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ARTHRODESIS OF THE TC OR PANTALAR JOINTS IN RHEUMATOID ARTHRITIS

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All previous follow-up studies have been performed on series in which talocrural (TC) or pantalar arthrodesis was carried out for reasons other than rheumatoid arthritis (RA). So far, no follow-up study has been published on a series in which RA constituted the indication for these operations. The most extensive follow-up investigations are those published by Guildal & Sodeman (1930), Hamsa (1936), Liebolt (1939), Dahmen & Meyer (1965), and Waugh et al. (1965). Not even the series of Waugh et al., which consisted of 116 patients on whom pantalar arthrodesis had been carried out, comprised any case of RA.

OWN INVESTIGATIONS

Material and Indications for Operation

The series consists of 32 arthrodeses of the TC or pantalar joints, performed on 31 patients with definite RA (Ropes et al. 1959). There were 23 female patients and 8 male patients. All operations were performed at the Rheumatism Foundation Hospital, Heinola, during the years 1953-1965. The series comprises only patients whose RA began after the age of 15. Pantalar arthrodesis, including the talocrural, talocalcaneal, talonavicular, and calcaneocuboid joints, was performed only on *five* rheumatic ankles. The total number of TC arthrodeses was 27, performed on 26 patients. In one case TC arthrodesis was successfully performed on the ankles of a female patient at an interval of 12 years. The patient has continued her work as a hair-dresser. In addition to TC arthrodesis, the talonavicular joint was fused in three cases and also the talocalcaneal joint in three cases. In four feet, triple arthrodesis had been performed prior to arthrodesis of the TC joint.

The duration of RA in the ankle ranged from 1 to 34 years, the average being 14 years. The operative age of the patients ranged from 30–64 years, the average being 46 years. In 29 cases the ankle joints became inflamed at the beginning of the disease (within one year). In these patients RA has been symmetrical and severe.

The follow-up time from the operation ranged from one to 14 years, the mean being $4\frac{1}{2}$ years. Twenty-two patients were clinically and roentgenologically examined by the author, and 9 patients were followed up by means of questionnaires. Eight patients replied personally and one questionnaire was filled in by relatives. Two patients died (8 and 6 years postoperatively), but in one of these cases follow-up examination had already been performed. Both patients probably died of cardiac infarction.

The indications for TC arthrodesis were persistent pain in the ankle joint and destructive roentgenological changes of at least stage II (Steinbrocker et al. 1949). As a rule, persistent inflammation had been present for many years. Because of the pain, the patient could not walk without a cane or crutches. In one case painful equinus position of the ankle joint constituted the indication. It was regarded as a condition, however, that the subtalar joints were clinically symptom-free. They had either been ankylosed in a satisfactory position several years ago, or the slight motion left was completely painless. If painful motion remained or a disturbing deformation was present, pantalar arthrodesis was performed at the same time (five cases only).

Preoperative Clinical and Roentgenological Findings

All ankles on which operation was planned were markedly swollen and painful on motion and weight-bearing. All these patients needed a cane or crutches on walking. The total active motion was slightly less than 20 degrees in the 27 ankles in question. The average dorsal flexion of the remaining five ankles was 8 degrees, the average plantar flexion 23 degrees. In five cases only was the motion of the subtalar joints almost normal, in one case it was limited up to one-third and in the remainder these joints were rigid. Active motion was examined with the knee joint in maximal extension.

Deformities: (1) Planovalgus: severe (valgus over 20 degrees) in three feet, moderate (over 10 degrees) in ten feet, and slight (10 degrees or less) in eight feet. For measurement of calcaneal valgus a special device was used (Vahvanen 1967). (2) Varus of the forefoot:



Figure 1. Destroyed TC joints in a case of over ten years' duration. Narrowing and erosions in both joints. In addition, osteoarthrosis is present.

eight feet. In two of these there was slight calcaneal varus, in one also moderate cavus. (3) Cavus-calcaneus: one foot. (4) Equinus of about 30 degrees: one ankle.

The roentgenological stage of the TC joint (Steinbrocker et al. 1949) was stage II in 5 ankles, stage III in 27 ankles. In six TC joints severe destruction was present and the joint space was very narrow. The roentgenological stage of the subtalar joints (the changes in one or another of the three subtalar joints) was stage I in one foot, stage II in seven feet, stage III in 16 feet. Triple arthrodesis had previously been performed on four feet. Of the remaining four feet no X-ray pictures were available.

Operative Methods

In this series arthrodesis of the TC or pantalar joints was performed by five different methods.

1. Blocking of the TC joint by a short cortical-spongy bone graft as suggested by Cramer (1910) and Lasker (1923): 13 ankles. The TC joint was opened by a straight anterior incision, and a bone graft from the iliac crest was applied between the tibia and talus, in which an appropriate groove had been modelled in the direction of the leg. In three cases the talonavicular joint, too, was fixed by a bone graft. No metal fixation was used.

2. Adams' (1948) operation: 6 ankles. In one case only was the talocalcaneal joint, too, opened and debrided because of severe, painful

**A****B**

Figures 2 A and B. The same feet as in Figure 1 after arthrodesis of the right TC joint (Adams). The operation was successful, the joint shows union and is completely stable and painless. The subtalar joints of the right foot are in better condition than those of the left foot, which cause discomfort, both the TC and subtalar joints being painful.

destruction. The distal part of the fibula was fixed by screws as an on-lay graft to the tibia and talus.

3. Compression arthrodesis by Charnley's method (1951): 5 ankles. All these operations were performed in slightly different ways, but in every case the TC joint was debrided. The talocalcaneal joint was also debrided if it was not already ankylosed. Compression was effected by strong Steinman nails through the tibia and calcaneus. In three cases the distal part of the osteomized fibula was used as a graft on the lateral or anterior aspect of the TC joint.

4. Pantalar arthrodesis by the method of Guildal & Sodeman (1930), 5 ankles. The distal part of the osteomized fibula was fixed as an on-lay graft by one screw to the tibia and the talus. In addition, triple arthrodesis was performed by the technique previously described by the author (1967). In one case the talocalcaneal joint was not opened because it was ankylosed in a good position and was painless.

5. A sliding graft from the tibia to the talus: 3 ankles. This method has been used only in the last few years. By anterior longitudinal incision the TC joint was debrided and a bone graft (the shape of a spear head) was chiselled from the anterior tibial crest. The sharp distal part was applied deep to the talus, and the broader and thicker proximal part was fixed by one screw to the anterior part of the tibia.

In all these different methods small spongy chips were applied to the debrided joints and around the graft. A below-knee well-moulded plaster cast was applied, which was changed after two weeks (in Charnley's method after four weeks), and a heel was applied under the cast. Partial weight-bearing was then allowed. The total immobilization time was eight weeks, except in two cases in which it was longer. The TC joint was usually positioned in five degrees' plantar flexion in the males and ten degrees' plantar flexion in the females. The foot was positioned into slight (5 degrees) calcaneal valgus.

Anaesthesia

General anaesthesia (ether) was used in 26 cases and spinal anaesthesia in 2 cases. In 4 cases the operation was carried out under combined sciatic-femoral nerve block (Moore 1954, Vahvanen 1964). No complications from anaesthesia occurred. In all cases the operation was performed in a bloodless field.

RESULTS OF THE 32 TC
OR PANTALAR ARTHRODESES

The results were classified as good, fair, or poor on the following criteria:

Good result: The fused joints were stable and the ankle was painless. In addition, the foot showed no disturbing deformity.

Fair result: Slight deformity was present, but this did not cause much discomfort. Slight swelling and pain on walking sometimes occurred.

Table 1. Results of 32 TC or pantalar arthrodeses.

	No. feet	No. patients	♂/♀	Good	Fair	Poor
Pantalar arthrodesis (Guilidal)	5	5	5 ♀	4	1	0
Talocrural arthrodesis	27	26	19 ♀ 7 ♂	16	6	5
Total	32	31	24 ♀ 7 ♂	20 (62%)	7 (22%)	5 (16%)

Table 2. The results of 27 TC arthrodeses performed by different methods.

Method	No. feet	Good	Fair	Poor
Blocking of the TC joint with transplanted cortical-spongy bone graft from the iliac crest	13	8	2	3
On-lay graft from the fibula (Adams)	6	4	2	0
Arthrodesis by compression according to Charnley	5	3	2	0
Sliding graft from the tibia	3	1	0	2
Total	27	16 (59%)	6 (22%)	5 (19%)

Poor result: Pseudarthrosis was present, or the foot was still painful.

The results were good in 20 ankles (62 per cent), fair in 7 ankles (22 per cent), and poor in 5 ankles (16 per cent). According to the subjective opinions of the patients, the results were good in 20 ankles,

fair in 9 ankles, and poor in 3 ankles. Two pseudarthrosis of the TC joint were almost painless, slight pain being caused only by major stress.

In the good cases (20 ankles), postoperative swelling and pain persisted for 1–24 months, the average being 9 months. In the fair ankles major postoperative discomfort occurred for 1–36 months, the average being $11\frac{1}{2}$ months. Two patients had used a brace for keeping the ankle in good position until pain in the pseudarthrotic joint had disappeared nearly completely. In general, the patients could walk well. Only five patients occasionally used a cane or crutches because of a painful knee or hip joint.

Postoperative Equinus Position of the TC Joint

Slight motion being present in five ankles, this analysis refers to 27 ankles. In the females (21 ankles) the mean angle of the equinus was 11 degrees, in the males (6 ankles) about 4 degrees. These mean values nearly coincide with what was set up as a goal of the operation. All patients were satisfied with the position of the ankle. The females used heels of $2\frac{1}{2}$ –5 cm in the shoe. In two cases the ankle was positioned at 90 degrees, because extension of the knee joint was slightly limited.

Findings in the Subtalar Joints at Follow-up

A moderate degree of painless motion was present in two feet only, the remainder being ankylosed. Preoperatively moderate motion was present in six feet. On postoperative X-ray examination of 14 feet, the distribution of changes of various stages (Steinbrocker et al.) in one or other of the subtalar joints was as follows: stage I, four feet; stage II, six feet; stage III, four feet. The subtalar joints of nine feet were fused, and X-ray pictures of the remaining nine feet were not available.

Detailed Analysis of the Results

Good results (20 ankles). In one foot slight calcaneovarus was present, and in another two feet a slight cavus deformity, which in one case was combined with slight calcaneovarus. These deformities caused no discomfort.

Fair results (7 ankles). In these cases the operated joints were well fused, but for some reason or another slight pain on walking persisted. Planovalgus of over 15 degrees was a cause of discomfort in

three cases. Varus of the forefoot caused discomfort in a further three cases. In two of these, slight, painful motion of the Chopart joint was still present. In these cases the Chopart joint had not been operatively fused. In the third case severe postoperative swelling and pain were present for 1½ years. During this time the Chopart joint had probably fused in a position of slight varus of the forefoot. In one foot only, slight planovalgus was present, but nonetheless moderate pain occurred on walking. This was probably due to the fact that all subtalar joints had not fused spontaneously, and slight passive, painful motion was still present in the unfused joints.

Table 3. Causes of the poor or fair results in 32 TC or pantalar arthrodeses.

Result	Total no. feet	Planovalgus	Varus of the forefoot	Painful subtalar joints	TC pseud- arthrosis
Fair	7	3	3	1	0
Poor	5	0	0	0	5
Total	12	3	3	1	5

Poor results (5 ankles). Pseudarthrosis of the TC joint was present in five cases. Two of these ankles had been treated by the sliding graft method, three by blocking of the TC joint with a transplanted graft from the iliac crest. Of the first-mentioned ankles one was re-operated on by Adams's technique because of pain about one year from the first operation. In the other case re-operation was planned. The last-mentioned three pseudarthroses were followed-up for at least eight years. One patient did not experience any discomfort on walking. Another patient was living in a home for the aged and occasionally used crutches for reasons other than the pseudarthrosis. The subtalar joints were fused, and the foot was in a slight varus position. The ankle of the third patient was very painful, and the forefoot was in a disturbing varus position. At the primary operation an attempt was made to correct this deformity by ankylosing the talonavicular joint, also. This did not succeed: slight active and passive motion of both the TC and the talonavicular joints still being observed as soon as one year after operation. Varus of the forefoot had increased at the time of the follow-up examination. This patient died of cardiac infarction about eight years after the operation.

Operative Complications

No wound complications or infections occurred. In two cases (6 per cent) early complications were immediately corrected and the end result was good. Five ankles (15 per cent) showed late complications in the form of pseudarthrosis of the TC joint. In one foot there was also pseudarthrosis of the Chopart joint.

In one of the cases showing early complications compression arthrodesis had been performed. Anterior subluxation of the talus was noticed when the plaster was removed about eight weeks after the operation. This ankle was immediately re-operated. Swelling and pain did not disappear completely until after three years, when the TC joint was well fused. In the second case the ankle was positioned at equinus of ten degrees at operation, although extension of the knee joint was not complete. When the plaster was changed after two weeks, the ankle was redressed in mid-position (about 90 degrees). The ankle healed completely in two years.

DISCUSSION

Rheumatic destruction is much more infrequent in the TC joint than in the subtalar joints in RA (Vainio 1956, Vahvanen 1967). Arthrodesis of the TC joint is seldom indicated. This joint is resistant to RA, and the inflammation very often subsides. The healing process is aided by triple arthrodesis of the inflamed subtalar joints. As a prophylactic measure a minor operation, synovectomy, may be attempted, which if necessary can be combined with triple arthrodesis (Vahvanen 1967).

On comparison with other series (Guildal & Sodeman 1930, Hamsa 1936, Liebolt 1939, Fritsche 1957, Jansen 1962, Kivilaakso et al. 1965, Waugh et al. 1965) the follow-up results of the present study are not unfavourable, but definite healing quite often required a long time. Many other authors have used longer immobilization in plaster, 12–16 weeks, *e.g.* Fritsche (1957), Ratliff (1959), Jansen (1962), Waugh et al. (1965).

The operations performed by the methods of Guildal, Adams, and Charnley were successful and the TC joint always fused completely. Pseudarthrosis of the TC joint developed after blocking of the joint with a graft from the iliac crest or from the tibia. Fritsche, Dahmen & Meyer (1965), and Waugh et al., for instance, have reported poor results by these two methods. In the present series experience with sliding graft from the tibia was particularly unfavourable. Better results could perhaps be obtained by longer immobilization. Union of

spongy bone seems to occur satisfactorily in rheumatoid patients, since only three pseudarthroses occurred when arthrodesis of the TC joint was performed by means of a short transplanted bone graft from the iliac crest and the total immobilization time was only eight weeks. In many cases bony union probably did not occur until after eight weeks, since discomfort persisted for a long time. In the author's opinion it is advisable to avoid weight-bearing for about 4-6 weeks and to keep the foot immobilized for about 10-12 weeks. Especially because of the need to move the knee joint, the plaster cast must leave this joint free. For the same reason the bone graft should be firmly fixed to the tibia and the talus. After pantalar arthrodesis in particular, a longer non-weight-bearing time should be used in order to prevent the calcaneus from slipping back into valgus. Because of the good union in RA, the immobilization time may be somewhat shorter than after corresponding operations on other indications.

SUMMARY

The present series consists of the 32 arthrodeses carried out on rheumatoid ankles, *i.e.* five pantalar and 27 TC arthrodeses. Follow-up examinations were performed an average of $4\frac{1}{2}$ years after operation. The results were good in 20 ankles (62 per cent), fair in 7 ankles (22 per cent), and poor in 5 ankles (16 per cent). According to the subjective opinions of the patients, the results were poor in only three ankles.

The five pantalar arthrodeses were successful, but one foot remained in complete planovalgus position, which caused some discomfort. Hence the result was classified as fair. The results of TC arthrodesis were good in 16 cases (59 per cent), fair in 6 cases (22 per cent), and poor in 5 cases (19 per cent). The latter showed pseudarthrosis of the TC joint. Guildal's, Adams's and Charnley's methods gave the best results. Union of spongy bone was found to occur satisfactorily in rheumatoid patients. Attention should be paid to firm fixation and sufficient duration of immobilization.

If the subtalar joints are painful and/or marked deformity is present, it is advisable to perform pantalar arthrodesis. Special attention should be paid to correction of the deformity.

Destruction of the TC joint is relatively infrequent and mainly results from a rheumatoid process persisting for many years. Arthrodesis should be performed if a destroyed TC joint is persistently pain-

ful, because painless ankylosis of the joint cannot be expected to occur for many years if the treatment is conservative.

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