

THE CLOSED TREATMENT OF SEVERE MALLEOLAR FRACTURES

A. FEDERICI, F. SANGUINETI, F. SANTOLINI

The authors studied, with clinical and radiological criteria the results of closed treatment (reduction by manipulation and immobilization in a plaster cast for 7 or 8 weeks) of severe displaced malleolar fractures. Of 145 patients who had suffered an ankle fracture and were treated with closed methods between 1979 and 1989, 78 were reviewed, with an average follow-up of 6.2 years. The main difficulties of closed treatment concerned reduction of the fractures; anatomical reduction was achieved only in 32.4% of the cases, and deterioration of the position achieved often occurred (26.2%). Although some joints healed in a fair position, subjective and objective late results were excellent or good in 77% of the cases, fair in 20.5% and poor in 2.6%.

The most common clinical outcome was a slight decrease of the range of motion in the injured ankle, which was found in 68% of the cases. Arthritis developed in 28.2% of the reviewed ankles, both after an initial good reduction as well as after an initial poor reduction. A complete failure of closed treatment occurred in 8.3% of the cases, caused by an interpositioning of soft tissues among bone fragments leading to unsuccessful manipulation or by late deterioration of the initial position of reduction causing healing of the fracture in a poor position (severe talar shift).

Keywords : malleolar fractures ; closed treatment.

Mots-clés : fractures malléolaires ; traitement orthopédique.

The treatment of severe and displaced malleolar fractures is still controversial. Several surgical procedures, with open reduction and internal fixation, have been improved as an alternative to traditional conservative methods, including mani-

pulation and immobilization in a plaster cast. Open treatment, generally allowing greater accuracy in lesion repair, is now widely used, on the basis of the contention that precise restoration of anatomy must result in perfect return of function.

Conversely, the majority of authors now ascribe to closed treatment a series of drawbacks, such as inadequate reduction, difficulty in nursing and delayed and often incomplete functional recovery. They therefore think that it should be restricted to milder injuries or to the elderly, who usually do not have adequate bone stock to achieve fixation.

In spite of such premises, at the Orthopedic Clinic of the University of Genova, closed treatment still remains the primary procedure in every patient and in every type of malleolar fracture.

In this paper we report and analyze the results of closed treatment of severe malleolar fractures, with the aim of determining advantages and disadvantages of our therapeutic choice.

MATERIALS AND METHODS

a) Materials

Between 1979 and 1989, 145 patients with bi- or trimalleolar fractures (simple or with dislocation of the talus) were treated by a closed method at the Orthopedic Clinic of the University of Genova (Italy). This group

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included adults of both sexes (56 men and 89 women), ranging from 17 to 70 years of age (average : 55 years).

Most of these patients (101) sustained the fracture in a trivial or moderate trauma (stumbling on a step, slipping on level ground); in the other cases the fractures resulted from motor vehicle accidents (23), sport injuries (11) or falls from heights (10).

Injuries caused by supination trauma were prevalent (59.2%). Falls from heights, involving vertical compressive loading, always caused the detachment of the posterior lip of the distal end of the tibia (third malleolus of Destot).

The fractures were classified according to both the Lauge-Hansen system (16, 26) and the Burwell-Charnley classification (5), and had the distribution shown in tables I and II; 25 of them were complicated by slight skin lesions (Gustilo Grade I wounds, excoriations or flictenes).

Table I. — Distribution of ankle injuries according to the Burwell-Charnley classification

Fracture type	No. of injuries	percent
- Bimalleolar fractures	29	20.0%
- Trimalleolar fractures (3rd malleolus involving less than 25% of the articular surface)	61	42.0%
- Trimalleolar fractures (3rd malleolus involving more than 25% of the articular surface)	38	26.2%
- Fractures with associated disruption of the deltoid ligament	17	11.7%
Total	145	

Table II. — Distribution of ankle injuries according to the Lauge-Hansen classification

Fracture type	No. of injuries	percent
- SE stage IV	78	53.7%
- SE stage IV (with deltoid disruption)	10	6.9%
- SA stage II	8	5.5%
- P/PE stage III	9	6.2%
- PE stage IV	32	22.0%
- PE stage IV (with deltoid disruption)	7	4.8%
- Atypical fractures	1	
Total	145	

Most of the trimalleolar fractures were associated with a posterior subluxation of the talus; 17 (10 SE IV, 7 PE IV) were fractures of the distal part of the fibula with associated disruption of the deltoid ligament and lateral dislocation of the talus.

All the fractures were treated by closed reduction by manipulation, and immobilization in a toe-to-groin plaster cast (with the knee flexed 30°) for 3 weeks, followed by 4 weeks of immobilization in a below-the-knee walking cast.

Manipulation was performed, when possible, during the first hours after the trauma, before swelling and clotting of the fracture hematoma appeared, yielding a difficult and unstable reduction.

Weight-bearing was not allowed during the first 3 weeks; in this period the patients underwent the procedures to prevent early complications: anti-thrombotic prophylaxis, anti-edema therapy, careful supervision of cast bearing and radiological surveillance.

Standard radiograms (in anteroposterior, lateral and mortise views) were routinely performed 4 times: on reduction, 4 or 5 days later, on weight-bearing and on the final cast removal.

When the fracture healed, physical therapy was suggested to every patient, for recovery of muscular tone and range of motion.

For long term follow-up the 145 available patients were asked to return for a clinical and radiographic evaluation, or at least to fill in a questionnaire about their subjective and functional situation. Seventy-eight patients (36 men and 42 women, 53%) answered and were examined, with an average follow-up of 6.2% (range 2 to 12 years).

b) Methods

The medical histories, the records and the radiographs of the 145 available patients were reviewed.

The follow-up clinical evaluation was based on a personal scoring system in which pain, patient's subjective assessment of function and range of motion of the injured ankle were considered (table III).

This scoring system, based on those of Hugues (10), Olerud (18), Phillips (20) and Baird (1), provides quantitative data on patients' symptoms, by assigning a maximum possible score of 100 points. Of these 100, 25 points were concerned with pain, 50 with assessment of function and 25 with evaluation of gait and range of motion. A total score of 90 to 100 points was considered excellent; 70 to 89 points, good; 50 to 69 points, fair and less than 50 points, poor. Further-

Table III. — The Scoring System

<i>Pain</i>	25 points
- No pain	25
- Mild pain with heavy activity	20
- Mild pain with daily activity	15
- Pain with weight-bearing	5
- Pain after any activity and at rest	0
- Required use of analgesics occasionally	-2
- Required use of analgesics regularly	-5
<i>Articular function</i>	50 points
* <i>Stability of ankle joint (subjective)</i>	
- No instability	10
- Instability during heavy activity (running, sports)	5
- Instability during daily activity	0
* <i>Ability to walk</i>	
- Able to walk unlimited distances without pain or limp	15
- Able to walk unlimited distances ; mild pain or limp after long distances	12
- Able to walk ; moderate pain or limp after short distances	8
- Able to walk short distances only ; 1 cane	4
- Unable to walk	0
* <i>Ability on stair climbing</i>	
- Able to climb stairs	15
- Able to climb stairs, with some difficulty	10
- Required aid of bannister	5
- Unable to climb stairs	0
* <i>Ability to run</i>	
- Able to run	10
- Able to run ; mild pain after long distances	7
- Able to run ; moderate pain after short distances	3
- Unable to run	0
<i>Physical examination</i>	25 points
* <i>Range of motion</i>	
- Dorsiflexion	
No difference from normal side	10
Difference < 15°	5
Difference > 15°	0
- Plantar flexion	
No difference from normal side	8
Difference < 20°	4
Difference > 20°	
- Pronation/supination	
No difference from normal side difference	3
Difference	0
* <i>Gait analysis</i>	
Normal gait	4
External rotation gait	2
Antalgic limp	0

more, other objective symptoms (not included in the scoring system card), such as swelling and tenderness or laxity of the ligaments, were evaluated ; these data were not held essential to express the final rate, but they are useful for a more complete assessment.

The (loaded) range of motion was measured manually on both sides with a standard goniometer, as described by Olerud *et al.* (18), and the difference between the injured and the uninjured ankle was recorded.

Gait analysis was carried out using the method described by Rowley *et al.* (21).

Radiographs of the injured ankle performed at the time of trauma, showing the type of fractures and the quality of the reduction achieved, were compared with the radiographs done on follow-up, showing the possible evidence of arthritis, osteoporosis or other abnormalities, such as nonunion and distal TP synostosis.

The types of fractures were classified according to both the Lauge-Hansen and Burwell-Charnley methods ; the quality of the reduction achieved was rated according to modified radiological criteria on the basis of those suggested by Baek Kristensen (13), Cedell (6) and Phillips (20) (table IV). Arthritis severity was rated according to the Magnusson criteria (17).

RESULTS

The results of this retrospective study can be divided into two groups : early and late results. Early results are related to all the 145 patients.

No general complications occurred during the treatment. The reduction achieved was rated as anatomical in 47 patients, good in 51, fair in 32 and poor in 15. The rate of inadequacy of the reduction concerned both the malleoli, with widening of the mortise and talar tilt in 3 cases, the medial malleolus in 5 cases, the lateral malleolus and the syndesmosis TP in 4 cases and the posterior malleolus in 3 cases. Most of the poor reductions occurred in the pronation injuries (13 : 2), especially when there was a large posterior fragment.

The initial position of reduction deteriorated in 38 patients ; most had not been treated emergently. A second manipulation was then performed, usually under anesthesia. In 8 patients one or two Delitala's pressers were also applied to improve the reduction of a large posterior fragment (Fig. 1).

Nevertheless, in 5 patients the second manipulation was unsatisfactory owing to interposition-

ing of soft tissues among bone fragments ; open treatment was carried out, with screwing of the medial malleolus (3 patients) or the TP syndesmosis (2 patients). These patients have been excluded from further analysis, since they must be considered as failures of conservative treatment.

Table IV. — Radiological criteria of reduction (modified from Kristensen, Cedell and Phillips)

<i>Medial joint space</i>	
- No widening	Anatomical (A)
- No widening	Good (G)
- Widening < 4 mm	Fair (F)
- Widening > 4 mm	Poor (P)
<i>Talar tilt</i>	
- No talar tilt	A
- No talar tilt	G
- Talar tilt < 2 mm	F
- Talar tilt > 2 mm	P
<i>Distal TP syndesmosis</i>	
- No widening	A
- No widening	G
- Widening < 5 mm	F
- Widening > 5 mm	P
<i>Lateral malleolus</i>	
- No displacement	A
- No lateral or proximal displacement	G
Dorsal or ventral displacement < 2 mm	
- Lateral or proximal displacement < 2 mm	F
Dorsal or ventral displacement 2 to 5 mm	
- Lateral or proximal displacement > 2 mm	P
Dorsal or ventral displacement > 5 mm	
<i>Medial malleolus</i>	
- No displacement	A
- Displacement (any direction) < 2 mm	G
- Displacement (any direction) 2 to 5 mm	F
- Displacement (any direction) > 5 mm	P
<i>Posterior malleolus</i>	
- No displacement	A
- Displacement < 2 mm	G
- Displacement < 2 mm	F
- Displacement > 2 mm	P

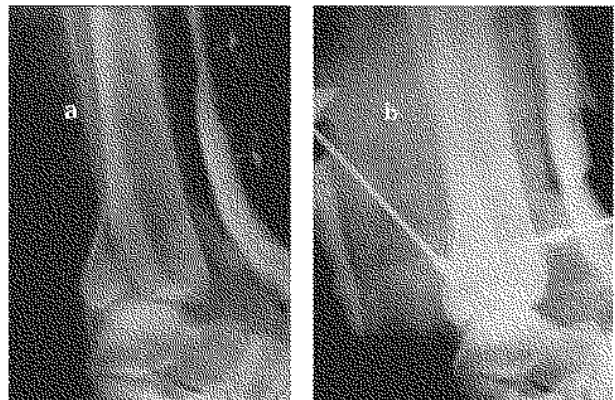


Fig. 1. — Lateral radiographs showing a trimalleolar fracture (SE stage IV) with third malleolus involving more than 25% of the articular surface. a) Unsatisfactory closed reduction of third malleolus. b) Very satisfactory reduction after application of two Delitala pressers.

Five plaster sores were found ; all but one healed spontaneously, which required a free cutaneous graft.

Most of the fractures healed properly in an average of time of 7 or 8 weeks. Eight delayed unions of the medial malleolus and one asymptomatic lateral nonunion were found ; in the last case no therapy was performed. After the final removal of the cast, 18 patients sustained osteoporosis ex non usu, with pain, swelling and difficult weight-bearing ; however, no Sudeck's atrophy occurred.

Late results are expressed for the 78 patients reviewed.

Clinical results, according to our personal scoring system, are shown in table V.

Table V. — Clinical findings at follow-up

Score	No.	percent
- Excellent (100-90 points)	28	35.9%
- Good (89-70 points)	32	41%
- Fair (69-50 points)	16	20.5%
- Poor (< 50 points)	2	2.6%
Total	78	

Twenty patients (25.6%) were free of subjective and objective symptoms ; symptoms were present in the remaining 58 (74.3%).

Forty-five patients complained of mild pain, generally appearing after heavy activity, but in 12 the pain was more severe and also appeared during normal daily activity. Twenty-eight patients experienced a slight subjective instability, during effort or running ; objective instability, with tenderness and laxity on the medial side, was present only in 4 of them, whose initial diagnosis was a fracture of the lateral malleolus with associated disruption of the deltoid ligament.

A decrease of the range of motion of the injured ankle, compared with the uninjured ankle, was found in 53 patients. In most of them the loss of motion concerned especially dorsiflexion, with a difference from the normal side of less than 15° ; 12 patients experienced a loss of both dorsiflexion and plantar flexion, with a difference from normal side greater than 15°, and also showed an external rotation gait.

The most common late radiological result was represented by arthritis, which was found in 22 patients (28.2%) ; according to Magnusson criteria, it was rated as first degree for 10 cases, as second degree for 4 cases, as third degree for 4 cases and as fourth degree for 4 cases.

Arthritis developed within 1 to 5 years after ankle injury, and was noted either after an initial good reduction (14 cases ; fig. 2) or after an initial poor reduction (8 cases) ; in the latter the rate of inadequacy concerned both the malleoli (2 cases), the lateral malleolus (4 cases) or the medial malleolus (2 cases). The radiographic evidence of arthritis was always associated with pain and decreased range of motion.

In 7 patients the original position of the fracture was found to have deteriorated. Two fractures healed with a severe talar shift, 4 healed with a slight talar tilt, and one had a persistent diastasis of the mortise. These radiological findings correlated with low clinical scores ; in particular the 2 patients with severe talar shift were rated as poor results.

Finally, a synostosis of the distal TP syndesmosis was found in 2 patients.

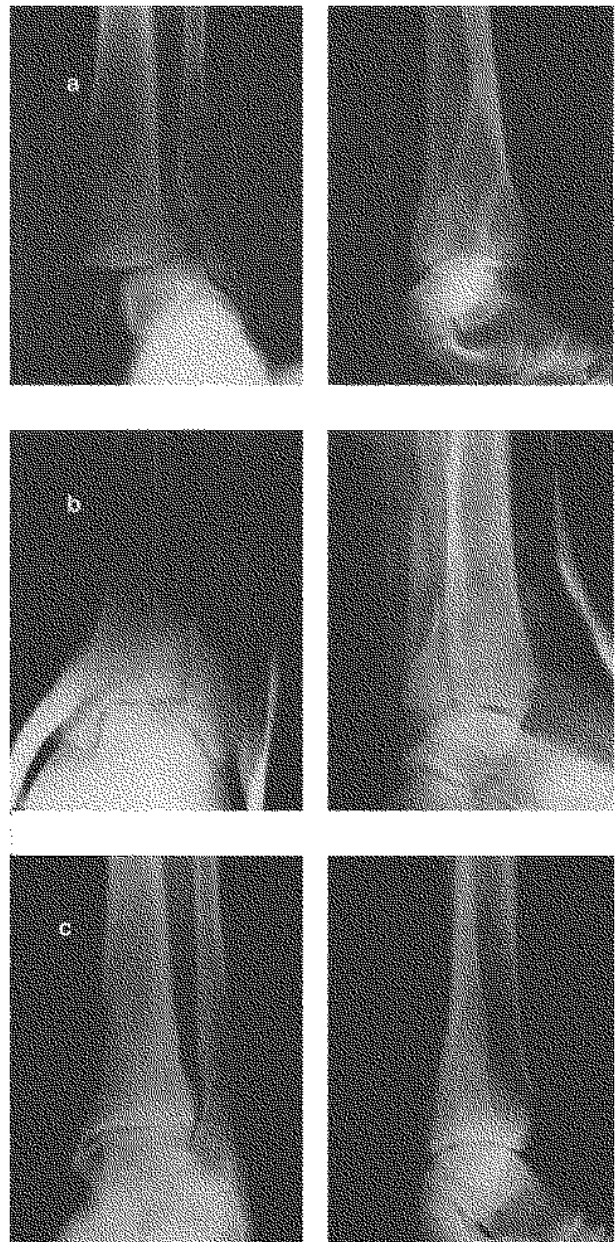


Fig. 2. — Radiographs showing closed treatment of a tri-malleolar fracture (PE stage IV) with severe talar shift.

a) Radiographs at the trauma.

b) Radiographs of the closed reduction achieved. Good repositioning of the lateral and medial malleoli ; no talar shift ; no widening of the distal TP syndesmosis ; satisfactory reduction of the third malleolus, with slight posterior displacement.

c) Radiographs made 6 years after the injury, showing signs of arthritis (second degree).

Clinical score : Fair.

DISCUSSION

Many authors have attempted to compare the results of closed and open treatment of severe malleolar fractures, and most of them (10, 11, 19, 20, 24, 27) have disclosed that operative methods generally achieve a more exact reduction than non-operative methods, allow fuller and quicker restoration of functional activity and give better results.

However, in many studies late results are similar for both open and closed treatment ; indeed, open treatment has proved to be plagued by some technical difficulties, a higher risk of complications and a greater incidence of post-traumatic arthritis (3, 4, 7, 21, 22, 23).

This series, including severe and displaced malleolar injuries only, is difficult to compare with previous non-operative series (3, 10, 12, 15, 17, 19, 20, 22, 26), generally including milder types of malleolar fractures ; comparisons are also difficult to make with operative series, due to different criteria of clinical and radiological evaluation that have been used.

The main problems of closed treatment in this series have proved to be achievement and maintenance of reduction. Although manipulation has always been performed in order to restore the joint anatomy, anatomical reduction has been achieved only in 32.4% of the cases. As expected, this rate has been lower than the one reported for open treatment. However, it must be emphasized that anatomical reduction is not the rule even after open treatment.

The main cause of a non-anatomical reduction has been difficulty in achieving exact repositioning of the medial malleolus and in restoring the normal length of the lateral malleolus with manipulation. Also an accurate reduction of the posterior malleolus has often been difficult, but this has not constituted a real problem, since for good function it is more important to achieve a congruence between the talus and the anterior part of the tibial articular surface than to avoid a residual displacement of the posterior malleolus.

Furthermore the role of the posterior malleolus in the stabilization of the talus has been minimized by many authors (9, 19), thinking that only

reduction and stabilization of the fibula reduces and stabilizes the talus within the mortise. Nevertheless in this series a great effort has been made to reduce accurately every large-sized posterior fragment, in order to prevent posterior dislocation of the talus.

The original position of reduction deteriorated early in 26.2% of the cases ; since deterioration occurred especially when injuries were not treated emergently, it is possible that in most of these particular cases the main causal factors were post-traumatic swelling and a blood clot in the fracture hematoma, appearing a few hours after the injury and making manipulation difficult and reduction unstable.

Sometimes the reduction achieved deteriorated because of interposition of soft tissue among bone fragments ; when this occurred, every attempt to reduce the fractures by manipulation was unsuccessful, and closed treatment failed.

Although some joints healed in only a fair position, at follow-up examination excellent or good clinical results were found in 77% of the cases. These findings are very similar to those reported by other authors with open treatment (2, 4, 6, 8, 10, 27), and support the idea that, although the accuracy of the reduction is very important for the quality of the clinical outcome, poor positioning is better tolerated after closed treatment than after open treatment (7, 22, 23).

Among late results, a slight decrease in the range of motion in the injured ankle, especially in dorsiflexion, has proved to be the most common clinical outcome (68% of the cases). Few other authors (2, 4, 21) have reported data on the range of motion after treatment of an ankle injury. Decreased range of motion seems to be a usual finding, probably related to the immobilization of the ankle joint. Therefore they have suggested that closed methods might cause a greater loss of movement, because of the protracted immobilization in a plaster cast.

This contention might be true ; however it must be emphasized that if stable fixation is not achieved, the period of immobilization is protracted with open treatment as well.

Arthritis was the most common late radiological outcome ; it was observed in 28.2% of the reviewed

injured ankles, and it was the main cause of pain. Contrary to all expectations, but in accordance with the reports of many other authors (1, 10, 19) arthritis also developed in some joints that were reduced to the correct position: this seems to suggest that, in very displaced fractures, primary injury to cartilage and soft tissues might be involved.

Closed treatment was a complete failure in 7 cases (8.3%). As mentioned above, 5 were early failures and had to be treated operatively since manipulation was unsuccessful because of the interposition of soft tissue among bone fragments.

The remaining 2 cases were late failures, in which the fractures, after an initial good reduction, healed in an extremely poor position (severe talar shift), since the reduction achieved deteriorated after the fractures (one SE IV and one PE IV, both with severe comminution of the fibula) had been assessed as healed. Deterioration might have occurred because of a missed delayed union of the fibula fracture; weight bearing, allowed too early, could have displaced laterally both the lateral malleolus and the talus, since the lateral malleolus controls stability and position of the talus in the mortise (9, 19, 25). Ankle fusion was carried out in these cases.

CONCLUSIONS

Although the relatively small number of patients in this study does not make it possible to attribute statistical significance to our data, the study suggests that if closed treatment is properly carried out, it may be as good as open treatment, and it might be tried as a primary procedure in every patient and in every type of malleolar fracture.

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SAMENVATTING

A. FEDERICI, F. SANGUINETI, F. SANTOLINI.
Conservatieve behandeling van ernstige malleolaire fracturen.

Aan de hand van klinische en radiologische criteria hebben de auteurs de resultaten van de conservatieve behandeling (repositie, gevolgd met gipsimmobilisatie voor 7 à 8 weken) geëvalueerd na ernstig verplaatste malleolaire fracturen. Bij honderdvijfveertig patiënten met een conservatief behandelde ernstige enkelfractuur tussen 1979 en 1983 was een na-onderzoek mogelijk voor 78 gevallen met een gemiddelde follow-up van 6,5 jaar. De grootste moeilijkheid bij de conservatieve behandeling was het bekomen van een correcte initiale repositie ; anatomische repositie werd slechts in 32,4% van de gevallen bekomen en een laattijdige degradatie van de verworven stand gebeurde bij 28,2%. Ofschoon meerdere gewrichten slechts in een matige stand heelden, waren de subjektieve en de objektieve resultaten uitstekend of goed voor 77% van de gevallen, middelmatig bij 20,5% en slecht bij 2,6%.

Het meest voorkomend klinisch resultaat was een lichte beperking van de beweeglijkheid van de enkel, bij 68% van de patiënten. Bij 28,2% werd een secundaire arthrose vastgesteld, zowel na een aanvankelijk

goede repositie als na een minder goede repositie. Een volledige mislukking van de conservatieve behandeling gebeurde bij 8,3% van de patiënten, vooral door interpositie van de weke delen tussen de botfragmenten, waardoor de repositie ontoereikend was of door laattijdige deterioratie van de aanvankelijk bekomen correcte stand, wat geleid heeft tot een heling in onvoldoende stand (meestal ernstige kanteling van de talus).

RÉSUMÉ

A. FEDERICI, F. SANGUINETI, F. SANTOLINI.
Le traitement conservateur des fractures malléolaires graves.

Les auteurs ont passé en revue, à l'aide de critères cliniques et radiologiques, les résultats du traitement orthopédique (réduction suivie d'immobilisation plâtrée de 7 à 8 semaines) des fractures malléolaires avec déplacement important. Sur 145 blessés, présentant une fracture de cheville, traitée de manière orthopédique, de 1979 à 1989, 78 furent revus avec un recul moyen de 6,2 ans. La principale difficulté du traitement non sanglant est la qualité de la réduction ; une réduction anatomique ne fut obtenue que dans 32,4% des cas et un déplacement secondaire fut souvent observé (26,2%). Quoique la guérison ne se soit pas toujours faite en position optimale, les résultats subjectifs et objectifs étaient bons ou excellents dans 77% des cas, moyens dans 20,5 et mauvais dans 2,6%.

Une légère limitation de mouvement fut la séquelle la plus fréquemment observée, dans 68% des cas. Une arthrose secondaire fut constatée dans 28,2% aussi bien après réduction initialement bonne, qu'après une réduction initialement approximative. Un échec complet du traitement conservateur fut noté dans 8,3% des cas, suite à une interposition des parties molles entre les fragments osseux, cause de l'échec de la réduction et de la dégradation tardive de la réduction obtenue (déplacement astragalien secondaire important).

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