ABSTRACT

Purpose. To review the outcome of the modified Brostrom-Evans-Gould technique in patients with chronic lateral ankle ligament instability.

Methods. Between August 2003 and June 2005, 20 men aged 19 to 35 (mean, 23) years with chronic lateral instability affecting 21 ankles, underwent the modified Brostrom-Evans-Gould technique by a single surgeon. The mean follow-up period was 12 (range, 6–20) months. Patients were assessed preoperatively and postoperatively using the Kaikkonen Ankle Scoring Scale.

Results. Preoperatively, all patients had poor scores (<50). Postoperatively, 17 (81%) of the ankles attained excellent scores (85–100) and 4 (19%) attained good scores (70–84).

Conclusion. The modified Brostrom-Evans-Gould technique appears effective for chronic lateral ankle ligament instability, particularly in the Asian population with a higher prevalence of generalised joint hyperlaxity.

Key words: joint instability; lateral ligament, ankle; recurrence

INTRODUCTION

Ankle sprains are common, particularly in athletes. Those involving the lateral ligamentous complex of the ankle constitute 85% of all such sprains. The anterior tibiofibular ligament is damaged 3 times more commonly than the calcaneofibular ligament, due to (1) the injury mechanism (the ankle is usually plantar flexed during the inversion strain) and (2) the relative weakness of the anterior talofibular ligament as compared with the calcaneofibular ligament.

Though most patients recover well with conservative treatment and rehabilitation, 10 to 20% develop chronic instability caused by repeated inversion injuries, resulting in pain, swelling,
tenderness, and sometimes bruising over the lateral ligament.\textsuperscript{5,6} Many patients may be asymptomatic between recurrences, while others have persistent pain, tenderness, and swelling.

The recurrence rate for lateral ankle sprains can be as high as \textasciitilde 80%.\textsuperscript{7} Healing of the torn ligament with weak fibrous tissue or in an elongated fashion could account for chronic instability.\textsuperscript{8} So too could proprioceptive deficit, peroneal muscle weakness, and instability of the subtalar joint.\textsuperscript{9,10}

Surgery is indicated when conservative management fails to produce a satisfactory functional outcome. Surgeries are classified as either anatomical reconstructions using direct repair or non-anatomical reconstructions by tenodesis procedures. The modified Brostrom-Evans-Gould technique is a hybrid of both. It involves shortening and imbricating the damaged elongated lateral ankle ligaments.\textsuperscript{11} Gould\textsuperscript{12} modified the procedure by mobilising the ankle inferior extensor retinaculum and suturing it to the distal fibula over the ligamentous repair. This reinforces the repair and limits inversion. The Evans procedure involves anchoring of the peroneus brevis tendon to the fibula, thus limiting inversion of the foot.\textsuperscript{13}

We aimed to review the outcome of the modified Brostrom-Evans-Gould technique used in patients with chronic lateral ankle ligament instability.

**MATERIALS AND METHODS**

Between August 2003 and June 2005, 24 male patients aged 19 to 35 (mean, 23) years with chronic lateral ankle instability (one injured bilaterally, 11 and 12 injured the left and right ankles, respectively) underwent the modified Brostrom-Evans-Gould procedure by a single surgeon. The indications for surgery were based on symptoms, physical examination including anterior drawer test, varus tilt test, and tenderness over the lateral ankle.

All patients had a history of repeated ankle sprains and a preceding traumatic ankle inversion injury and at least 3 months of preoperative physiotherapy (most were in military service). Radiographs did not reveal any bony avulsion or osteochondral fracture.

Under either regional or general anaesthesia, patients were placed in a lateral position, with the leg prepared and draped and a tourniquet was applied. A 5 to 6 cm curvilinear incision was made posterior to the lateral malleolus, taking care not to damage the sural nerve (Fig.). The anterior talofibular ligament was exposed by dissecting the anterior tissues to access the front of the ankle. The transverse ligament was cut and double-breasted with a periosteal flap over the anterior fibula. The peroneus brevis tendon was isolated, with the proximal half divided and split for 5 cm and passed through an oblique-anteroposteriorly directed drill hole. The tendon graft was tensioned with the ankle in a neutral position and then tenodesed to the lateral malleolus. The anterior Brostrum repair was further reinforced with the inferior extensor retinaculum (Gould procedure).

Postoperatively, the patient was placed in a well-padded posterior plaster backslab with the ankle held in a neutral position with slight eversion. After 2 weeks, the stitches and the backslab were removed. A fibreglass short-leg walking cast was applied for a further 4 weeks. Then, the cast was removed and a rehabilitation programme lasting 2 to 3 months was initiated. This included active ankle range of movements and muscle strengthening exercises, and progressed to more vigorous activities such as brisk walking.

Four patients (involving 4 ankles) who did not have any major complications and were apparently satisfied with the outcome were lost to follow-up. The remaining 20 patients (involving 21 ankles) were followed up for 6 to 20 (mean, 12) months and their preoperative and postoperative Kaikkonen Ankle scores assessed.

The Kaikkonen Ankle Scoring Scale\textsuperscript{14} comprised 9 parameters: 3 in subjective assessments (symptoms, ability to walk and run), one in functional stability (walking down a staircase), 2 in muscle strength (rising on heels and toes), one in balance (balancing on a square beam), and 2 in physical function (range of movement in dorsiflexion and ankle laxity by
anterior drawer test). Scores of 85 to 100 are rated as excellent, 70 to 84 as good, 50 to 69 as fair, and <50 as poor (Table). The final score correlates significantly with the isokinetic strength of the ankle, subjective opinion about the recovery, and subjective functional assessment.

**RESULTS**

19 patients (20 ankles) were satisfied with the outcome; one was dissatisfied due to stiffness. Preoperatively, all 21 ankles had poor Kaikkonen scores (<50): 19 presented with pain, 18 with swelling, one with stiffness, 10 with tenderness, and 15 with a sensation of ‘giving way’. Postoperatively, 17 ankles attained an excellent score and 4 a good score; none attained fair or poor scores (Table). Only 2 ankles had residual pain, 6 had some degree of stiffness, and 3 had the symptom of ‘giving way’. No ankle had any swelling or tenderness. Ten ankles had limited inversion but none had limited eversion. All patients had improvement in their Kaikkonen scores, experienced fewer symptoms, and were able to walk, run, and descend stairs normally. Ankle laxity was significantly improved. There were no problems with wound healing or infection when the cast was removed.

**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 anterior talofibular ligament is torn, followed by the calcaneofibular ligament. The posterior talofibular ligament, being the strongest of the 3 ligaments making up the lateral ligamentous complex, is rarely injured.\(^{15,16}\)

Initially, most ankle sprains are managed conservatively. Functional rehabilitation involves restoration of range of movement and strengthening of muscles, ankle foot orthoses, taping techniques as well as proprioceptive and coordination exercises. Despite treatment, 10 to 20% of the ankles develop chronic ankle ligament instability, for which surgery may be indicated. 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.\(^7\)
More than 60 different surgical techniques have been described for the treatment of chronic lateral instability of the ankle. Most are non-anatomical reconstructions, using all or part of the peroneus brevis tendon for tenodesis, by limiting physiological ankle and subtalar motion. The Watson-Jones, Chrisman-Snook, and Evans techniques are examples. The main drawback of tenodesis procedures is that the lateral ligaments are not reconstructed anatomically thereby restricting the postoperative range of movement, particularly dorsiflexion and movement of the subtalar joint. In addition, part or all of the peroneus brevis (an evertor that stabilises the distal ankle) is sacrificed, which risks decreasing eversion strength. Other possible disadvantages include: failure to control anterior talar translation and rotatory instability. Moreover, large incisions are required for tenodesis procedures, in comparison to direct anatomical repair. Despite good short-term results, some long-term studies indicate that normal mechanical stability is not restored, thereby predisposing to later degenerative changes.

Anatomic reconstructions using the ruptured ends of the ligaments to restore stability have gained popularity. Such repair was initially described by Brostrom and later by Gould and Karlsson. Success rates with good to excellent results ranged from 82 to 87%. These procedures avoid donor tendon sacrifice, are technically easier, restore normal anatomy, and confer greater anterior stability. However, they can be difficult, as margins of the torn ligament can be very tenuous and filmy. Gould reinforces the ligamentous repair by mobilising and suturing the inferior extensor retinaculum to the distal fibula. This limits inversion and stabilises the subtalar component. Poor results are mostly confined to patients with long-standing instability, generalised hyperlaxity, and a previous tenodesis procedure. The torn ligaments are often inadequate and not strong enough for anatomic reconstruction.

In view of the prevalence of generalised joint laxity in Asians (17% in a Singaporean population vs 10% in Caucasians vs 14.1% in an African population), we had assessed the optimal method of ligamentous reconstruction. 62 patients with chronic lateral ankle ligament instability for at least 6 months underwent either the Brostrom repair or the tenodesis procedure. In the former group, 86% of the patients without generalised ligamentous laxity achieved excellent or good functional results, and 14% attained fair results (due to subsequent stretching out and subtalar instability). Only 40% with moderate ligamentous laxity did well. In the latter group, 82% of the patients with generalised ligamentous laxity did well, but only 68% without generalised ligamentous laxity did so. 34% had fair results due to excessive tightness and restricted range of movement. Patients undergoing a Brostrom repair had better functional and cosmetic results. However, this procedure should be avoided in Asian patients with moderate generalised ligamentous laxity. Therefore, we decided to perform a modified Brostrom-Evans-Gould procedure in nearly all patients with chronic lateral ankle ligament instability. This confers greater stability than using the Brostrom’s repair alone. A modified Evan’s procedure using half of the peroneus brevis tendon harvested for tenodesis limits the postoperative decrease in the range of movement and eversion strength, as opposed to using the entire tendon.

CONCLUSION

The modified Brostrom-Evans-Gould technique appears effective for chronic lateral ankle ligament instability, and results in minimal complications and good surgical outcomes. The main incision is only 5 to 6 cm, thereby offering better cosmesis and less morbidity and pain. The procedure is relevant to Asian populations, as they have a higher prevalence of generalised joint hyperlaxity, which renders the standard Brostrom’s repair alone less effective.

REFERENCES