LATERAL INSTABILITY OF THE ANKLE TREATED BY THE EVANS PROCEDURE

A LONG-TERM CLINICAL AND RADIOLOGICAL FOLLOW-UP

JON KARLSSON, TOMMY BERGSTEN, OLLE LANSINGER, LARS PETERSON

From the University of Göteborg

We have reviewed 42 of 52 consecutive patients at an average of 14 years after a tenodesis based on Evans' operation performed for chronic lateral instability of the ankle. Only 21 patients (50%) had satisfactory long-term functional results, and 12 patients with satisfactory early results had deteriorated after three to six years.

Stress radiographs were used to measure anterior talar translation and talar tilt, and a good correlation was found between function and mechanical stability. Talar tilt had been controlled more successfully than anterior translation. Marginal osteophytes were found in most ankles, and were larger and more numerous in those with the greatest instability.

After injury to the lateral ligaments, chronic instability of the ankle may result, needing surgical treatment when conservative management fails. Several operations have been described (Nilsson 1932; Elmslie 1934; Evans 1953; Windfeld 1953; Watson-Jones 1955; Lee 1957; Stören 1959; Castaing, Le Chevallier and Meunier 1961; Broström 1966; Chrisman and Snook 1969). Most of them involve a tenodesis between the distal fibula and the calcaneus, the talus or the base of the fifth metatarsal.

Tenodesis of the peroneus brevis tendon (Gallie 1913), was later modified by Evans (1953). This method and its variations have been widely used and accepted; good short-term results have been reported (Evans 1953; Good, Jones and Livingstone 1975/6; Ottoson 1978; Kristiansen 1981; Cass and Morrey 1984; Green 1985). However, we could find only one report of long-term results in the English literature, by Cass et al. (1985). We therefore present our long-term results after the Evans reconstruction.

PATIENTS AND METHODS

From 1969 to 1976, the Evans procedure was performed on 52 patients with chronic lateral instability of the ankle at the Department of Orthopaedic Surgery, Göteborg, Sweden. There were 23 men and 29 women with a mean

age at the time of operation of 23 years (range 17 to 39 years). In all, 33 right ankles and 19 left ankles were treated.

All 52 patients had had an inversion injury with ligament rupture at a mean time of 20 months before operation (range 6 to 48 months). All patients had suffered chronic functional instability of the ankle with giving-way, swelling, pain, and restriction of activity. A positive anterior drawer sign had always been present and 14 of the 42 patients reviewed had increased inversion as compared to the other ankle. In all patients, a training programme, supervised by a physiotherapist, had failed to relieve their symptoms.

Operation. The operation performed was based on the original description of the method (Evans 1953). The peroneus brevis tendon was divided from its muscle belly proximally. A tunnel was drilled through the lateral malleolus from the anterior aspect of its tip to emerge posteriorly about 2.5 to 3 cm proximally (Fig. 1). The tendon was passed through the tunnel and re-attached under tension to the peroneus brevis with some overlap while the foot was held in slight eversion. Postoperatively the ankle was immobilised in a below-knee plaster for six weeks. Weight-bearing was allowed after three weeks.

Follow-up. We reviewed 42 patients, 18 men and 24 women, at a mean period of 14 years after the operation (range 10 to 17 years). Of the missing 10 patients, three had died from unrelated causes, three had moved abroad and four could not be traced. A full history was taken of pain, swelling, walking ability, occupation, and activity level including sport. The need for ankle support was recorded.

At examination, tenderness or hyperaesthesia of the scar, joint stability, range of ankle movement and

J. Karlsson, MD, Orthopaedic Surgeon
T. Bergsten, MD, Radiologist
O. Lansinger, MD, Orthopaedic Surgeon
L. Peterson, MD, Orthopaedic Surgeon
East Hospital, University of Göteborg, S-416 85 Göteborg, Sweden.
Correspondence should be sent to Dr J. Karlsson.

© 1988 British Editorial Society of Bone and Joint Surgery
0301-620X/88/3083 \$2.00
J Bone Joint Surg [Br] 1988;70-B:476-80

Diagram of the Evans reconstruction. PB, peroneus brevis; PL, peroneus longus.

general joint mobility were tested. Results were assessed using the criteria suggested by Sefton et al. (1979) and given in Table I.

Radiographic examination of both ankles of each patient included stress views using the TELOS equipment (Forster, Scheuba and Weber 1978) with standard measurements of both anterior talar shift and talar tilt

(Fig. 2). The load was 150 N in both directions; this did not cause any discomfort, patients being asked to relax their muscles.

RESULTS

The functional results (Table II) were excellent in 11 patients (26%), good in 10 (24%), fair in six (14%) and poor in 15 (36%). Results were better for men than for women, and were not influenced by age.

Four patients with good results complained of mild stiffness and six patients had occasional pain and swelling after exercise. The six with fair results all complained of subtalar stiffness with pain and swelling after exercise. Four of them also had functional instability of the ankle. All 15 patients with poor results complained of instability with pain and swelling after exercise and restriction of activity. Two of these patients also complained of subtalar stiffness.

Before injury 34 of the 42 patients had been active in sport; after operation 28 had returned to the same level of sport and six had reduced or ceased their activity. At late follow-up, only six patients were still active in sport. Of the 28 patients who had been able to return to their pre-injury level of sport, 12 had developed instability with pain and ankle swelling three to six years after operation and had to give up sport. Of these 12 patients, two had

Table I. Criteria used to assess the functional results at follow-up

Excellent	Full activity, including strenuous sports. No pain, swelling or giving-way
Good	Occasional aching, only after strenuous exercise. No giving-way or feeling of apprehension
Fair	Some residual instability and remaining apprehension, although less than before operation
Poor	Recurrent instability and giving-way in normal activities with episodes of pain and swelling. Need for re-operation

Table II. Long-term functional results in 42 patients after the Evans procedure

Result	Men	Women	Total		Age in years	
			Number	Per cent	Mean	Range
Excellent	7	4	11	26	34	(28 to 49)
Good	4	6	10	24	33	(28 to 39)
Fair	1	5	6	14	38	(28 to 54)
Poor	6	9	15	36	36	(27 to 49)

Fig. 2

Apparatus used to apply force for measurement of anterior talar translation and talar tilt.

sustained a new injury, but the other 10 had deteriorated gradually.

On clinical examination, inversion was reduced by more than 10° in 11 patients, of whom eight had unsatisfactory results due to subtalar stiffness and pain on exertion. In 23 patients there was a positive anterior drawer sign, and 19 of these had unsatisfactory results (four fair and 15 poor). In contrast, at short-term follow-up about one year after the operation 35 of the 42 patients had had a negative anterior drawer sign.

The objective stability had decreased in 16 ankle joints during long term follow-up, and 12 of these 16 patients developed functional instability. In addition, 13 patients had increased inversion compared to the other side, and all of these had poor results. The results of the clinical and radiological examinations correlated well in all but one patient.

Thirteen patients had required a second operation: five for repeated ligament reconstruction after two to six years, three for removal of loose bodies, three for neuroma and two for excision of granuloma.

Radiology. The results for anterior talar translation and talar tilt in stress radiographs are given in Table III for the 37 patients who had not had a second ligament reconstruction, and there is an obvious correlation between excellent and good functional results and good mechanical stability. All except two patients with anterior talar translation of over 10 mm (Fig. 3) had unsatisfactory results. Increased talar tilt was seen only in patients with poor functional results (Fig. 4).

The results of stress radiographs of the normal contralateral ankle in 26 patients are also given in Table III. Anterior talar translation was significantly different only in those with fair or poor functional results of operation. Talar tilt was significantly greater only in patients with poor functional results.

Marginal osteophytes were seen in 32 ankles, varying from minimal changes on the medial or lateral malleolus to widespread osteophytes on all joint surfaces. Osteophytes were graded according to size: Grade 1, 0 to 2 mm; Grade 2, 2 to 5 mm; and Grade 3, over 5 mm (Fig. 5). More osteophytes were seen on the medial malleolus and the anterior tibial margin in patients with severe talar instability, and the largest were seen in patients with unsatisfactory functional results and mechanically unstable ankles (Table IV). The three patients who had osteoarthritis, as evidenced by reduced joint spaces (Fig. 6), all had unsatisfactory results.

DISCUSSION

Tenodesis has been the best accepted and most used reconstruction for chronic lateral instability of the ankle (Evans 1953; Watson-Jones 1955; Chrisman and Snook 1969; Snook, Chrisman and Wilson 1985; Singer and Jones 1986). These operations sacrifice normal structures and the anatomy is not completely restored.

Fig. 3

Fig. 4

Examples of stress radiographs. Figure 3 – Increased anterior talar translation in a patient with a poor functional result. Translation is measured as the maximum distance between the talus and the tibia after provocation force is applied. Figure 4 – Increased talar tilt in a patient with a poor functional result. Talar tilt is measured as the angle between the joint surfaces.

Fig. 5

A Grade 3 marginal osteophyte on the anterior tibial margin in a patient with a severe instability.

Fig. 6

Osteoarthritis of the ankle in a patient with instability 17 years after operation.

The Evans reconstruction does not replace either the anterior talofibular or the calcaneofibular ligaments (Peterson, Althoff and Renström 1981), but acts along the resultant of the two ligaments, working in a different way in plantarflexion and in dorsiflexion (Orava et al. 1981). The strength of the peronei is reduced (St Pierre et al. 1984). Despite this, good short-term results have been reported by several authors after the original method or its modifications (Good et al. 1975; Ottoson 1978; Vaionionpää, Kirves and Läike 1980; Kristiansen 1981; Orava et al. 1981; Green 1985).

The only long-term follow-up of the Evans procedure we could find in the English literature (Cass et al.

and 25% of those with symptoms had radiological evidence of osteoarthritis. Cadaver studies showed that the Evans reconstruction gave protection against inversion with the ankle in neutral position, but that the talus tended to subluxate in equinus, possibly because of the absence of the anterior talofibular ligament. St Pierre et al. (1982) compared the results of five different operations after follow-up of one to seven years (mean, 2.1 years). In 17 ankles treated by the Evans reconstruction there were two failures and in 10 ankles treated by the Watson-Jones method there were also two failures. All 13 patients treated by the Chrisman-Snook reconstruction were found to be stable.

Table III. Correlation between the functional and the radiographic results for both operated and contralateral ankles

Functional Result	Injured, repaired side (n = 37)		Uninjured side (n = 26)*	
	Anterior talar translation (mm)	Talar tilt (degrees)	Anterior talar translation (mm)	Talar tilt (degrees)
Excellent	7 (4-10)	3 (1-5)	6 (4-7)	4 (3-6)
Good	8 (4-12)	4 (1-8)	7 (3-10)	4 (2-5)
Fair	11 (9-13)	4 (2-6)	6 (5-7)	4 (1-6)
Poor	13 (7-17)	9 (4-21)	6 (5-8)	3 (0-5)

* In only 26 of the 37 patients was the uninjured side measured

Table IV. Correlation between the functional results and the size and number of marginal osteophytes

Result	Grade of osteophyte	Site of osteophyte				
		Lateral malleolus	Medial malleolus	Anterior tibia	Posterior tibia	Anterior talus
Excellent	1	3	5	4	-	2
	2	2	-	1	-	-
	3	-	-	-	-	1
Good	1	3	5	-	-	-
	2	2	2	2	-	-
	3	-	-	-	-	-
Fair	1	-	-	1	-	-
	2	1	-	2	2	-
	3	3	4	-	1	-
Poor	1	-	4	6	1	1
	2	4	2	3	2	5
	3	7	6	3	-	-

Grade of osteophytes: 1, 0 to 2 mm; 2, 2 to 5 mm; 3, >5 mm

1985) reports that five of 19 patients followed for a mean period of 9.5 years had functional instability, four of them using ankle supports during sport. However, 18 of 19 patients were satisfied with the result, although in 12 patients the mean talar tilt was 6.5° (range 0 to 21°). Anterior talar translation was not measured.

Few studies of the long-term results of direct ligament reconstruction have been published. Tindall and Heaney (1976) assessed 28 patients at one to 16 years after the Evans operation. Although 26 patients had improved stability, only 46% had no residual symptoms

Snook et al. (1985) have studied the results of the Chrisman-Snook reconstruction in 48 ankles, after a mean follow-up of 10 years (range 4 to 24 years). The results were excellent or good in 45 ankles and fair or poor in three, all of whom had sustained a severe re-injury. However, injury to the sural nerve was seen in 14 patients. Several other authors have reported 90% or more satisfactory short-term results after the Chrisman-Snook reconstruction (Savastano and Lowe 1980; Leach et al. 1981; Rehtine, McCarroll and Webster 1982). Van der Rijt and Evans (1984) reported the long-term results

of the Watson-Jones tenodesis in nine patients after a mean follow-up of 22 years. Only three of their patients had satisfactory results and only two ankles were mechanically stable as measured with stress radiographs. Chrisman and Snook (1969) have shown that talar tilt is better controlled by their reconstruction than by the Watson-Jones or Evans operations, perhaps because their procedure reconstructs both the anterior talofibular and the calcaneofibular ligaments.

Our series shows 50% unsatisfactory results after 14 years. Functional stability had deteriorated in 10 patients after an initially good result and only six of 42 patients were able to take an active part in sport.

Eight patients had restricted inversion, but increased anterior talar translation. This restriction may be due to adhesions in the subtalar joints (Freeman 1965) or to the tenodesis being too tight (Green 1985). Many patients had persistent instability in one or both planes, more commonly anterior translation than talar tilt. The Evans tenodesis seems to reduce subtalar movement, at least in plantarflexion, but offers less control of anterior translation (Tindall and Heaney 1976; Orava et al. 1981; Green 1985).

In our patients, satisfactory functional results correlated with correction of mechanical instability, the anterior talar translation being more significant than talar tilt. There was a high incidence of osteophyte formation, with both number and size greatest in ankles with the most mechanical and functional instability. We conclude that the results of the Evans operation for chronic lateral instability tend to deteriorate in the long-term and that consideration should be given to the use of more complex types of reconstruction.

The authors wish to express their gratitude to Magnus P. Albertsson, MD, for professional help with the illustration.

This study was supported with grants from the Research Council of the Swedish Sports Federation. No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES

- Althoff B, Peterson L, Renström P. Simple plastic surgery of inveterate ligament damage in the ankle joint. *Läkartidningen* 1981;78:2857-61.
- Broström L. Sprained ankles: VI. Surgical treatment of "chronic" ligament ruptures. *Acta Chir Scand* 1966;132:551-65.
- Cass JR, Morrey BF. Ankle instability: current concepts, diagnosis, and treatment. *Mayo Clin Proc* 1984;59:165-70.
- Cass JR, Morrey BF, Katch Y, Chao EYS. Ankle instability: comparison of primary repair and delayed reconstruction after long-term follow-up study. *Clin Orthop* 1985;198:110-17.
- Castaing J, Le Chevallier PL, Meunier M. Entorse à répétition ou subluxation récidivante de la tibio-tarsienne. Une technique simple de ligamentoplastie externe. *Rev Chir Orthop* 1961;47:598-608.
- Chrisman OD, Snook GA. Reconstruction of lateral ligament tears of the ankle: an experimental study and clinical evaluation of seven patients treated by a new modification of the Elmslie procedure. *J Bone Joint Surg [Am]* 1969;51-A:904-12.
- Elmslie RC. Recurrent subluxation of ankle-joint. *Ann Surg* 1934;100:364-7.
- Evans DL. Recurrent instability of the ankle joint: a method of surgical treatment. *J R Soc Med* 1953;46:343-4.
- Forster G, Scheuba G, Weber EG. Die standardisierte "gehaltene Aufnahme" zur Diagnostik der Bandverletzungen an der unteren Extremität. *Aktuel Chir* 1978;13:239-52.
- Freeman MAR. Treatment of ruptures of the lateral ligament of the ankle. *J Bone Joint Surg [Br]* 1965;47-B:661-8.
- Gallie WE. Tendon fixation: an operation for the prevention of deformity in infantile paralysis. *Am J Orthop Surg* 1913;11:151-5.
- Good CJ, Jones MA, Livingstone BN. Reconstruction of the lateral ligament of the ankle. *Injury* 1975;6:7:63-5.
- Green ADL. Reconstruction for ankle instability in young active adults. *J R Coll Surg Edinb* 1985;30:50-3.
- Haigh H. Repair of ligaments in recurrent subluxation of the ankle joint. *J Bone Joint Surg [Br]* 1950;32-B:751.
- Kristiansen B. Evans' repair of lateral instability of the ankle joint. *Acta Orthop Scand* 1981;52:679-82.
- Leach RE, Namiki O, Paul GR, Stockel J. Secondary reconstruction of the lateral ligaments of the ankle. *Clin Orthop* 1981;160:202-11.
- Lee HG. Surgical repair in recurrent dislocation of the ankle joint. *J Bone Joint Surg [Am]* 1957;39-A:828-34.
- Nilsson H. Making a new ligament in ankle sprain. *J Bone Joint Surg* 1932;14:380-1.
- Orava S, Jaroma H, Weitz H, Loikkanen T, Suvela M. Radiographic instability of the ankle after Evans' repair. *Acta Orthop Scand* 1983;54:734-8.
- Ottosson L. Lateral instability of the ankle treated by a modified Evans procedure. *Acta Orthop Scand* 1978;49:302-5.
- Rechtine GR, McCarroll R, Webster DA. Reconstruction for chronic lateral instability of the ankle: a review of twenty-eight surgical patients. *Orthopedics* 1982;5:46-50.
- Riegler HF. Reconstruction for lateral instability of the ankle. *J Bone Joint Surg [Am]* 1984;66-A:336-9.
- Savastano AA, Lowe EB Jr. Ankle sprains: surgical treatment for recurrent sprains. Report of 10 patients treated with the Chrisman-Snook modification of the Elmslie procedure. *Am J Sports Med* 1980;8:208-11.
- Singer KM, Jones DC. Ligament injuries of the ankle and foot. In: Nicholas JA, Hershman EB, eds. *The lower extremity and spine in sports medicine*. St. Louis, etc: CV Mosby Co, 1986: 475-97.
- Snook GA, Chrisman OD, Wilson TC. Long-term results of the Chrisman-Snook operation for reconstruction of the lateral ligaments of the ankle. *J Bone Joint Surg [Am]* 1985; 67-A:1-7.
- Solheim LF, Denstad TF, Roaas A. Chronic lateral instability of the ankle: a method of reconstruction using the Achilles tendon. *Acta Orthop Scand* 1980;51:193-6.
- St. Pierre RK, Allman F Jr, Bassett FH III, Goldner JL, Fleming LL. A review of lateral ankle ligamentous reconstructions. *Foot Ankle* 1982;3:114-23.
- St. Pierre RK, Andrews L, Allman F Jr, Fleming LL. The Cybex II evaluation of lateral ankle ligamentous reconstruction. *Am J Sports Med* 1984;12:52-6.
- Stören H. A new method for operative treatment of insufficiency of the lateral ligaments of the ankle joint. *Acta Chir Scand* 1959;117:501-9.
- Tindall SFG, Heaney SH. Repair of the lateral ligaments of the ankle by the Evans technique. *J Bone Joint Surg [Br]* 1976;58-B:133.
- Vainionpää S, Kirves P, Lälke E. Lateral instability of the ankle and results when treated by the Evans procedure. *Am J Sports Med* 1980;8:437-9.
- van der Rijt AJ, Evans GA. The long-term results of Watson-Jones tenodesis. *J Bone Joint Surg [Br]* 1984;66-B:371-5.
- Watson-Jones R. *Fractures and joint injuries*. 4th ed. Edinburgh: E & S Livingstone Ltd, 1952/5.
- Windfeld P. Treatment of undue mobility of ankle joint following severe sprain of ankle with avulsion of anterior and middle band of external ligament. *Acta Chir Scand* 1953;105:299-304.