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To cite this article: G. N. Boobbyer (1981) The Long-Term Results of Ankle Arthrodesis, Acta Orthopaedica Scandinavica, 52:1, 107-110, DOI: [10.3109/17453678108991769](https://doi.org/10.3109/17453678108991769)

To link to this article: <https://doi.org/10.3109/17453678108991769>



Published online: 08 Jul 2009.



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THE LONG-TERM RESULTS OF ANKLE ARTHRODESIS

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Thirty-seven patients who had ankle arthrodesis carried out from 1–17 years previously were reviewed. The commonest indication in this series was post-traumatic osteoarthritis. Five different methods of fusion were used, the most common being the Charnley compression technique.

The incidence of union, the fusion position, gait, subtalar stiffness and midtarsal hypermobility were recorded and analysed. Objective and subjective assessments were carried out. Poor results were recorded in 11 patients and these results are reported in more detail. The incidence of union was 78.4 per cent.

Key words: ankle; arthrodesis; fusion; non union

Accepted 22.v.80

No less than 22 techniques for ankle arthrodesis have been described (White 1973), indicating that no one technique has gained general acceptance. The current indications, methods and results of ankle arthrodesis are described. The reasons for failure of fusion and other factors causing poor results are discussed.

Campbell & Rinehart. A longitudinal anterior incision is made with resection of the joint surfaces. Cancellous bone chips are inserted and internal fixation (staples or screws) used (Campbell & Rinehart 1974).

Brian Thomas. A segment of the lower fibula is excised and the joint approached by osteotomising the medial malleolus. The concavity of the lower tibia is positioned to fit the convexity of the upper talus. The Charnley compression device is used (Thomas 1969).

PATIENTS AND METHODS

Fifty-eight patients were recorded as having had ankle arthrodeses during the 17 years between 1960 and 1977 in three hospitals (Guy's, Lewisham and Hastings). Of these, 8 had died of unrelated causes and 13 could not be traced. Twenty-six of the remaining 37 patients were personally seen and examined, and 11 answered a questionnaire. Twenty were male and 17 female. Their average age was 47 years (range 18 years to 66 years). The reasons for fusion are detailed in Table 1. The commonest indication for operation was post-traumatic osteoarthritis, which is in accordance with other series (Boyd 1974).

In the post-traumatic cases the average time between the original injury and the arthrodesis was 9 years (range 2 months to 50 years). The type of fusion performed in each case is detailed in Table 2

Modified Roger Anderson. The joint is exposed through medial and lateral incisions with removal of both malleoli. The joint surfaces are resected and the Charnley compression device is used (Anderson 1945).

Table 1. Reasons for ankle arthrodesis.

Post-traumatic osteoarthritis	23
Rheumatoid arthritis	6
Old septic arthritis – leading to secondary osteoarthritis	2
Neurological disorders :-	
Poliomyelitis with flail ankle	1
Polyneuropathy with flail ankle	1
Muscular dystrophy with flail ankle	1
Spastic quadriplegia with fixed equinus of the ankle	1
Disseminated sclerosis with fixed equinus of the ankle	1
Old lateral popliteal nerve palsy with fixed equinus of the ankle	1

Table 2. *The types of ankle arthrodesis performed*

Charnley	{ Classical transverse incision	6
	{ Longitudinal anterior incision	11
Roger Anderson		9
Campbell & Rinehart		7
Brian Thomas		3
R.A.F.		1

R.A.F. The lower end of the fibula is used as an on-lay graft. Three screws are used to secure it (Crawford Adams 1948).

The period of immobilisation following surgery averaged 14 weeks (range 8–18 weeks). All patients who had successful fusions had evidence of bony union by 18 weeks except for one patient with delayed union whose arthrodesis united 1 year after the initial surgery. There was no significant difference between the period of immobilisation and the method of fusion.

RESULTS

The average follow-up was 8 years (range 1–17 years).

Union. Twenty-nine out of 37 ankles progressed to sound union after the first operation – an incidence of primary union of 78.4 per cent. Two patients attained sound union after a second operation.

Fusion position. Fusion position was studied at follow-up and the results are detailed in Table 3.

Three results are included in three patients who answered a questionnaire only, but whose fusion position was accurately recorded in the outpatient clinical notes.

Gait (with shoes on). This was a purely visual analysis by the author and was recorded at the time of review (Table 4).

Table 3. *The results as regards fusion position.*

Right angle	10
Equinus	7 (maximum 10°)
Calcaneus	0
Varus	9 (5° in 7, 10° in 2)
Valgus	3 (maximum 10°)

Table 4. *Visual analysis of gait (with shoes on)*

Normal	17
Slight limp	6
Varus heel	3

A varus heel tends to cause the patient to walk on the outer border of the foot; secondary callosities may result. Associated stiffness of the subtalar joint does not allow compensation for this deformity.

In the patients with a noticeable limp, one patient had had bilateral total knee replacement, one patient had a painful osteoarthritic knee, two had subtalar joint pain and in two no abnormality was found to account for the limp. Both these latter patients were over 65 years of age.

The objective and subjective assessment of the results is outlined in Table 5.

Subtalar stiffness. This is a common feature after ankle arthrodesis. The mechanism is not known (Ratcliff 1959). At review, three patients had marked subtalar stiffness but no pain and an otherwise excellent result. Twenty patients had minimal stiffness not affecting the subjective result.

Midtarsal hypermobility (Said et al. 1978). One patient developed marked painfulmidtarsal hypermobility following a satisfactory fusion. He later had a successful talo-navicular arthrodesis with excellent relief of symptoms.

Return to employment. No patient reviewed was unemployed as a result of the operation. Most patients had returned to their previous occupation. Only one patient – a builder – had taken a lighter job following his arthrodesis. Three patients returned to heavy jobs – one was a window cleaner, one a gardener and one was a forklift truck driver. One patient returned to his work as a dancing instructor.

Analysis of poor results in 11 patients. The complication rate of ankle arthrodesis is high. Johnson & Boseker (1968) had a complication rate of 60 per cent in a series of 132 patients. The

original diagnosis in the 11 patients with a poor result was post-traumatic osteoarthritis in five, rheumatoid arthritis in two and neurological causes in three. In the seven poor results following a Charnley fusion, five were by the classical transverse incision. There were two patients with non-union, two who developed subtalar pain and one who developed ischaemia of the foot and finally had a below-knee amputation. Two patients having the anterior longitudinal approach developed non-union. They retained fibrous ankyloses. One patient with rheumatoid arthritis appeared to have sound fusion both clinically and radiographically on coming out of plaster at 3 months following the operation: one week later whilst a physiotherapist was undertaking passive manipulation of the subtalar joint the patient developed severe pain in the ankle. A radiograph taken then showed a fracture through the arthrodesis. Despite further immobilisation she developed non-union. No obvious cause was found in the other three patients with non-union. One patient with rheumatoid arthritis had an attempted Brian Thomas arthrodesis converted later to a successful pantalar arthrodesis using a fibula graft driven up from the heel crossing the ankle and subtalar joints (Bingold 1956). The other patient retained a fibrous union. In the one R.A.F. arthrodesis non-union developed. The postoperative radiographs clearly showed poor bony contact between tibia and the talus. Later a success-

ful Charnley compression arthrodesis was carried out.

Three patients had persistent hindfoot pain following technically successful arthrodeses. Two patients had had Charnley arthrodeses and one a Brian Thomas arthrodesis. One patient with rheumatoid arthritis clearly had radiological involvement of the subtalar joint and would have been better served by an arthrodesis of the ankle and subtalar joints at the same time. Another patient, who had a fixed equinus deformity of 30° following an old lateral popliteal nerve palsy, developed hindfoot pain immediately on coming out of plaster 3 months after the operation. Clinically and radiographically, the arthrodesis appeared sound. Tomograms of the hindfoot were carried out as it was thought that the pain could be originating from an unsound arthrodesis. The tomograms showed the arthrodesis to be sound but degenerative changes in the subtalar joint were evident. The third patient developed subtalar pain several years after a successful Brian Thomas arthrodesis. Radiographs showed evidence of subtalar osteoarthritis.

There were three amputations in this series. One patient who had a flail ankle as a result of polyneuropathy had a Charnley arthrodesis by the classical transverse incision. A deep slough developed over the dorsum of the foot. Gross infection with exposure of the bones on the dorsum of the foot necessitated a below-knee am-

Table 5. Objective and subjective assessment of the results

<i>Objective assessment</i>		
Excellent	12 (32.5 per cent)	No pain, no limp, no loss of function, sound fusion.
Good	12 (32.5 per cent)	Minimal ache, very slight limp, occasional slight loss of function, sound fusion.
Fair	2 (5 per cent)	Moderate ache, some limp, some loss of function, sound fusion.
Poor	11 (30 per cent)	Moderately severe or severe pain, some limp, moderately severe or severe loss of function, unsound fusion.
<i>Subjective Assessment</i>		
Excellent	12 (32.5 per cent)	
Good	13 (35 per cent)	
Fair	6 (16.5 per cent)	
Poor	6 (16.5 per cent)	

putation 11 weeks after the initial operation. One patient with spastic quadraplegia and an ankle in fixed equinus developed non-union following a classical Charnley compression arthrodesis. She later had a triple arthrodesis of the foot which also failed. Bone grafting to the midtarsal region was later carried out but this became infected. Chronic osteomyelitis developed and 5 years after the initial operation a below-knee amputation was carried out. Another patient with post-traumatic osteoarthritis developed non-union following a Charnley arthrodesis by using a longitudinal anterior incision. Later a sliding tibial bone graft was used but this became infected and finally a below-knee amputation was carried out 3 years after the first operation.

DISCUSSION

The fusion rate of 78.4 per cent is in accord with most series (Johnson & Boseker 1968, Said et al. 1978). Even so, a pseudoarthrosis rate of one in five appears unacceptably high. Different techniques were used but as the numbers are relatively small for each method of arthrodesis no firm conclusion can be drawn as to which technique gives the greatest success rate. In this series, however, the Roger Anderson and Campbell & Rinehart methods seemed to give the best results. Two out of three Brian Thomas arthrodeses developed non-union. This may be due to the technical error of not fashioning correctly the curvature of the tibia and talus with the result that there was poor bony contact. When a sound arthrodesis is obtained the aims of surgery to produce a pain-free ankle, a normal gait and a

return to previous employment can be fulfilled. There is evidence to suggest that deterioration of function due to subtalar or midtarsal stiffness or degenerative changes does not necessarily occur. Up to 10° of equinus allows a normal gait but a heel in varus always produces some difficulty in walking and should be avoided. The complication rate of ankle arthrodesis is high. If a sound fusion in an acceptable position is obtained an excellent long-term result without deterioration of function can be expected in the majority of cases. Extra care in technique and attention to detail are important as the price of failure remains high.

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