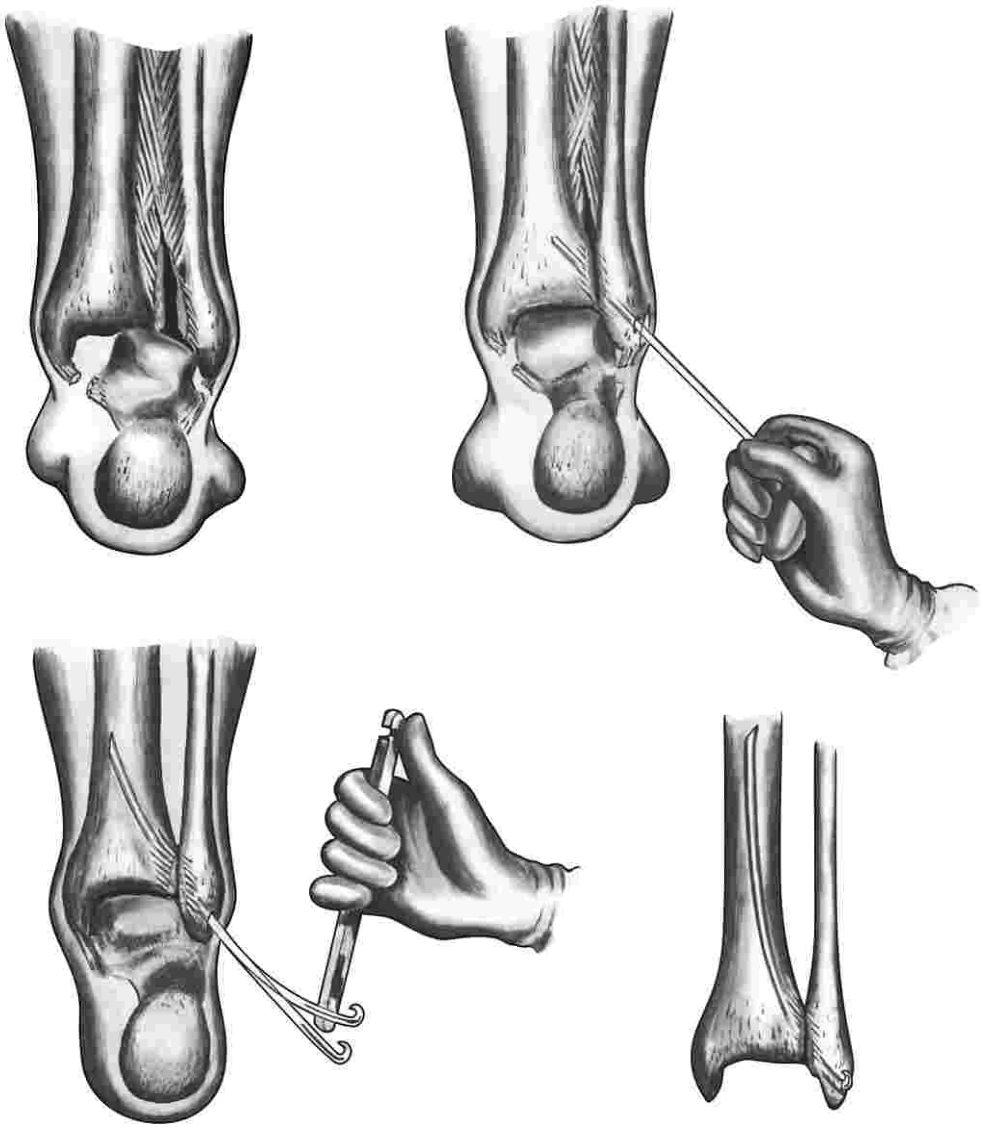
Furthermore, when both malleoli are broken there is frequently associated a vertical fracture of either the anterior or posterior lip of the tibia. This associated fracture rarely requires direct surgical attack if the two malleoli are accurately reduced and pinned. This fragment is held in position by ligament pull.

The technic of pinning the external malleolus is not too different from that of the internal malleolus. When both malleoli are to be pinned they should be attacked simultaneously.

The lower fibula is usually fixed with a straight pin 1/8 inch in diameter. The head should be stress relieved to prevent angulation of the lower fragment. This is necessary because the opening is usually made somewhat laterally in the malleolus and the pin actually passes obliquely through this fragment. As the sled runner point is deflected in the passage up the shaft of the fibula, the lower fragment tends to angulate and distract because of the “vase of flowers” principle. The slight curve to the proximal portion of the pin provides proper alignment and compression.

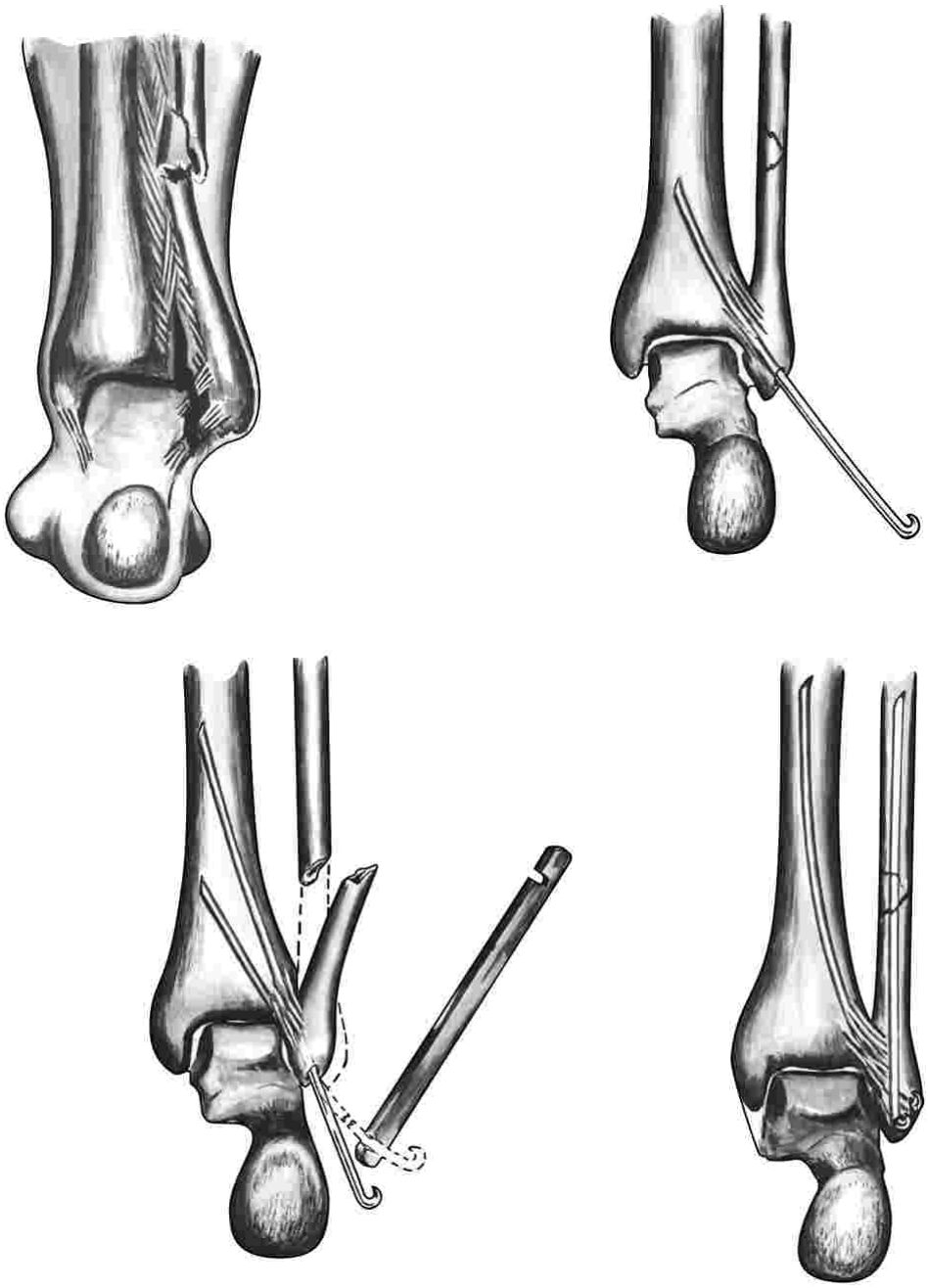
In an occasional case, fixation can be better secured by driving the pin obliquely across the tibio-fibulal joint into the shaft of the tibia.





Tibio-Fibulal Diastasis

In this injury the ligaments which bind the tibia to the fibula tear, allowing the mortise joint to widen to varying degrees. Without proper treatment, a permanently painful ankle with a tendency to persistent swelling is apt to occur. Before pinning an injury of this type, it is necessary for the surgeon to study the articulated skeleton so that he can learn the proper angle in which the pin must be driven. The opening is made obliquely through the external malleolus of the fibula, across the tibio-fibulal joint and into the lower extremity of the tibia. The pin driven in this fashion acts as a lever, and as the sled runner surface of the point is deflected by the far cortex of the tibia, very firm pressure is exerted at the fulcrum which is the tibio-fibulal joint. It is necessary to stress relieve the head before the pin is driven completely home to prevent migration of the head of the pin into the external malleolus.



Diastasis with Fracture of Fibula

The dynamic forces exerted by a straight pin driven into a curved bone are markedly demonstrated in an injury of the type shown above. The pin can produce very definite angulation of the lower fragment of the fibula unless the head is stress relieved. In a situation of this sort, it is usually essential that in addition to the oblique pin across the tibio-fibulal joint, an additional one be driven axially up the shaft of the fibula to transfix the fracture in this area.