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ARTHRODESIS OF THE ANKLE JOINT

By

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The tibiotalar arthrodesis is generally considered an adequate and most useful procedure. It is most frequently applied to two types of disorders. In case of instability due to severe paralysis the intervention may improve the gait and permit discarding of the brace. In painful osteoarthritis following fractures or dislocations in the ankle region, remarkable relief may be obtained; however, in such cases an analysis of the conditions also of the subastragular joints must be carried out as a panarthrodesis or perhaps merely a triple arthrodesis is the right answer.

Several authors have stated that we should expect a proportionally high rate of non-unions as the ankle joint is rather difficult to fuse and the later strain in the region is great. My experience did not differ from this, and the variety and number of procedures recommended do clearly support this conception.

The compression arthrodesis, published by *Charnley* in 1951, was therefore studied with keen interest. By this technique Charnley obtained solid union in 15 out of 19 cases. He could explain the failures by technical errors, such as wrong placement of the nails transmitting the compression force or poor adaption of the resected bone ends.

While I felt the principle of firm compression convincingly sound and correct, his surgical anterior transverse approach with division of nerves, tendons, and vessels appeared less attractive. Furthermore this approach did not permit a one stage pantalar arthrodesis, which traditionally is a common procedure in our clinic. For these reasons I have preferred to combine the Charnley compression method with the surgical approach as described by *Roger Andersen* (1945). According to his report the joint is exposed through lateral and medial incisions and with removal of the malleoli.

This procedure has been tried out in 25 cases since 1955, and the

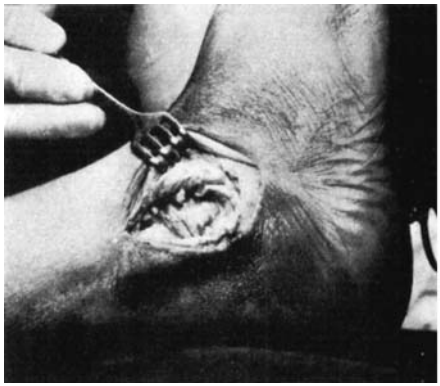


Fig. 1.

Fig. 2.

Fig. 1. Lateral incision, malleolus exposed.
Fig. 2. Medical incision, malleolus removed, joint exposed.

results and the considerations involved may contribute to the discussion and to the solution of an important problem.

TECHNIQUE

Skin incision.

The lateral incision is slightly dorsoconvex, approximately two inches and a half long, from a point a little distally to the apex of the malleolus and following the posterior edge of the malleolus (slightly anterior to this). The distal end of the fibula is now exposed subperiostally; damage to the peroneal sheath should be avoided. The malleolus is removed by an oblique osteotomy and by dissection, leaving the cancellous surface sloping towards the joint. On the medial side a similar, somewhat shorter incision curves along the posterior edge of the malleolus; the malleolus is treated like the lateral malleolus, and the posterior tibial tendon sheath is preserved.

Resection of cartilage and positioning of foot.

Through the lateral wound a slice of cartilage and bone is chiseled off the tibia, enough to leave a fresh cancellous plane, transverse to the axis of the tibia. Any prominent brim or peg preferably near the dorsal edge should be carefully removed. Now the foot is placed in the desired position and an approximately 5 mm.s thick section of the trochlea is chiseled off leaving a cancellous, plain surface parallel to the tibial plateau.

The optimal degree of plantiflexion should be a slight equinus unless particular circumstances such as pronounced discrepancy of leg length indicate other measures. The positioning problem is dealt with in the discussion later. In order to obtain the correct position it may be recommended to have the patient placed in a supine

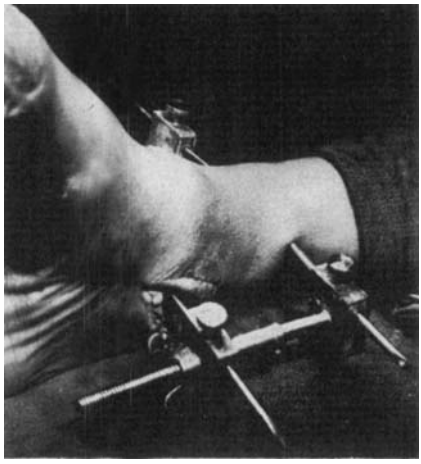


Fig. 3.
Apparatus placed, not tightened, medial aspect.

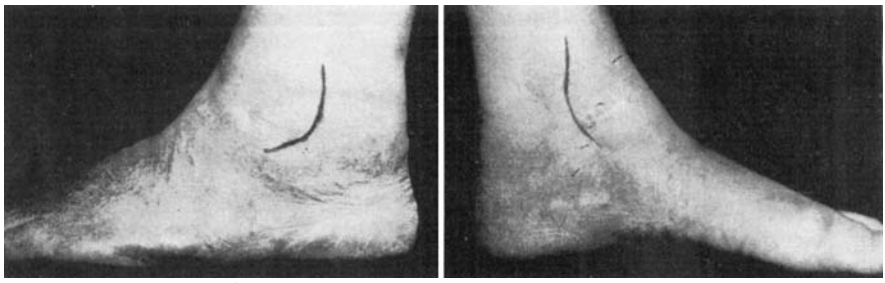
position and the patella within reach and sight. Any valgus or varus position should be avoided. The degree of outward rotation averages 8°. We should not forget to check the position of the healthy foot prior to surgery as the patient in question may have another normal position, perhaps "ten minutes to two".

Placement of the pins for the compression apparatus.

The pins applied are those recommended by Charnley (Steinman nails). The point is equipped with sharp edges like an awl. The nail is drilled through the bone by a handle (or electric motor). The distal nail is passed transversely through talus 1 cm. distally to the resection level. It may pass the wound or a separate small incision. The proximal nail is passed through the tibia 5–7 cm. proximally to the joint and parallel to the distal nail. Preliminary attachment of the compression apparatus may serve as a useful guide for the proximal nail. The apparatus is now fixed in position under visual control of the contact and of the foot position. Finally the compression is applied as firmly as the pins permit.

Suture and bandage.

The periosteum, fascia and skin are now closed by interrupted sutures, and a sterile bandage is applied with a sterile elastic band, and next the whole apparatus is covered with sterile cotton and a band. A plaster cast is used in most cases. Recently this bandage has been discarded in order to facilitate the early training of active subastragular and forefoot movements. Six weeks after the operation the apparatus is removed under sterile conditions, and a high, unpadded walking plaster is applied for another six weeks. After this period the arthrodesis is checked by X-ray, and the patient is discharged with orthopaedic shoes. Measurements for the shoes are made at the time of change of bandage. After months or years several patients change to commercial standard shoes with some adjustments.



b. a.

Fig. 4.
Medial and lateral aspect of foot after solid healing, typical scars painted.

Pantalar arthrodesis.

In case of simultaneous arthrodesis of the ankle joint and of the subastragular joints the procedure is slightly modified. The fibular incision is prolonged, curving along the dorsolateral border of the foot, and finally it is curved medially ending near the basis of the fourth metatarsal bone. The peroneal tendons are now temporarily divided, and the foot is inverted while the tarsal joints are dissected free. After careful chondrectomy in the subastragular and in the Chopart joints the ankle is treated as described above. The pin for compression is also in this case placed through the talus owing to biomechanical conditions, and as the triple arthrodesis itself presents no particular problem of healing. The peroneal tendons are now united with a silk suture, and periosteum, fascia, and skin are sutured as usual. In panarthrodesis a plaster cast is of course indispensable. While a high bandage is correct, a bandage below the knee may be sufficient as the apparatus inhibits the rotary movements.

Aftercare does not differ from that described above.

MATERIAL

Since 1955 twenty-five patients have been treated according to these principles.

Age distribution (14–62 years, average 38.6).

Age of patients	<18	18–40	40–60	>60
Number of patients	5	6	12	2

Out of the patients 13 had a pantalar arthrodesis and 12 a talotibial arthrodesis. In the latter group three patients had a triple arthrodesis performed some time previously.

This high proportion of panarthrodeses is partly due to the traditional concept that the talocrural arthrodesis should be combined with a stabilization of the tarsus in order to avoid later tarsal disorders and pain.

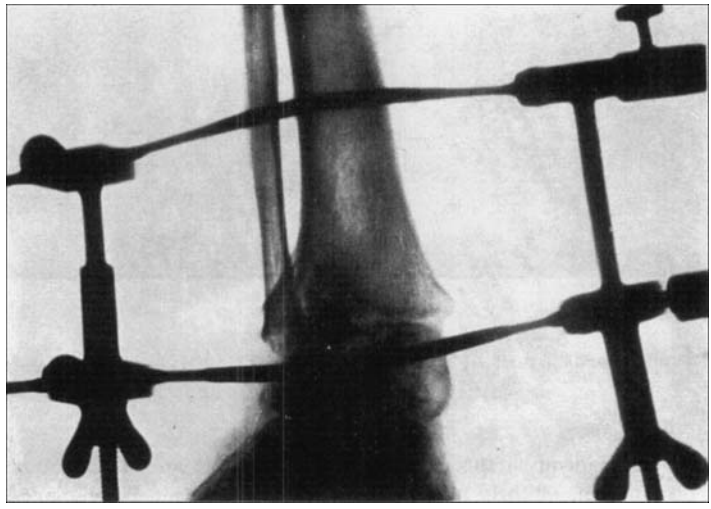


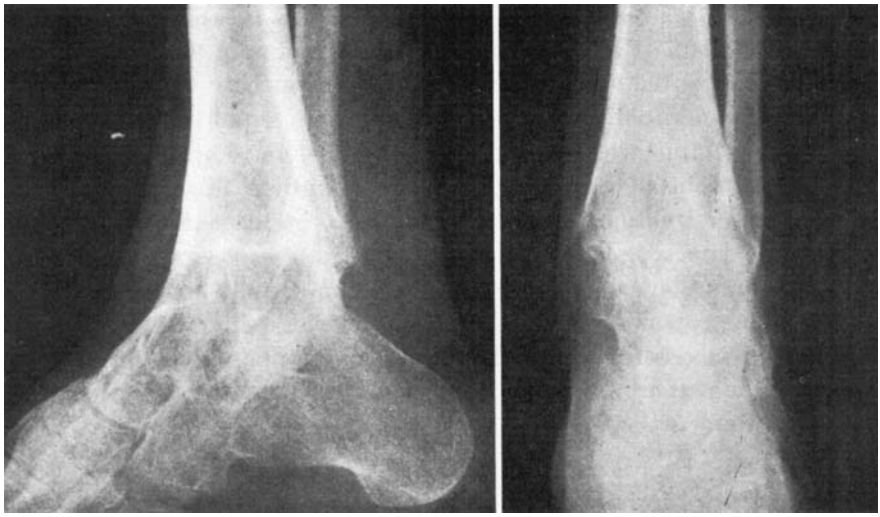
Fig. 5.
X-ray of ankle with apparatus inserted (talotibial fusion).

Painful osteoarthritis following fractures in the malleolar region or following dislocation of the talus was the indication for arthrodesis in 18 cases, while the procedure was applied to seven patients for stabilization of the ankle (polio 6, cerebral palsy 1). These latter groups represent the younger part of the material.

Indication:		fracture	polio	cerebral palsy
panarthrodesis	(13)	8	4	1
talotibial arthrodesis	(12)	10	2	
(previous triple-arthrodesis: 3)				

RESULTS

Primary bony union was obtained in 24 cases. In the one case of non-union a re-fracture was apparently provoked in connection with the removal of the compression apparatus and the nails. This procedure was performed in general anesthesia, and while the course had been smooth prior to this procedure there were constant complaints of pain after this date. The patient was, however, as usual equipped with a walking cast. When non-union was confirmed after three months, rearthrodesis was performed and solid union achieved after another three months.



a. *b.*

Fig. 6.
X-ray of solid pantalar fusion.

COMPLICATIONS

In the first years several of the patients had an annoying although not serious infection with drainage from the proximal nail wound. The wounds healed spontaneously during the following months. Since a sterile bandage has included the compression apparatus such infections have not occurred. There has been no infection of the joint region.

LATER RESULTS

Among the occurrences after the primary treatment two cases deserve particular discussion.

A fifteen year old boy, who obtained solid union of the panarthrodesis, indicated by polio, sustained an apparent re-fracture four months after the operation due to a fall. Further examination revealed that the lesion was located to the epiphyseal plate. Rearthrodesis with the same technique was performed. At operation the preoperative diagnosis was confirmed, and the epiphyseal plate was removed. The later course was uneventful.

Another polio patient, a Chilean lady aged 38, who previously had an arthrorisis done to stabilize the ankle, which was unstable after a severe polio paralysis, was discharged without orthopaedic footwear

or any other aftertreatment, because she wished to utilize her visit to Europe, and she left immediately for a tour to Spain and France. She returned six months after removal of the plaster cast with complaints of pain in the midfoot. She had been walking in small light shoes since discharge. By clinical examination and by X-ray a diaphyseal fracture of the fifth metasal bone was revealed. Doubtless this was a fatigue fracture. After treatment with a plaster walking cast and fitting with orthopaedic shoes she has no complaints.

Among the other cases there have been no serious complaints. In a considerable proportion of the material, however, some walking pain in the forefoot is recorded, and this problem is apparently significantly greater in the patients who had a pantalar arthrodesis than in the group with tibiotalar arthrodesis.

DISCUSSION

The transmalleolar approach does in my experience offer three definite advantages. Firstly the approach is a minimal trauma to the patient, and locally it is a gentle technique, in particular with reference to the tendons of invertors and evertors of the foot. Next the procedure is easily applied to both talotibial and pantalar arthrodesis, and thirdly the cosmetic result with the "lifted" ankle configuration is most agreeable.

The optimal position of the foot regarding degree of plantiflexion is still subject to discussion. In particular to the ladies it may be agreeable to place the foot in moderate or more pronounced equinus which permits the use of shoes with heels. I have used different positions according to my own estimation and to the desire of the patient. If the patient plans to walk on bare feet only a few degrees of plantiflexion are indicated. In one case I adjusted the foot for really high heels to please the patient. Probably she may return some day to have a secondary osteotomy done. In general, however, it should be remembered that the orthopaedic modification of the footwear indicates only a very slight plantiflexion. Otherwise it is impossible to obtain room for the necessary rocker sole.

Whenever the procedure is indicated by instability the choice between tibiotalar and pantalar arthrodesis is merely determined by the evaluation of the supra- and infraastragular conditions. When the invertors and evertors are paralyzed a panarthrodesis should be preferred. In the posttraumatic cases, the material does support the viewpoint of

Karlen. The pantalar arthodesis does not offer any additional relieving effect. This procedure should be preferred only when the preoperative examination has revealed a manifest disorder of the subastragular joints, preferably an osteoarthritis.

The aftercare of the arthrodesed patient is obviously important. The supply of orthopaedic shoes or adjustment of commercial shoes must be considered part of the treatment. The shoes must possess the correct height of the heel, and it must be furnished with a pronounced rocker function. This rocker should be designed differently from the metatarsal bar, as the axis of the rolling action intends to compensate for the lost ankle function. Probably the axis should be located about 4–6 inches above the ankle joint, and the bottom of the heel should be incorporated in the roller circle. The tremendous stress is clearly demonstrated by the two cases described. It may be considered whether children with remaining epiphyses in the ankle region should be supplied with a leather bandage to protect the epiphyses unless a primary epiphyseodesis be considered feasible.

SUMMARY

The technique of talotibial arthrodesis via transmalleolar approach and application of the Charnley compression apparatus is described.

The results in 25 cases are reported. Primary union was obtained in all but one case, and in this one case the defective healing was apparently due to iatrogenic fracture on the occasion of removal of the compression apparatus.

The problem of aftercare is discussed, and the great stress to the anchylosed foot is emphasized, it should be minimized by adequate shaping of the shoe.

The optimal position of the foot is in the average case neutral alignment with a few degrees of equinus. The particular problem of youngsters with residual epiphyseal plate is also discussed, and epiphyseodesis or a protecting leather bandage during the remaining years of growth is recommended.

RESUME

Description de la technique de l'arthrodèse talo-tibiale par rapprochement transmalléolaire et application de l'appareil de compression Charnley.

Il est rendu compte des résultats obtenus dans 25 cas. Une soudure

primaire a ètè obtenue dans tous les cas sauf un chez lequel le défaut de guérison était apparemment dû à une fracture iatrogénique qui s'est produite au moment de l'enlèvement de l'appareil de compression.

Il est discuté du problème des précautions à prendre et l'on recommande de diminuer la pression sur le pied ankylosé par des chaussures de forme appropriée.

Dans la plubart des cas la position optimale du pied est l'alignement neutre avec un faible degré en position de pied équin. Le problème particulier des jeunes chez lesquels la croissance n'est pas terminée est également abordé. Une épiphyseodèse ou un bandage protecteur de cuir est recommandé pendant les années de la croissance qui restent.

ZUSAMMENFASSUNG

Die Technik der talotibialen Arthrodes mittels des transmalleolaren Zuganges und die Anwendung von Charnleys Kompressionsapparat wird beschrieben.

Über die Ergebnisse in 25 Fällen wird berichtet. Primäre Vereinigung wurde in allen, mit Ausnahme von einem Falle, erzielt und in diesem einen Falle war die mangelvolle Heilung augenscheinlich einer iatrogenischen Fraktur, die anlässlich der Entfernung des Kompressionsapparates entstand, zuzuschreiben.

Das Problem der Nacbehandlung wird besprochen und die grosse Beanspruchung des ankylosierten Fusses wird hervorgehoben wobei man empfiehlt diese mittels entsprechender Formung des Schuhes möglichst herabzusetzen.

Die beste Stellung des Fusses ist im allgemeinen eine neutrale Einstellung mit wenigen Graden Spitzfuss. Das besondere Problem von jungen Individen mit noch vorhandener Epiphysenplatte wird ebenfalls besprochen und Epiphyseodesis oder eine beschützende Lederbandage während der noch übrigen Wachstumsjahre wird anbefohlen.

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