Chrisman-Snook Ankle Ligament Reconstruction Outcomes – A Local Experience

M Cheng, K S Tho

ABSTRACT

Introduction: Chrisman-Snook reconstruction is a surgical method of treating chronic lateral ankle instability. This study aims to examine the outcome and possible factors including joint hypermobility that may influence the outcome in our local population.

Materials and Methods: Twenty-four ankles with chronic lateral ankle instabilities were treated with the Chrisman-Snook reconstruction procedure between May 1995 and November 1997. Fifteen were available for review at an average follow-up period of 35.3 months, ranging from 26 to 51 months. The patients were young and the average age was 24 years. The lateral ligaments were reconstructed by rerouting half the peroneus brevis tendon, based distally, through the lateral malleolus and anchoring it to the calcaneum. Functional results were assessed using the Kaikkonen ankle stability score. Joint hypermobility was assessed by the Beighton et al score.

Results: Excellent results were achieved in ten cases, good in four, and fair in one. None had poor results. Best outcomes tended to occur in patients with joint hypermobility. Complications included decreased sensation in a small area of the lateral foot.

Conclusions: Chrisman-Snook reconstruction is a surgical option for young patients who have failed conservative treatment for chronic ankle instability. In our local population with a higher incidence of joint hypermobility, it gave good results with few serious complications.

Keywords: Chronic ankle instability, Chrisman-Snook reconstruction, Kaikkonen ankle stability score, Beighton joint hypermobility score

Singapore Med J 2002 Vol 43(12):605-609

INTRODUCTION

Inversion sprains cause varying degrees of damage to the lateral ankle ligaments. Most recover with conservative treatment and rehabilitation. However a small proportion develop chronic ankle instability requiring surgical treatment. The various surgical options include direct ligament repair[7] and various types of ligament reconstructions using a variety of tendon grafts, one of which was described by Chrisman and Snook[8]. The aim of this study is to review the results of the Chrisman-Snook surgical procedure in young patients with chronic ankle instability and to identify factors including generalised ligamentous laxity in our local population that may influence the results.

MATERIALS AND METHODS

From May 1995 to November 1997 in Alexandra Hospital, 24 ankles with chronic instability were surgically treated by the senior author using the Chrisman-Snook reconstruction method. Five patients (seven ankles) were not contactable and lost to follow-up. One patient had a tendo-achilles tear confirmed on MRI and another had documented significant cartilage loss on the medial talar dome on ankle arthroscopy; both were excluded from the study. The remaining 15 ankles in 13 patients who were contactable were available for review. The five patients who could not be contacted were discharged from follow-up after they had recovered post-operatively. From the case records, they had no significant complications and had returned to work. It was noted that out of these five patients, two were clearly satisfied with their outcomes and had their other ankle similarly operated on.

Surgical Technique

The surgical technique begins after anaesthesia and ankle examination. The patient is placed in a lateral position. A 15 cm curvi-linear incision is made posterior to the lateral malleolus, taking care not to damage the sural nerve (Fig. 1). Half the peroneus brevis tendon is harvested proximally, preserving its distal attachment. It is then routed through a horizontal anterior-posteriorly directed 4.5 mm drill hole in the lateral malleolus (Fig. 2). It is then passed

Department of Orthopaedic Surgery
Alexandra Hospital
378 Alexandra Road
Singapore 159964

M Cheng, MBBS, FRCS
Associate Consultant

K S Tho, MBBS, FRCS, FAMS
Consultant

Correspondence to:
Dr M Cheng
Tel: (65) 6379 3561
Fax: (65) 6379 3540
Email: mat_cheng@rocketmail.com

Fig. 1 The incision is as shown. Avoid injury to the sural nerve nearby (also shown).

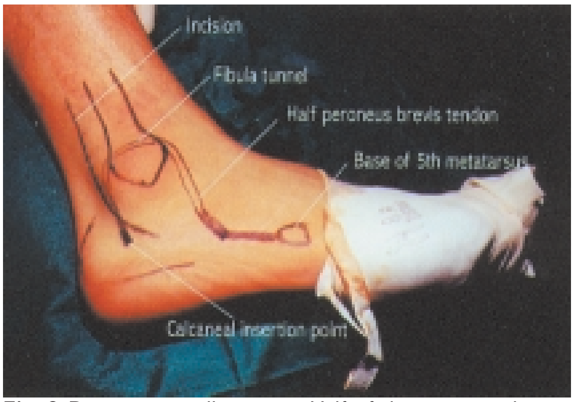

Fig. 2 Diagrammatic illustration. Half of the peroneus brevis, originating from the base of the 5th metatarsus, is passed through the lateral malleolus and then onto the calcaneum, thus reconstructing the lateral ankle ligaments.

below the peroneal tendons and secured to the calcaneum through another bone tunnel. This bone tunnel at the calcaneo-fibular ligament insertion site is created by two 4.5 mm drill holes 1 cm apart on the surface but connected below. Finally, the tendon graft is tensioned with the ankle in neutral and stitched back onto itself.

Postoperatively, the patient was placed in a cast for four weeks before physiotherapy with graduated ankle motion and walking exercises were started. Increased activities and jogging were encouraged at two months.

Table I. Kaikkonen scoring system.

1. Subjective assessment of the injured ankle	
No symptoms of any kind	15
Mild symptoms	10
Moderate symptoms	5
Severe symptoms	0
2. Can you walk normally?	
Yes	15
No	0
3. Can you run normally?	
Yes	15
No	0
4. Climbing down stairs	
Under 18 seconds	10
18 to 20 seconds	5
Over 20 seconds	0
5. Rising on heel with injured leg	
Over 40 times per minute at 1 sec intervals	10
30 to 39 times	5
Under 30 times	0
6. Rising onto toes with injured leg	
Over 40 times per minute at 1 sec intervals	10
30 to 39 times	5
Under 30 times	0
7. Single-limb stance with injured leg	
Over 55 seconds	10
50 to 55 seconds	5
Under 50 seconds	0
8. Laxity of the ankle joint, anterior drawer	
Stable (</= 5mm)	10
Moderate instability (6-10mm)	5
Severe instability (>10mm)	0
9. Dorsiflexion range of motion injured leg	
>/= 10 degrees	10
5-9 degrees	5
<5 degrees	0

Assessment of results

All the patients were contacted for physical examination by the authors. This was done in the hospital or at the patients' home. The patients were reviewed with the Kaikkonen et al score (Table I).

The Kaikkonen rating score comprises nine elements. Three questions address symptoms (walking and running ability). One assesses functional stability (stair descending test). Two assess muscle endurance (rising onto heels and rising onto toes). One assesses balance (single limb stance on a 10 cm wide platform), and finally, two clinical measurements are taken (range of dorsiflexion, and ankle joint laxity by the anterior drawer test).

In the stair descending test, the patient descends 44 steps with soles placed flat on each step and is timed in seconds. Rising on heels is to be done at a rate of 60 per minute according to a metronome and

Table II. Beighton et al, Score for General Ligamentous Laxity[13].

Criteria	Left	Right
1. Little finger dorsiflexion >90deg	0 or 1	0 or 1
2. Thumb apposition to flexor forearm	0 or 1	0 or 1
3. Elbow hyperextension >10deg	0 or 1	0 or 1
4. Knee hyperextension >10deg	0 or 1	0 or 1
5. Trunk flexion, palms touching floor	0 or 1	
Total	0 to 9	

Table III. Break down of outcomes by categories tested.

	Ave of 15 patients	Max possible
Symptoms	11	15
Walking	15	15
Running	9	10
Staircase	10	10
Rising on heel	7.3	10
Rising on toes	8.7	10
Single-limb stance	8	10
Anterior drawer	9	10
Dorsiflexion	9	10

likewise on toes. A minimum of 1 cm free movement is required, and the maximum number of repetitions is recorded. Balancing is tested on a 10 cm wide platform and timed in seconds. Anterior drawer testing is done at 10 degrees of plantarflexion and graded as in Table I.

Out of a maximum of 100 points, a score of 85 and above was rated as excellent, 70 to 84 is good, 50 to 69 is fair, and less than 50 is poor.

Assessment of Generalised Ligamentous Laxity

Beighton's scoring (Table II)(13) was used to quantify the degree of generalised ligamentous laxity in the study group.

RESULTS

Results were obtained by physical examination and testing of the patients and a review of the case records.

From the case records, the average age at the time of operation was 22.1 years, ranging from 20 to 30 years. All were young adult males in physically active occupations. The majority were in military service; one was a chauffeur and one, a prison officer. All the patients had a significant history of traumatic inversion sprains and clinical evidence of chronic lateral ankle instability. Ten involved the right ankle and five the left. Four ankles had radiological evidence of lateral bone-ligamentous injury, seen as old small avulsion fractures of the lateral malleolus. Documented physiotherapy averaged four months. Surgery was done an average of 21.6 months after the first significant injury. Average operative time was 73.4 minutes. The average follow-up period (time from operation to the current review) was 35.3 months, ranging from 26 to 51 months.

At the time of review and examination by the Kaikkonen et al ankle stability score, 10 (67%) ankles achieved outcomes that were excellent, 4 (27%) good and 1 (7%) fair. No ankle had poor outcomes. All the patients felt that their ankles were "tightened" post operatively.

Two (13%) patients had superficial wound complications, which healed by two weeks. Six (40%) had a small 2 cm square area of hypoaesthesia near the distal operation scar site over the lateral foot.

Two (13%) patients had significant inversion sprains one year post-operatively. Thereafter, they reported ankle function deterioration.

The patients were assessed for generalised ligamentous laxity by the Beighton et al score (Table II). A score of five or more out of nine is accepted as abnormal laxity. This group of patients ranged from 0 to 8, the majority scoring 6 (mode = 6, mean = 4.6).

DISCUSSION

Ankle inversion sprains are common injuries in young athletes[1]. Inversion sprains cause varying degrees of damage to the lateral ankle ligaments. Despite treatment, up to 20 percent of patients develop chronic functional instability[2,3] which leads to recurrent inversion sprains, mechanical instability of the ankle joint, repetitive cartilage damage, and finally, degenerative joint disease[4]. Functional rehabilitation emphasises peroneal muscle strengthening, tendo-achilles stretching, and proprioceptive exercises. Taping and bracing[5] should be used in sports. When these measures fail and chronic instability occurs in normal day-to-day situations, surgery is indicated.

Surgical Pathology of Lateral Ligaments of the Ankle

The mechanism of injury of the lateral ankle ligaments in inversion ankle sprains is one of progressive inversion of the plantar flexed foot and ankle. As the injury progresses, the anterolateral aspect of the capsule is torn first, followed by sequential injury to the anterior talofibular ligament(ATFL) and the calcaneofibular ligament(CFL). The posterior talofibular ligament is rarely injured unless complete dislocation occurs. More than half of the patients may have combined injuries to both the ATFL and CFL and even the subtalar ligaments[6]. So it is important to repair the CFL as well (the Chrisman-Snook method reconstructs the CFL).

Anatomical Repair of Lateral Ligaments

More than 50 surgical procedures have been described for chronic lateral ankle instability. Brostrum[7] advocated anatomical repair and recognised the need to imbricate the lengthened lateral ankle ligaments, ATFL and CFL.

Reconstruction of Lateral Ligaments

The ATFL and CFL may not be clearly found and may be so frayed that they cannot be repaired, so various grafts have been used to reconstruct the lateral ankle ligaments. These include the plantaris, peroneus brevis, and extensor digitorum longus tendons, fascia lata, and periosteal flaps. Chrisman and Snook[8] modified the Elmslie procedure by using the split peroneus brevis tendon to reconstruct the lateral ankle ligaments. The rerouted peroneal brevis from the base of the 5th metatarsal base to the distal fibula attempted to simulate the original anterior talo-fibular ligament (ATFL) and the calcaneo-fibular ligament (CFL) is anatomically reconstructed. The ATFL is most commonly deficient leading to a positive clinical anterior drawer test. This ligament is difficult to reconstruct anatomically as the Wastson-Jones reconstruction does, requiring anchoring onto the talus. The Chrisman-Snook rerouting of the peroneus brevis from the base of the 5th metatarsus eliminates the anchoring required and though oblique to the ATFL, has an anteriorly directed restraining vector force resulting in its effectiveness. However, there is resultant ankle inversion limitations due to the anterior limb spanning the subtalar joint. Chrisman accepted this limitation of inversion as necessary and in patients with subtalar instability, this reconstruction is advantageous. Control of the subtalar joint is also advantageous in patients with subtalar instability, which is more common than previously thought[6].

Choice of Ankle Outcome Score

The Kaikkonen score[9] was chosen as it is relatively simple to perform, has excellent reproducibility and correlated well with ankle stability, differentiating normal from injured and excellent from fair or poor outcomes. The final total test score correlates with isokinetic ankle strength, subjective recovery, and subjective functional assessment[9]. It comprehensively includes symptoms, functional stability, muscle endurance, balance, range of motion and clinical ankle joint laxity. Different studies have used many ankle scoring systems, some involving many cumbersome tests and others, too patient subjective. We have used the Kaikkonen score and have found it easy to use, yet comprehensive, balancing patient symptoms with objective clinical and functional tests of ankle stability. It is hoped that more researchers will use this scoring so that fair comparisons can be made between studies.

Outcome

An analysis of this study (Table III), shows that the patients did not have problems with walking or running or the functional test of stair-descending. Anterior drawer laxity was improved and ankle dorsiflexion is not significantly decreased. Ankle dorsiflexion is necessary for squatting and other functional activities and rightly included in the Kaikkonen score. One patient had only 10deg ankle dorsiflexion post-op and felt that his ankle was very tight but was very satisfied with his ankle stability.

After totalling the nine subscores, the final Kaikkonen scores showed that 14 (93%) of the 15 ankles had excellent or good outcomes. This is similar to Snook's long term outcomes[10] and others[11,12] have also achieved more than 90% stability in patients with chronic ankle ligament laxity. Only one patient had a fair outcome and none had poor outcomes in this study.

Complications

The main critics of the Chrisman-Snook procedure argue that a direct repair described by Brostrom was equally effective and had fewer complications. William et al[14] compared 42 ankles randomised into two surgical groups; a Brostrom group of 22 and a Chrisman-Snook group of 20. Both operations provided good or excellent stability in more than 80% of the patients. However, more complications like wound and sensory deficits occurred in the Chrisman-Snook patients.

In our study, 2 (13%) patients had superficial wound complications, which healed by two weeks. Six (40%) had a small 2 cm square area of hypoaesthesia near the distal operation scar site over the lateral foot. These deficits however, did not result in any further problems for the patients. Out of 20 ankles with the Chrisman-Snook reconstruction, William[14] reported 5 (25%) with wound complications and 11 (55%) with sensory loss over the sural nerve distribution. Our patients were similarly affected but to a lesser extent. Care must be taken to preserve the branches of the sural nerve as far as possible during the procedure (Fig. 1).

The Brostrom repair is not without problems. Karlsson et al[17] had 20 (13%) out of 152 ankles with a fair or poor outcome. Of these 20 patients with fair and poor outcomes, three factors were consistently present: a history of at least 10 years of instability prior to surgery, generalised joint hypermobility, and repair of the ATFL alone. Thus the indications for a Chrisman-Snook reconstruction would include the afore-mentioned three factors, when the original frayed ligaments can not be easily identified for repair and when a previous Brostrom repair has failed[18].

Generalised Joint Laxity in Relation to Outcome

William[14] also reported 6 (30%) patients in his Chrisman-Snook group who complained that their ankles felt "too tight" and one of these patients developed painful iatrogenic flat foot, presumably due to over tightening of the ankle's lateral side. This patient underwent a second operation. As for ankle overtightness in our study, one patient had only 10 deg ankle dorsiflexion postoperatively and felt that his ankle was very tight but was very satisfied with his ankle stability. All other patients felt that their ankles were tighter postoperatively but none felt that the tightness was excessive. It is interesting to note that increased ligamentous laxity in our local Asian population may account for the lack of excessive tightness reported in the West after a Chrisman- Snook reconstruction[10,14]. Hyperlaxity was found in 17% of our local population[15] compared to 14.1% in the African[13] population and 10% in a Caucasion[16] population. The majority of our patients scored six out of nine on the Beighton score (range 0 to 8, mean = 4.6) and were therefor considered lax or hypermobile. Comparing the two largest outcome groups, the excellent outcome group had 8 (80%) patients with a Beighton score of five or more, with the remaining 2 (20%) patients scoring less than five. The good outcome group had no patients with a Beighton score of five or more and three patients scored less than five. This was signif cant (p=0.02) by the Chi square test, suggesting that better outcomes occurred in patients with ligamentous laxity.

CONCLUSION

The Chrisman-Snook reconstruction procedure is consistently effective for correcting chronic ligamentous laxity in young active patients, particularly when the original, frayed ligaments can not be easily identified for repair. One must be very wary of sural nerve injury during this procedure. This procedure may be particularly relevant in our local Asian population as complications of excessive tightness are minimised by the larger proportion of individuals with hyperlaxity.

REFERENCES

1. Jackson DW, Ashley, RD, Powell JW. Ankle sprains in young athletes: Relation of severity and disability. Clin Orthop 1974; 101:201-15.
2. Freeman MAR, Dean MRE, Hanham IWF. The etiology and prevention of functional instability of the foot. J Bone Joint Surg 1965; 47B:679-85.
3. Boruta PM, Bishop JO, Brally WG, Tullos HS. Acute lateral ankle ligament injuries: a literature review. Foot and Ankle 1990; 11:107-13.
4. Harrington KD. Degenerative arthritis of the ankle secondary to long standing lateral ligament instability. J Bone Joint Surg (Am) 1979; A:354-61.
5. Balduini FC, Vegso JJ, Torg JS, Torg E. Management and rehabilitation of ligamentous injuries to the ankle. Sports Med 1987; 364-80.
6. Meyer JM, Garcia J, Hoffmeyer P, Fritschy D. The subtalar sprain. A rontegenographic study. Clin Orthop 1988; 226:169-73.
7. Brostrom L. Sprained ankles. Treatment and prognosis in recent ligament ruptures. Acta Chir Scand 1966; 132:537-50.
8. 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 and Joint Surg 1969; 51-A:904-12.
9. Kaikkonen A, Kannus P, Jarvinen M. A performance test protocol and scoring scale for the evaluation of ankle injuries. Am J of Sports Med 1994; 462-9.
10. 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 and Joint Surg 1985; 67-A:1-7.
11. Leach RE, Naiki O, Paul GR, Stockel J. Secondary reconstruction of the lateral ligaments of the ankle. Clin Orthop 1982; 226:169-73.
12. Riegler HF. Reconstruction for lateral instability of the ankle. J Bone and Joint Surg 1984; 66A:336-9.
13. Beighton P, Solomon L, Soskolne CL. Articular mobility in population. Ann Rheum Dis 1973; 32:413-8.
14. William L, Hennirkus, Randall, et al. Outcomes of the Chrisman-Snook & Modified-Brostrom procedures for chronic lateral ankle instability. Am J of Sports Med 1996; 400-4.
15. Seow CCD, Chow PKH, Khong KS. Ann Acad Med Singapore 1999; 28:231-6.
16. Grahame R. Hypermobility in healthy subjects. In: Scott JT, editor. Textbook of the Rheumatic Diseases. 5th ed. Edinburgh Livingstone. 1978; 635-7.
17. Karlsson J, Bergsten T, Lasinger O, et al. Reconstruction of the lateral ligaments of the ankle for chronic lateral instability. J Bone Joint Surg 1988; 70A:581-7.
18. Peters JW, Trevino SG, Renstrom PA. Chronic lateral ankle instability. Foot Ankle 1991; 12:182-91.