Tarsal Tunnel Syndrome: Case Study of a Male Collegiate Athlete

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Abstract:
A case of tarsal tunnel syndrome in a male collegiate lacrosse player is presented. The subject reported symptoms consistent with tarsal tunnel syndrome following two incidents of medial ankle sprain in one lacrosse season. Conservative treatment was successful following the first ankle sprain but failed to relieve pain and paresthesia in his heel and medial arch following the second injury. Laboratory tests provided an inconclusive diagnosis, and the subject underwent a retinacular release 5 months after the second ankle sprain. Following a 13-week rehabilitation program, the subject returned to full participation in his sport.

Article:
The multiple mechanisms of injury and often inconclusive diagnostic tests make tarsal tunnel syndrome a difficult injury to diagnose. This case study describes the onset and subsequent surgical correction of tarsal tunnel syndrome in a 22-year-old male intercollegiate lacrosse player.

The tarsal tunnel extends from the medial maleolus to the tarsal—navicular junction on the medial aspect of the ankle. The tunnel floor is comprised of the medial surfaces of the talus, the calcaneus, and the sustentaculum tali and is covered by the flexor retinaculum (3). The tibial nerve, the posterior tibial artery and vein, and the tibialis posterior, flexor digitorum longus, and flexor hallucis longus tendons all pass through the tarsal tunnel. Tarsal tunnel syndrome results from the compression of the contents of the tunnel. Symptoms include tingling, burning, pain, or paresthesia along the medial border of the sole of the foot and great toe. As the symptoms progress, sensory deficits along the distribution of the medial and lateral plantar nerves are common (1-3) (Figure 1).

Several intrinsic, space-occupying lesions have been identified as causes for tarsal tunnel syndrome including ganglions, varicosities, lipomas, tenosynovitis,

FIGURE 1 IS OMITTED FROM THIS FORMATTED DOCUMENT

fibrosis, and synovial hypertrophy. In addition, several extrinsic factors place trauma and tension across the flexor retinaculum. A hypertrophic flexor hallucis tendon or pronation and subtalar

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eversion can stretch the flexor retinaculum and cause a narrowing of the tunnel (3, 5). These causes are especially prevalent in runners (3).

CASE STUDY

Subject

The subject for this case study was an intercollegiate lacrosse player (age = 22 years, height = 5 feet 8 in., weight = 160 lb) who was treated from February 1, 1995, to January 1996.

History

The athlete initially reported to the clinic with a mild eversion ankle sprain. Initial treatment consisted of ice, compression, and elevation, which were followed by a progression of therapeutic exercises including ankle range of motion, calf stretching, elastic band resistance, and balance and proprioceptive training. The athlete returned to competition on the following day with the aid of ankle taping. Following several days of participation, the injury became progressively worse. Diagnostic tests included radiographs and magnetic resonance imaging (MRI). Radiographic findings were normal. The MRI showed inflammation around the tibialis posterior tendon. Due to the worsening of the injury, a regimen of anti-inflammatory medication, contrast bath, moist heat, ultrasound, progressive resistive tubing exercises, and stretching was initiated. Three weeks of rest were also provided during the course of the rehabilitation, at which time the athlete was fitted with custom orthotics (Foot Management, Inc., Pittsville, MD). Following this 3-week rest, the athlete returned successfully to full participation in his sport for 10 weeks. Initially, the ankle was taped for practice and games but this was discontinued over time. On May 14, 1995, the athlete suffered another mild eversion ankle sprain and subjectively reported that his cleats "stuck to the turf." The timing of the reinjury presented a dilemma for the athlete and medical team, as the NCAA final four lacrosse tournament was 7 days from the time of reinjury.

Symptoms of the injury during the week preceding the NCAA tournament included pain from the heel to the medial longitudinal arch. Treatment consisted of a resumption of anti-inflammatory medication, moist heat, ultrasound, and rehabilitative exercises. After his team lost the semifinal game, the athlete traveled to Europe for a 6-week respite from lacrosse.

Upon return to the university in the fall of 1995, the athlete reported feeling no improvement in the ankle. Symptoms were exacerbated by running and included a numbing pain from the heel to the medial longitudinal arch with noctparesthesia of the toes. A second MRI and electromyography (EMG) were performed and showed only inflammation of the posterior tibialis tendon. The EMG was negative, although this test has questionable sensitivity in diagnosing tarsal tunnel syndrome (3).

After attempting to return to participation, the athlete sought a second medical opinion from an orthopedic surgeon. Based on the history and clinical presentation of the injury, the orthopedic surgeon diagnosed tarsal tunnel syndrome and recommended surgical intervention to release the nerve entrapment within the tunnel. The surgical procedure consisted of a release of the tarsal retinaculum on October 27, 1995.

Postsurgical Rehabilitation

The athlete reported to the clinic on postoperative day 3 with a posterior plaster splint and physician's orders to be non—weight bearing for 2 weeks. Treatment at this point consisted of ice. Sutures were removed 2 weeks postsurgery with orders to continue ice therapy, begin gentle range of motion exercises and isometric resistance, and gradually increase to one-half weight bearing on one crutch (Table 1). Full weight bearing was accomplished within 3 weeks postsurgery. During the third week postsurgery, the athlete began Kinetic Ankle Trainer (KAT) (Breg Inc.,

Postop week	Treatment	
1–2	Non–weight bearing Ice	
3	Cast removed 1/2 weight bearing Gentle PROM/AROM	Ankle isometrics: plantar flexion, dorsiflexion inversion, eversion
4	Full weight bearing Full AROM all planes; circles Toe curls: towel with 2-1/2 lb weight Scar mobility Weight shift in parallel bars	Pool exercises: mini-squats, aqua-jogging, backward, forward walk Towel stretch to dorsiflexion KAT board ROM in sitting
5	Single-foot balance: KAT board Pool: carioka, lateral shuffle D/C isometrics	T-band: plantar flexion, dorsiflexion inversion, eversion 4-in. box: mini-squats, step-overs, step downs
6–7	Walking; carioka, backward, lateral shuffle Treadmill: speed walking 2% grade Jogging (Week 7)	

Note. PROM = passive range of motion; AROM = active range of motion; D/C = discontinue.

Vista, CA) board training in the sitting position, passive range of motion exercises with a towel, active range of motion exercises, towel pulls on a tile floor, scar mobility, and weight shifting to the involved side on parallel bars (front to back and side to side). Mobility activities in a pool at chest-high water level, including backward and forward walking and mini-squats, and aqua-jogging in a deep tank were initiated 4 weeks postsurgery along with ankle board stretching for the triceps surae and involved-leg knee flexion and extension progressive resistance exercises (PRE).

During Week 5 postsurgery, single-foot balance excursion, weight bearing on the KAT board, single-foot mini-squats, and lateral step-ups, step-downs, and step-overs with a 4-in. box were added to the dry land program; Theraband resistance in plantar flexion, dorsiflexion, inversion, and eversion replaced the isometric exercises. The pool program was progressed by adding carioca and lateral shuffle exercises. Mobility exercises including backward walking, lateral shuffle, and carioca were completed on land, and speed walking was begun on a treadmill at a 2% grade during Week 6 postsurgery. This protocol was maintained through Week 7 postsurgery. Light treadmill jogging commenced at the end of Week 7 postsurgery, and the athlete then left for holiday vacation for 3 weeks. While the athlete was at home, running progressed to 6 min of jogging at a comfortable pace to carioca and

Table 2 Running Progression

Postop week	Monday/Friday	Tuesday/Thursday
7	Jog 4 min	Jog 1/2 speed
	Lateral shuffle 4 × 40 yd	Carioka 4 × 40 yd
	Backward	Backward
	Figure 8s	Suicides 4 × 40 yd (1/2 speed)
8[a]	Jog 6 min	Jog 3/4 speed
	As above	As above
9[a]	Jog 8 min	90% speed
	As above	As above
	4 × 40-yd-diagonal cones	4 × 40-yd diagonal cones
	Cones 5 yd apart, 5 yd wide	
	(replacing figure 8s)	
10	No running: Secondary to adhesion tearing	
11	Week 11 program resumed at 3/4 speed	
12–13	Week 11 program at full speed	

Program completed independently by athlete.

figure-eight running, backward walking, and 40-yard side shuffles at three-quarters intensity (Table 2), The mobility and running activities were performed 3 days per week with duration increased progressively to 10 min.

The rehabilitation activities continued until the athlete reported a sharp pain in the medial ankle during and after an episode of running in the 10th postoperative week. The athlete presented with ecchymosis along the posterior longitudinal arch and nonpitting inflammation. This was treated with ice and suspension of running activities for 5 days. This event was attributed to a disruption of scar adhesions, Rehabilitation activities resumed gradually after the 5-day period. Upon the athlete's return to school in January 1996, treatment included pulsed ultrasound, aggressive transverse friction massage to the area of the scar, and resumption of balance activities and Theraband resistance exercises (Postop Week 11). Running and mobility exercises were also resumed at three-quarters speed on a flat indoor surface with the addition of zig-zag cutting.

Running and mobility exercises progressed to full speed 1 week after the athlete's return to school (12 weeks postsurgery). The athlete was cleared for full and unrestricted participation in intercollegiate lacrosse 13 weeks postsurgery. His return has been successful and at an elite level of participation.

DISCUSSION

The symptoms that accompany tarsal tunnel syndrome vary significantly from patient to patient, Manifestation of symptoms depends on the site of the lesion, duration of compression, and mechanism of injury. This subject noted symptoms of paresthesia in the heel and medial arch along the medial plantar and medial calcaneal nerve sensory distribution.

It is not unusual for tarsal tunnel syndrome to follow a traumatic episode, such as the two medial ankle sprains that the subject sustained prior to surgery. Radin (11) observed that 27 of 88 (30.7%) reviewed cases followed this type of traumatic incident. In these instances, the trauma is believed to cause hemorrhage within the tunnel and the formation of scar adhesions surrounding the nerves (3).

The differential diagnosis for tarsal tunnel syndrome is difficult due to the similar presentation of other injuries and the inconclusive nature of diagnostic tests. In nontraumatic episodes of tarsal tunnel syndrome, the symptoms may resemble those of plantar fasciitis, intermittent claudication, or interdigital neuroma, to name a few (1-3, 5). The traumatic cases are often confounded by symptoms similar to acute ankle sprain or reflex sympathetic dystrophy (5). Since the symptoms of nerve compression are usually manifested with activity, it is reasonable to consider the symptoms as the residual effects of the sprain.

EMG and nerve conduction velocity (NCV) studies can help confirm a diagnosis of tarsal tunnel syndrome. Abnormal EMG wave forms as well as terminal latency or decreased amplitude of evoked electrical potentials are characteristic of the syndrome. However, Oh et al. (8) and Johnson and Ortiz (4) noted these characteristics in only 52.4% and 62,5% of tested subjects, respectively. Diagnosis with NCV is more effective and has been reported to be as high as 90.5% (8). Because the sensory fibers are believed to be affected sooner than the motor fibers, sensory NCV tests are generally superior to motor exams (1, 7-9, 11). As was the case with this subject, a positive case of tarsal tunnel syndrome is not always accompanied by a positive electrodiagnostic test, As a result, these tests should be used only to confirm, not diagnose, tarsal tunnel syndrome.

MRI is a proven method for diagnosing tarsal tunnel syndrome. Erickson et al. (2) found MRI to be an effective method for locating the site of a lesion within the tarsal tunnel. In their study, the mechanical cause of the symptoms was correctly diagnosed in six out of six cases. Kerr and Frey (7) had similar success by diagnosing the presence and extent of a lesion in 17 of 19 cases. In both MRIs performed on our subject, inflammation of the tibialis posterior tendon within the tunnel was identified. Regardless of the diagnostic technique, the possibility of tarsal tunnel syndrome must be suspected from the onset of symptoms to ensure an accurate diagnosis.

Our subject underwent surgery 5 months after the second onset of symptoms. This course was only exercised after a conservative protocol including rest, orthotics, exercise, and modalities was exhausted. In this case, the surgery and subsequent rehabilitation were deemed a success, because the subject returned to full participation in his sport. The success rate of surgery varies, Radin (11) noted a greater than 90% success rate after 12 weeks following a surgical release of the flexor retinaculum. Similarly, Kaplan and Kernahan (6) reported that of the 18 surgical cases studied, 9 noted "complete relief" and 4 were "improved" up to 12 months postsurgery. Conversely, Pfeiffer (10) reported that only 14 of 32 (44%) subjects surveyed 3 years after corrective surgery had an "excellent" or "good" outcome. According to Pfeiffer's study, it will be difficult to pronounce our subject's outcome as a success until 3 years postsurgery.

Following surgery, the emphasis of rehabilitation was to return the subject to presurgical levels of range of motion, strength, and functional activity. Special attention was given to scar mobilization, because the subject noted "tightness" in the area of the surgical incision throughout the rehabilitation process. This was an important issue, as the subject's injury during the 10th week postsurgery was believed to be a tear of scar tissue adhesions.

CONCLUSION

Tarsal tunnel syndrome is a difficult injury to diagnose. The possibility of tarsal tunnel syndrome must be suspected from the onset of symptoms to ensure proper management of the injury. In this case, inconclusive laboratory tests were followed by a surgical release of the flexor retinaculum. A 13-week rehabilitation program was undertaken to return the subject to full functional activity.

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