The results of surgical treatment of chronic lateral ankle instability with the Evans technique

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Purpose
The aim of this study was to review the outcome of the Evans technique in patients with chronic lateral ankle–ligament instability.
Patients and methods
Between August 2009 and June 2012 a prospective study was conducted on 14 patients between 15 and 50 years of age (mean: 26.6 years) with chronic lateral instability who underwent the Evans technique and followed up for 2 years. Patients were assessed postoperatively using the Kaikkonen ankle scoring scale. Stress radiographs were also obtained to evaluate talar tilt and anterior drawer.
Results
The results were good to excellent in 79% of the 14 patients, fair in 14%, and poor in 7% of patients. Clinical examination showed an anterior drawer test results were equal to or less than that on the unaffected side in 75% of patients. Stress radiographs showed a mean anterior drawer of 7.0±1.8 mm and a mean talar tilt of 4.8 ± 3.8°.
Conclusion
The Evans reconstruction procedure is a valuable option in treating recurrent and complex chronic lateral ankle instability and provides good ankle instability, particularly when the original, frayed ligaments cannot be easily identified.

Keywords:
ankle, Evans, joint instability, lateral ligament, recurrence

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Introduction

Lateral ankle instability is one of the most common and well-recognized conditions presenting to foot and ankle surgeons. Although 80–85% of acute ankle sprains are successfully treated with conservative measures and functional ankle-rehabilitation program, the remaining 15–20% have recurrent ankle instability and reinjury, necessitating surgical intervention [1]. Recent literature has found an association between ankle instability and the development of osteoarthritis, which may be a cause of prolonged and worsening symptoms after neglected ankle instability due to unbalanced loading on the medial side of the ankle [2–4]. Determining as to in which patients the condition may progress to chronic instability and the appropriate time to intervene with more aggressive forms of treatment continues to be a challenge for treating physicians. Surgery is indicated when conservative management fails to produce a satisfactory functional outcome. Surgery has been broadly divided into an anatomic repair consisting of an imbrication of the lateral ligamentous complex and an ankle–ligament reconstruction. An ankle–ligament reconstruction weaves a harvested tendon graft, most commonly the peroneus brevis, to augment the lateral ligaments of the ankle. Nonanatomic reconstructions may be best suited for those patients with long-standing instability, hypermobility, or a failed anatomic repair [5]. Anatomic repair and imbrication of the lateral ligament complex provides increased stability by reinforcing local host tissue. However, direct repair is not always possible [6], concern in using the anatomic repair is the resultant strength of the repair. Ankle-reconstruction procedures that sacrifice tendons are thought to provide a stronger construct and hence more stability, especially in chronic cases. The Evans procedure is a widely used nonanatomical reconstruction. It was originally described to treat the mechanical instability of the lateral ankle ligaments [7].

Patients and methods

This prospective study was conducted on 14 patients, who underwent Evans procedure for the treatment of chronic lateral ankle instability. Their mean age was 26.6 years (range: 15–50 years). All patients were treated between the years August 2009 and June 2012, and followed up for 2 years. Patients who had not previously suffered from this injury and did not have any other fractures, those with a history of either recurrent ankle sprains or chronic post-traumatic ankle instability, and those with failed conservative therapy were included in the study. Diagnosis is typically based on clinical findings. Chronic lateral ankle instability was defined as recurrent ankle sprains, instability, and 'giving way' for at least 6 months after conservative treatment of an ankle inversion trauma. Physical examination included the anterior drawer test and the inversion talar tilt test to assess the integrity of the anterior talofibular ligament and the calcaneofibular ligament compared with the contralateral ankle. All 14 patients had an inversion injury with ligament rupture at a mean time of 20 months before operation (range: 6–48 months). All patients had suffered chronic functional instability of the ankle with giving way, swelling, pain, and restriction of activity. Stress radiographs were obtained preoperatively. The mean talar tilt before operation was 15.6° (range: 12–20°), and the mean anterior drawer was 12 mm (range: 10–15 mm). It is extremely important to compare the stress views with the contralateral ankle as some patients may have congenital laxity. Anyone with fractures, significant varus malalignment, severe osteoarthritis of the ankle, osteochondral dissecans lesions of the talus, and previous failed lateral ankle ligamentous repair or reconstruction were not candidates for this procedure. MRI was performed only when necessary to confirm diagnosis. The degree of degenerative arthritis as seen on the radiographs was assessed.

Operative technique

Under either regional or general anesthesia, patients are placed supine with a sandbag under buttocks. The limb is prepared and draped, and a tourniquet is applied. The surgical technique begins with a 15 cm curvilinear incision made posterior to the lateral malleolus, taking care not to damage the sural nerve. The Evans procedure involves harvesting the entire peroneus brevis tendon: proximally, it is divided at the upper limit of the incision, leaving it attached to the fifth metatarsal base distally. The free arm is then passed anterior to posterior through a drill hole in the distal fibula, which is made diagonally forwards and downwards through the lower end of the fibula. The sharp edges of the bone canals are smoothed with a rongeur and curette, and then the tendon is anchored to itself (Fig. 1). The position of the foot and the amount of tension applied during the suturing influence the degree of stability and the degree of restriction of subtalar motion. It is recommended to tension the reconstruction with the foot everted 5–8° to avoid overtightening while maintaining an adequate repair. Anatomically, the position of this tendon weave does not recreate the anterior talofibular ligament (ATFL) or calcaneofibular ligament (CFL) but lies somewhere in between. The wound is closed over a suction hemovac and a below knee plaster cast was applied.

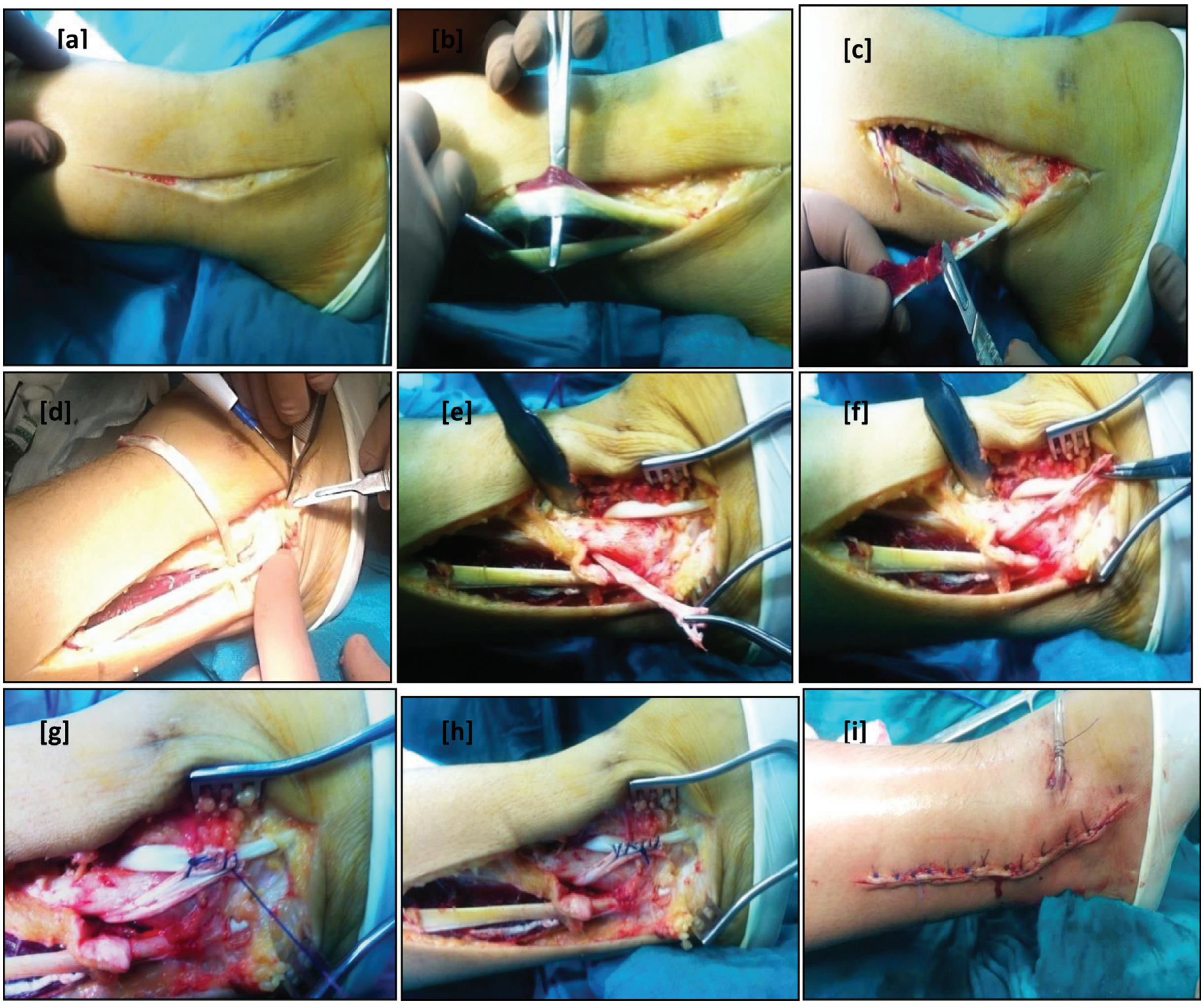
Postoperative protocol

The postoperative protocol following operative treatment for chronic ankle instability includes an initial cast holding the ankle neutral and the foot everted. The cast is removed at 2 weeks postoperatively and stitches are removed, and then another below knee cast is applied for 4 weeks more. Physical therapy is then started with active and passive range of motion, followed by strengthening exercises for the ankle dorsiflexion, plantarflexion, eversion, and inversion. A return to full activity can be expected at 3 months postoperatively.

Complications

Fortunately, major complications, such as deep venous thrombosis, reflex sympathetic dystrophy, septic arthritis, and osteomyelitis, were rare following operative treatment for chronic ankle instability. However, the more commonly occurring problems, such as wound and nerve problems, recurrent instability, stiffness, and subjective failure, can result in significant patient morbidity [8]. In this study wound complications occurred in two patients, representing 1.4%. The wound issues tend to be superficial and treatable with local wound care and does not require reoperation. Nerve problems can range in severity from mild temporary paresthesias to neuroma formation requiring operative excision. The incidence of nerve problems in this study was 0.5% and was in the form of paresthesia in one patient, and it resolved after 3 months. Early recurrent instability usually occurs after an acute reinjury, whereas late recurrent instability is likely due to chronic attritional injuries. Factors for failure and recurrent instability after operative procedure are ligamentous laxity, long-standing instability, high functional demand, and a cavovarus foot. Patients with ankle instability and hindfoot varus deformity should be treated with a concurrent calcaneal osteotomy with lateral ankle–ligament reconstruction [8,9]. However, stiffness is common after both anatomic and nonanatomic reconstructions and is often well tolerated by patients, as it may be a necessary trade-off for stability. However, overtightening of a nonanatomic tenodesis reconstruction is a recognized complication and can lead to loss of subtalar and tibiotalar motion and impingement. To avoid this from occurring, it is recommended to tension the

Figure 1



An Evans reconstructive lateral ankle tenodesis. peroneus brevis tendon is harvested, leaving it attached distally to the fifth metatarsal base. The proximal end is weaved anterior to posterior through a drill hole in the fibula. [a] 15 cm curvi-linear incision posterior to the lateral malleolus. [b] Identifying the peroneus brevis tendon. [c] harvesting the entire peroneus brevis tendon. [d] leaving the tendon attached to the fifth metatarsal base distally. [e,f] The free arm of the tendon is passed anterior to posterior through a drill hole in the distal fibula which is made diagonally forwards and downwards through the lower end of the fibula. [g,h] Tendon is anchored to itself. [i] Skin incision closure over suction hemovac.

reconstruction with the foot everted 5–8° to avoid overtightening while maintaining an adequate repair [10,11].

No subjective failure with a structurally sound repair was reported in this series. Failure actually may be due to poor patient selection or an inaccurate clinical diagnosis. Delayed subjective failure may be due to a single traumatic event or multiple subclinical events.

Results

The patients were evaluated clinically with the Kaikkonen rating score [12], which comprises nine elements: three questions address symptoms such as pain, stiffness, or giving way; one question assesses functional stability (stair descending test); two questions assess muscle strength (rising on heels and rising on toes); one question assesses balance (single-limb stance on a 10 cm wide square); and, finally, two questions assess the clinical measurements (range of motion in dorsiflexion, and ankle joint laxity using the anterior drawer test). Of a maximum of 100 points, a score of 85 and above was rated as excellent, 70–84 as good, 50–69 as fair, and less than 50 as poor. In this study, the results were good to excellent in 79% of the 14 patients, fair in 14%, and poor in 7% of patients (Table 1).

Clinical examination showed anterior drawer test results equal to or less than the unaffected side in 75% of patients, a slightly increased anterior drawer in 15% of patients, and a significantly increased drawer test in 10% of patients. Movement in the subtalar joint of the operated ankle was normal in 90% of patients.

Patients were evaluated radiologically. Stress radiographs showed a mean anterior drawer of 7.0 ± 1.8 mm and a mean talar tilt of 4.8 ± 3.8° (Table 2). There was an obvious correlation between excellent and good clinical results and radiological evaluation. Anterior talar translation was significantly different in those with fair or poor functional results. In addition, talar tilt was significantly greater in one patient with poor functional result (Table 3 and Fig. 2).

The distribution of the grade of degenerative change showed that three patients had grade I osteophytes without narrowing of the joint space, one had grade II osteophytes with narrowing of the joint space, no patient had grade III osteophytes with total disappearance or deformation of the joint space, and 10 patients had normal joints. More number of osteophytes were seen on the medial malleolus and the anterior tibial margin in patients with severe talar instability, and the largest osteophytes were seen in patients with unsatisfactory functional results.

At the time of review and examination with the Kaikkonen *et al.* [12] ankle stability score, eight (57%) ankles achieved outcomes that were excellent, three (22%) achieved good outcomes, and two (14%) achieved fair outcomes. One ankle (7%) had poor outcome. All patients felt that their ankles were 'tightened' postoperatively.

Table 1 Evaluation of the patients according to the Kaikkonen scoring system

Grades	*N*
Excellent	8
Good	3
Fair	2
Poor	1

Table 2 Results of stress radiological examination in 14 patients who had the Evans tenodesis for chronic lateral instability of the ankle

	Mean ± SD
Talar tilt (deg.)	
Affected ankle	7 ± 1.8
Unaffected ankle	4.1 ± 5.4
Anterior talar translation (mm)	
Affected ankle	4.8 ± 3.8
Unaffected ankle	2.8 ± 2.2

Table 3 Correlation between the functional and the radiographic results

	Anterior talar translation (mm)	Talar tilt (deg.)
Excellent	6 (4–10)	8 (1–5)
Good	3 (4–12)	4 (1–8)
Fair	2 (9–13)	1 (3–6)
Poor	1 (7–15)	1 (4–20)

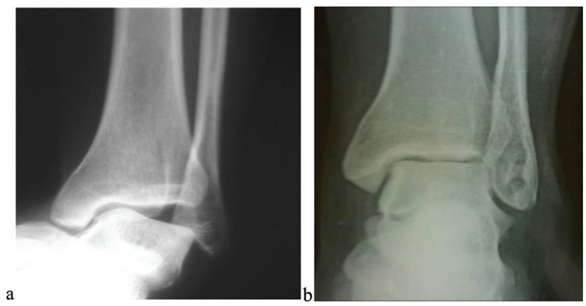
Discussion

The mechanism of the lateral ligamentous complex injury of the ankle involves inversion and supination of the plantarflexed foot. Initially, the anterolateral capsule is torn. As the injury progresses, the ATFL is torn, followed by the CFL. The posterior talofibular ligament, being the strongest of the three ligaments making up the lateral ligamentous complex, is rarely injured [13]. Initially, most ankle sprains are managed conservatively. Despite treatment, 10–20% of the ankles develop chronic ankle–ligament instability. However, several factors may lead to chronic ankle instability with recurring ankle sprains: inadequate primary treatment, incomplete healing of the ligaments, and repetitive trauma with deteriorated tissue quality [14]. Mechanical instability refers to weakening or laxity of the ligaments caused by structural damage to the connective tissue. Functional instability refers to the subjective sensation of 'giving way' and joint instability due to peroneal muscle weakness. In patients with recurrent lateral ankle instability, there is a clear relationship between mechanical and functional instability [15].

For many patients with chronic lateral ankle instability, surgical treatment is an appropriate option. The goal of surgery is to create greater stability and reduce pain and decrease the incidence to progression to early degenerative arthritis.

Operative treatment options include anatomic repairs using local tissues and nonanatomic reconstructions. Most of them include sacrificing the peroneus brevis tendon to mechanically stabilize ankle.

Figure 2



(a, b) Preoperative and postoperative x-rays of a 35 years male patient who underwent evans procedure 1 year after he initial trauma.

The gold standard for open anatomic repair remains Brostrom procedure; it was initially described in 1966. In this procedure, the torn ligament ends, usually the ATFL and the CFL, are oversewn and tightened in a pants-over-vest manner [6]. In 1980, this procedure was modified by Gould, which uses the extensor retinaculum to provide additional support [16]. However, certain factors may yield suboptimal results, especially poor and severely attenuated ligaments, from long-standing instability, and hence the repair is sometimes very difficult because the margins of the torn ligament can be very tenuous and flimsy [17]. Therefore, the main disadvantage of anatomic reconstruction remains its reliance on a potentially poor and lax local tissues [15].

Nonanatomic reconstructions, however, use tenodesis procedures to restrict ankle motion without repairing the ligaments of the ankle. The most commonly used tendon has been the peroneus brevis, which can be rerouted in many different configurations around the lateral ankle. The reported results of these procedures were comparable to those of anatomic reconstructions [11,18].

On reviewing the literature, we found that, studies comparing nonanatomic versus anatomic reconstruction, as those by both Hennrikus *et al.* [19], who compared Chrisman–Snook procedure with a modified Brostrom anatomic reconstruction, and Rosenbaum *et al.* [20], who compared a tenodesis (modified Evans procedure) with anatomic reconstruction, generally reported good results for both operations. There was no statistically significant difference between the two operations in subjective instability or pain at follow-up. Same was for radiographic assessment as regards talar tilt or anterior drawer [20].

Table 4 Results of nonanatomic reconstruction

References	*N*	Technique	Outcome % good/ excellent
Van der Rijt and Evans [21]	9	W-J	33
Sugimoto *et al.*[22]	37	W-J	90
Becker *et al.* [23]	25	W-J	72
Karlsson *et al.*[24]	42	Evans	50
Korkala *et al.*[25]	24	Evans	82.5
Elmslie [26]	19	Evans	79
Girard *et al.*[27]	20	Evans/ Brostrom	95
Nimon *et al.*[28]	91	Evans	57
Korkala *et al.*[29]	24	Evans	76
Baltopoulos *et al.* [30]	25	Evans	92.6
Snook *et al.* [31]	48	C-S	93

C-S, Chrisman–Snook; W-J, watson-Jones.

In this study, there was no pain or limitation of range of motion in any of the patients, and all patients reported that their ankles were stable postoperatively. Excellent and good results were achieved in 79% of patients, which is almost near to that reported in previous studies using nonanatomical repairs (Table 4) [21–31]. Nevertheless, there is a great controversy with myriad procedures described for chronic lateral ankle instability, and there is little consensus on optimal treatment outcome or a truly ideal option.

Conclusion

The Evans reconstruction procedure is a valuable option in treating recurrent and complex chronic lateral ankle instability and provides good ankle instability, particularly when the original, frayed ligaments cannot be easily identified for repair without sacrificing subtalar motion or predisposition to subtalar arthritis.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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