Treatment of Unstable Fractures of the Ankle *

PAUL W. BRAUNSTEIN, M.D.,** PRESTON A. WADE, M.D.***

*From the Fracture Service, New York Hospital and the Hospital for Special Surgery,
New York, N. Y.*

Introduction

IN TREATING fractures of the ankle, one recognizes a certain small group which causes difficulty in management and often leads to long term ankle disability. Seldom do the uncomplicated single malleolar fractures lead to pain or disability but rather it is the displaced unstable bimalleolar or trimalleolar fracture which proves difficult to reduce and maintain in reduction. The well recognized need for adequate reduction leads to vigorous and concentrated efforts to obtain this end. If this reduction is not maintained, too often there is a crippling end-result.

On the combined Fracture Service of the New York Hospital and the Hospital for Special Surgery there is an increasing tendency to treat these complicated injuries by open reduction and internal fixation with meticulous care being directed to restoration and maintenance of normal anatomic relationships.

There is little problem in therapy involved in the single malleolar fracture or in the stable undisplaced multiple malleolar fracture. Direct trauma to a medial malleolus may lead rarely to isolated displacement of the bone fragment. If anatomic reduction is impossible, open reduction with screw replacement is indicated to lessen the chance of nonunion so often noted in a poorly reduced malleolus (Fig. 1A, B).

Bimalleolar fractures are treated by internal fixation of the medial malleolus by Collison screw fixation and on occasion Rush nail fixation of the unstable lateral malleolus (Fig. 2A, 2B, 3A, 3B).

Trimalleolar fractures are treated very frequently with screw fixation of the medial malleolus. Should there be posterior dislocation of the talus and a posterior malleolar fragment comprising one third or more of the tibial articular surface, then posterior lip screw fixation is carried out through a postero-lateral approach (Fig. 4A, B).

Complete tears of the deltoid ligament are associated most often with lateral malleolar fractures. In almost all of these fractures, suture of the deltoid ligament has been performed shortly after injury. This has been the rule because of the impossibility to rule out incarceration of the deeper deltoid fibers in the tibio-talar interval. Furthermore, on several occasions Rush nail fixation of the fibula has led to further stabilization in this injury (Fig. 5A, 5B). More rapid mobilization has been accomplished by this method, and when suture of the deltoid ligament proved impossible due to poor overlying skin, Rush pin fixation of the fibula only has proven of great value. More and more frequently, stress films are used in the fresh injury to determine a deltoid ligament tear when only slight lateral displacement may be noted in the roentgenogram (Fig. 6A, B).

Distal tibio-fibular diastases have been treated by tibio-fibular bolt fixation if plas-

Fig. 1A. An isolated fracture of the medial malleolus is displaced inferiorly and medially. Attempts to anatomically replace this by closed methods failed.

ter immobilization with compression of the malleoli has failed to maintain adequate reduction. Because of the slight but definite motion between the distal tibia and fibula, it is always wise to remove the bolt following healing of the tibiofibular ligament. Should this bolt be left in situ for more than three or four months, constant motion
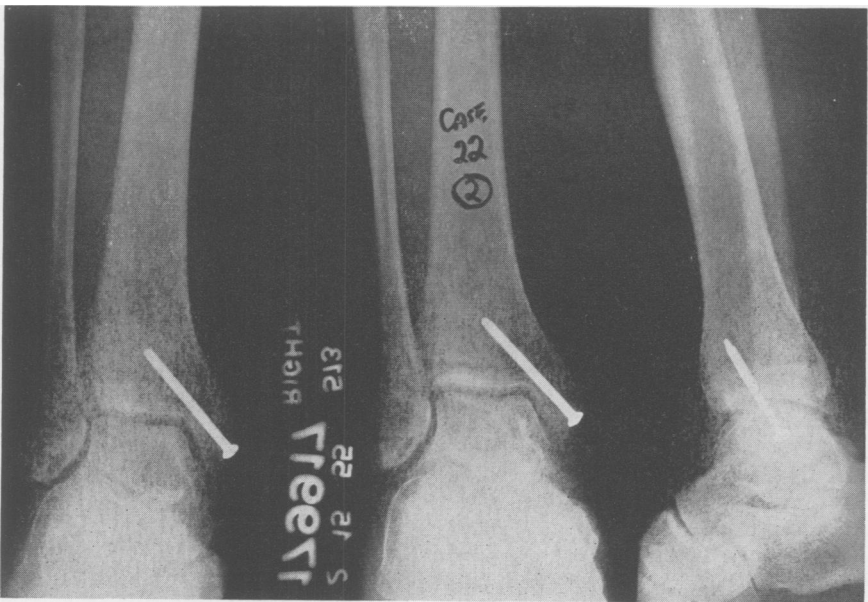

Fig. 1B. After open reduction anatomical replacement has been achieved, lessening the risk of nonunion of the medial malleolus.
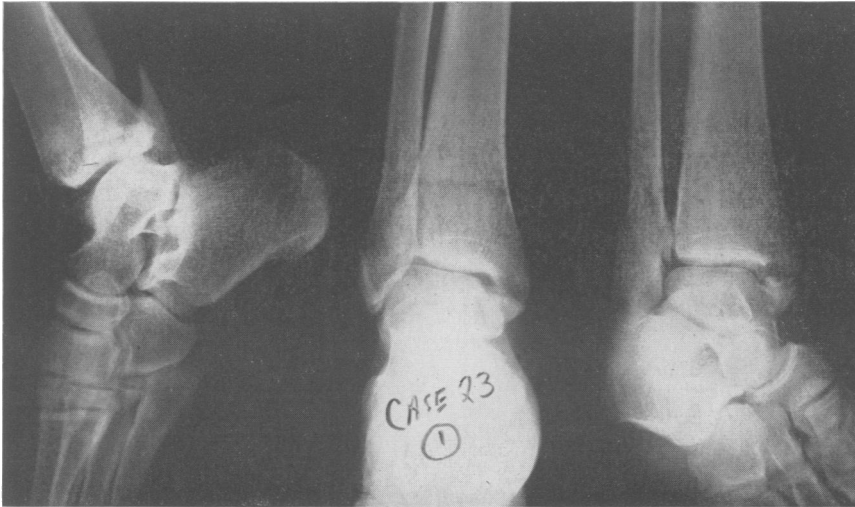
FIG. 2A. This bimalleolar fracture exhibits lateral and inferior displacement of the malleolus and posterior and lateral displacement of the lateral melleolus.

of the joint will inevitably lead to metal fatigue and breakage of the metal bolt. It should be stressed that we have not treated all tibiofibular diastases with bolt fixation. Simple plaster compression of the malleoli is often sufficient or internal fixation of a medial malleolus which is associated with tibiofibular diastasis often corrects all existing deformity (Fig. 7A, B).

The following study is an evaluation of the treatment for unstable ankle fractures. This method of treatment outlined above is presently employed on the Combined Fracture Service.

Children were excluded from the study because their cases present almost no problem when treating this type of fracture.

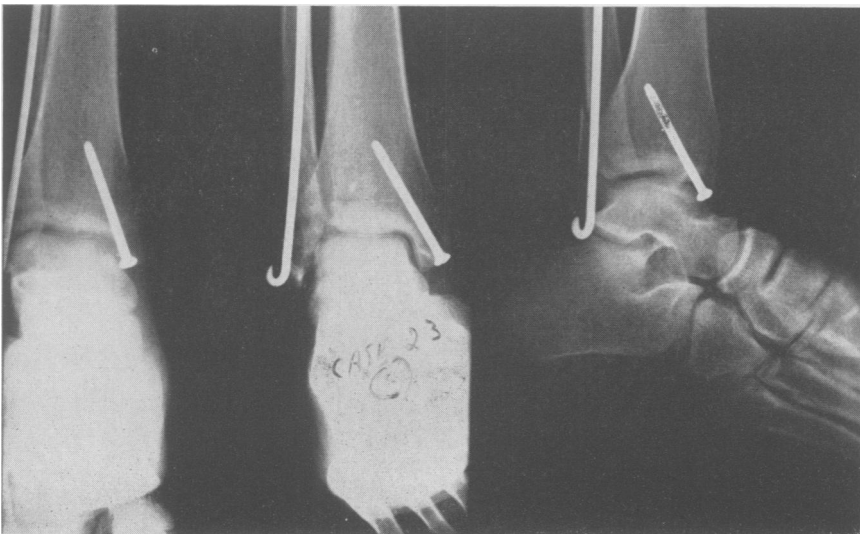Because of the small number of patients

FIG. 2B. Collison screw and Rush pin fixation lead to firm fixation and anatomic alignment.

FIG. 3A. Following closed reduction, this bi-malleolar fracture revealed lateral "slipping" of the talus and malleoli.

studied one cannot make an adequate evaluation to obtain valid statistical significance, yet we believe that from a clinical standpoint the differences are quite striking.

Method of Study

All fractures of the ankle in adults treated at the New York Hospital from 1951 to 1956 have been reviewed. All stable and undisplaced malleolar fractures and sprains were eliminated. The result was a highly selective but complete group of cases consisting of adults in whom a malleolar ankle fracture was displaced requiring reduction by manipulation or operation to obtain a satisfactory anatomic result. This selective study was designed for accurate comparison of closed and open treatment of the complicated fracture about the ankle.

Observations

On the Combined Fracture Service from 1951 to 1956, 107 patients were selected, all having sustained displaced malleolar fractures. All had loss of the normal mortise relationship of the ankle. All required manipulation, either open or closed, for restoration of normal anatomic relationships. All charts and available roentgenograms were reviewed. Adequate follow up observations were obtained from the charts or by follow up letters to the supervising surgeon. There were 37 males and 70 females. Approximately half (55) were private patients and 52 were pavilion (ward) patients. The ages of the patients were well distributed over the adult age range with
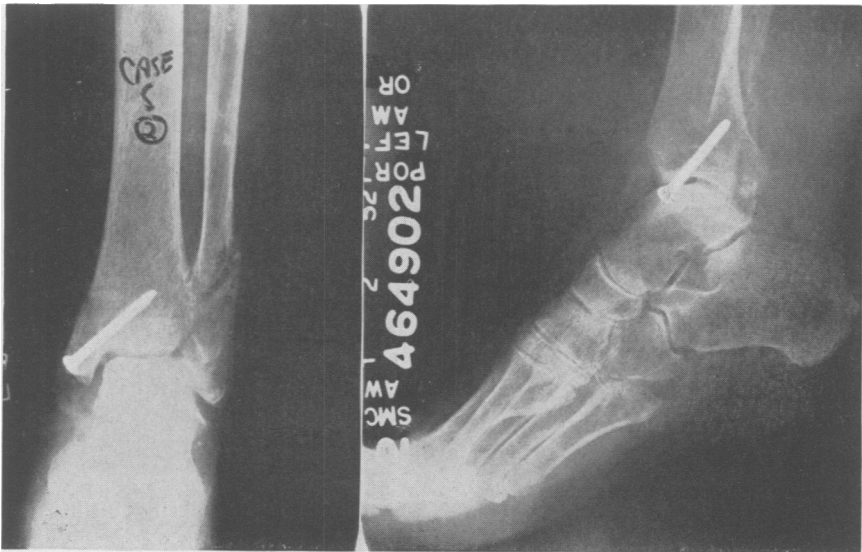

FIG. 3B. Single screw fixation proved adequate for reduction. Note the small fragment of posterior lip which is clinically insignificant.
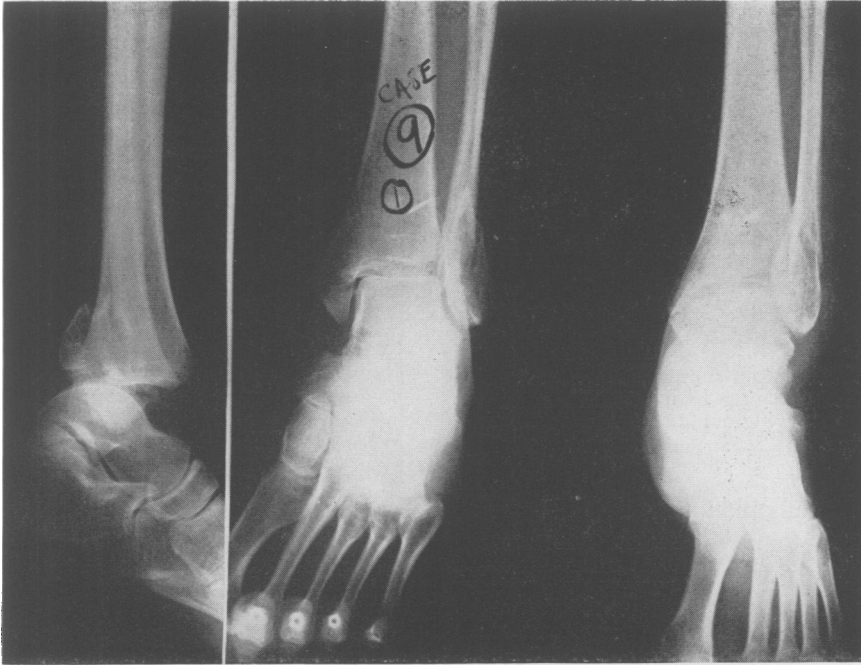
FIG. 4A. This trimalleolar fracture reveals a sizeable posterior lip fragment and posterior dislocation of the talus.

no one decade occurring significantly more than another.

All but one of these patients were admitted to the hospital in the course of care

FIG. 4B. Anatomic reduction has been accomplished by 2 Collison screws.

FIG. 5A. An obvious rupture of the deltoid liga-
ment can be recognized due to the increased
tibiotalar interval without associated medial mal-
leolar fracture.

of the fractured ankle and other injuries or
coexistent systemic diseases. There were
many disease processes identified in these
patients but in none was the associated con-
dition mentioned as a deterrent to adequate

FIG. 6A. Following closed reduction of an in-
jury diagnosed as a comminuted lateral malleolar
fracture, there is suspected slight residual widening
of the medial joint space.

care of the injured extremity. By vigorous
supportive care and varying types of anes-
thesia, all necessary care was afforded for
adequate treatment of the fracture. Those
diseases recorded in association with the
ankle fracture comprised those found in an
aging population, and as well, there were
several cases of multiple injuries. There
were also occasional infectious diseases
such as tuberculosis and syphilis. Again, in
no instance did the associated disease affect
or alter the definitive treatment of the
ankle fracture.

There were 59 trimalleolar fractures
(Table 1) of which 11 had large enough
post lip fragments to require maintenance
of reduction of this fragment. Twenty-seven
patients suffered bimalleolar fractures, and
17 had deltoid ligament tears and lateral
malleolar fractures. Two patients suffered
tibiofibular diastases, and two fractures
could not be rightfully assigned to any
one category. These unassigned fractures
coupled with tibiofibular diastases are
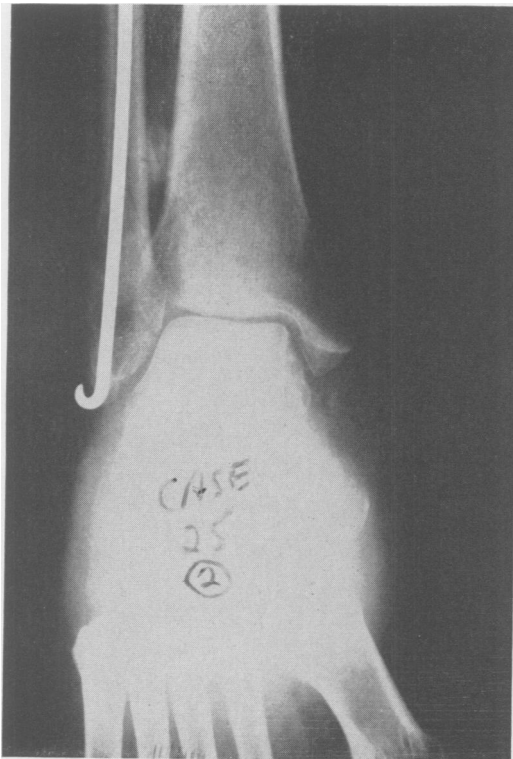listed as "miscellaneous" fractures of the
ankle.

FIG. 5B. Excellent anatomic reduction has been
accomplished by suture of the deltoid ligament
medially. Rush pin fixation of the lateral malleolus
has insured maintenance of the normal mortise.

As accurate reduction is a prerequisite
to adequate care of the displaced malleolar
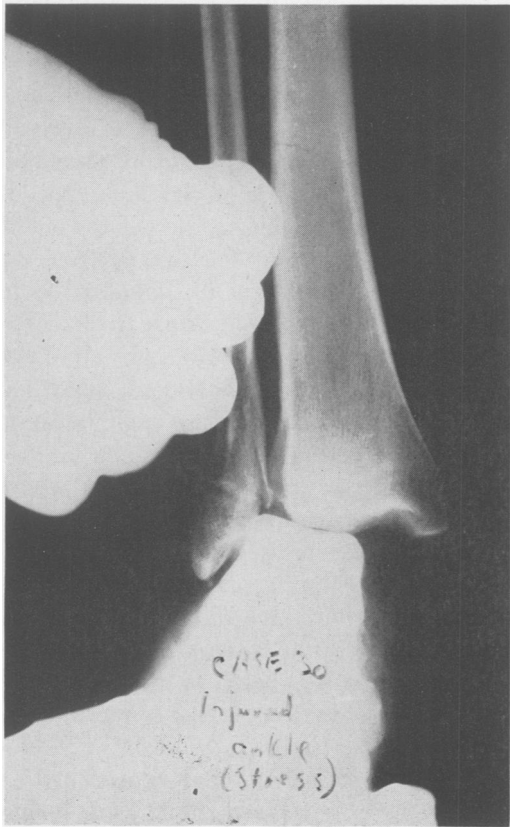fracture, the number of manipulations re-

FIG. 7A. Tibio-fibular diastasis is associated with an open fracture of the medial malleolus.

quired for adequate reduction was studied (Table 2).

It is interesting to note that of the 107 patients, 70 required but one manipulation or operation to obtain satisfactory position. Therefore, the remaining 37 patients (*more than one third of the total group*) required more than one attempt to satisfactorily reduce the fracture.

FIG. 6B. Prior to surgery stress films confirm the suspected deltoid ligament tear.

FIG. 7B. Adequate reduction of the severely deformed ankle joint has been accomplished by fixation with a single screw.

All patients with primary closed reduction were tabulated if a second reduction was deemed necessary. In Table 3 the number of primary closed reductions requiring secondary reduction is studied. Eight patients required three or four reductions. Approximately half of the secondary reductions performed were of the open type. Of those 28 patients undergoing second reductions, eight required further care subsequently.

Conversely, in those patients undergoing primary open reduction (almost always with internal fixation) there was only one patient who required secondary attempt for complete satisfactory anatomic appearance by roentgenographic studies. (Table 4).

In the one case which was attacked originally by open reduction, closed reduction at second attempt failed and finally re-operation corrected the deformity. The patient was a 55-year-old male who suffered an open trimalleolar fracture and had only catgut suture internal fixation of the medial malleolus because of the presence of a contaminated wound. This internal suture did not stabilize the fracture, and slipping occurred nine days later. Closed reduction failed to maintain position. Finally insertion

TABLE 1. *Types of Fractures*

1. Trimalleolar	59
A. Insignificant post lip fractures not requiring reduction (48)	
B. Post lip fractures requiring reduction (11)	
2. Bimalleolar	27
3. Deltoid ligament tear and fracture lateral malleolus	27
4. Tibiofibular diastasis	2
5. Miscellaneous	2

TABLE 2. *Number of Reductions Attempted*

(Closed or Open)

1. One reduction only	70
2. Two reductions	28
3. Three reductions	8
4. Four reductions	1

TABLE 3. *Primary Closed Reductions Requiring Re-Reduction*

(Total Primary Closed Reductions—57)

A. Two reductions		Total 28
1. Closed	13	
2. Open	15	
B. Three reductions		Total 7
1. Second closed, third open	4	
2. Second closed, third closed	3	
C. Four reductions		Total 1
1. Three closed then 1 open		

TABLE 4. *Total Primary Open Reductions 50*

Primary open reduction requiring re-reduction	
I. Two reductions	0
II. Three reductions (second closed, third open)	1

of a Rush pin into the fibula through a clean wound led to maintenance of adequate reduction.

The incidence of "slipping" in those fractures treated by closed reduction was impressive. Study of the age groups involved in those cases of slipping is inconsequential. Because we feared that the incidence of slipping might be due to the experience of the physician caring for the patient, we investigated those cases of "slipping" as to the service on which they were treated. We observed equal distribution of "slipping" of all types of fractures between the pavilion and private services and as well between general surgeon and orthopedist.

It is of interest that in the 36 cases where significant "slipping" or re-displacement occurred, the intervals between primary reduction and slipping varied from the immediate postreduction film to 18 days following reduction. Table 5 lists the time intervals elapsing between reduction and recognition either by clinical or radiological examination.

As well recognized, the dangerous period for significant displacement to recur is during the first three weeks following injury. At that time edema is decreasing, hema-

toma and ecchymosis are being resorbed and external fixation becomes relatively inefficient if not changed judiciously at correct periods in the postinjury period. If the patient is discharged from the In Patient Service before swelling of the ankle has subsided it may be difficult to carry out careful follow up examinations concerning the efficacy of the immobilization. Actually, however, most of the patients suffering redisplacement of the ankle fracture fragments were still hospitalized patients when the slipping occurred.

While slipping was the most frequent complication encountered in our series, there were several less frequent problems which developed in both the open and closed type of reductions.

In this small group of complications, approximately one-half (eight) were in patients undergoing open reduction. Another two were in that group first treated by closed, and then by open, method. Only three complications occurred in patients treated by closed method alone. It is interesting to note, however, that save for a serious case of thrombophlebitis, the greatest problem, namely, chronic ankle pain, occurred in the nonoperative cases. It should be stressed that in both cases anatomic restoration had been accomplished at closed reduction. Pain over metal used for internal fixation was cured by a minor surgical procedure of removing the metal. Two cases of infection proved mild and did not lead to abnormal joint appearance by roentgenogram. Both sinuses closed uneventfully with normal care.

TABLE 5. *Time Interval Observed Between Reduction and Significant Redisplacement of Fracture*

0–2 days	9
3–5 days	8
6–8 days	4
9–11 days	11
12 days or longer	5
(14 days, 14 days, 17 days, 18 days, 42 days)	

TABLE 6. *Results*

		Excellent	Good	Poor
Closed	Trimalleolar	4	7	4
	Bimalleolar	5	4	2
	Deltoid tear	1	1	0
	Miscellaneous	0	1	0
Open	Trimalleolar	24	9	1
	Bimalleolar	8	2	2
	Deltoid tear	7	7	1
	Miscellaneous	0	3	1

Results

The over-all results in these cases have been very good. Table 6 lists follow up evaluations on 94 of the 107 patients studied. The other 12 patients had less than three month follow up study and were excluded. At this short follow up, however, all were doing well.

It is well appreciated that many of these patients lack a follow up study of two years or longer but we believe that for the great majority of these fractures, adequate reduction and maintenance of this reduction will lead to good results.

The short term end results listed in Table 6 were categorized as excellent, good or poor. The term "excellent" indicated that the patient was without symptoms of limp, pain or swelling. The term "good" indicated that the patient had minor complaints of pain or residual swelling or had slight loss of motion but none of which was sufficient to prevent him from returning to previous activity or occupation. The term "poor" indicated a limp or loss of motion sufficient to prevent return to normal activity.

It is immediately evident that adequate results were obtained in the majority of the patients treated. All the "poor" results were encountered in severely comminuted "difficult" fractures. Many unreduced ankle fractures originally in the group treated by closed methods were prognostically poor risks. These were operated upon and ex-

perienced good or excellent results in the final tally.

We cannot attach statistical significance to the foregoing figures, but we do believe that the results obtained by open reduction versus those treated by closed methods only are appreciably different. Because of the difficulties and hazards inherent in closed reduction and plaster immobilization, we have resorted much more frequently to immediate open reduction as a definitive step in care of the patient with a displaced malleolar fracture.

Conclusion

Frequently, primary closed reduction in unstable fractures of the ankle is unsuccessful, necessitating further attempts at therapy.

If one closed reduction does not obtain perfect alignment, operation is indicated.

A proven rupture of the deltoid ligament should be operated upon and sutured without prior attempts at closed reduction.

A fracture of the posterior malleolus ("posterior lip") of the tibia requires internal fixation if over one third of the tibial articular surface is displaced.

Primary open reduction and internal fixation is often the method of choice in difficult ankle fractures.

Summary

One hundred and seven patients with displaced fractures of the ankle were studied. Fifty-seven patients underwent primary closed reduction and 50 primary open reduction. The group of patients undergoing primary closed reduction required repeated attempts at reduction in more than half of the group studied. In those patients undergoing primary open reduction, only one of 50 required further attempts at reduction.