CHAPTER 1

PERONEAL TENDON DISORDERS: Preoperative and Intraoperative Decision Making

Andrea D. Cass, DPM
Craig A. Camasta, DPM
Simon E. Smith, B.Pod M.Pod

INTRODUCTION

Disorders of the peroneal tendons can present a challenge to the podiatric physician treating them, on both a conservative and surgical level. Although frank overuse injury and trauma are common culprits in peroneal tendon problems, there is often an underlying biomechanic or structural abnormality that exists. This aberrant anatomy is often osseous in nature and may lead to a foot and ankle that is prone to increased stress and strain on the peroneal tendons. Peroneal tendon disorders are commonly associated with variations of pes cavus deformities of the foot. Anterior cavus, forefoot valgus, a plantarflexed first ray, metatarsus adductus, and rearfoot varus are just a few foot types that have been implicated in a direct association with peroneal pathology.[1] These structural deformities put the peroneal tendons at a mechanical disadvantage by reducing their moment arm and increasing frictional forces at the lateral malleolus, peroneal tubercle, and cuboid notch.[2] This increase in mechanical stress can increase the risk of peroneal tendon pathology.

There is also a frequent association of peroneal tendon disorders with severe ankle sprains, ankle fractures and chronic ankle instability.[2] During inversion ankle injuries the peroneus brevis tendon may become impinged between the peroneus longus and the fibula, leading to tears. It is also not uncommon for patients to have peroneal tendon impingement and other peroneal tendon disorders after sustaining a calcaneal fracture with a lateral wall blowout. Abnormalities of the retromalleolar sulcus may also predispose the patient to peroneal tendon disorders, including subluxation of the tendons from this groove. This is often seen in association with an incompetence of the superior peroneal retinaculum. This subluxation may cause splits in the peroneus brevis as it subluxes around the posterolateral fibular border. A low-lying muscle belly of the peroneus brevis or the presence of a peroneus quartus muscle may lead to stenosis in the retromalleolar groove and result in tears of the peroneus brevis tendon.[2]

The detailed clinical examination of the patient with peroneal tendon disorders is crucial for the understanding of the etiology of the disorder. It will also help to guide surgical treatment if necessary. Isolated muscle testing of the peroneus longus and brevis muscles should be assessed along with the areas along the tendon that elicit tenderness. There is commonly warmth and edema overlying the peroneal tendons, as well as a palpable thickening of the tendons. An assessment of the lateral ankle ligaments should also be assessed with the anterior drawer and talar tilt stress tests, and compared with the contralateral side, since these disorders can be difficult to distinguish from lateral ankle ligamentous injuries. If signs or symptoms of lateral ankle instability are noted, this should also be addressed intraoperatively. Palpable clicking, snapping, or crepitus of the tendons with active dorsiflexion and eversion or circumduction of the ankle may indicate peroneal tendon subluxation.[2]

Special attention should be paid to the biomechanic function of the foot as well as any structural deformities that exist. The resting position of the heel should be assessed, specifically for a varus component of the rearfoot (Figure 1). The position of the forefoot in relation to the rearfoot should also be assessed for a plantarflexed first ray

Figure 1. A varus rearfoot is commonly seen in association with peroneal tendon disorders.

or forefoot valgus. A Coleman block test should be performed to determine if the rearfoot varus position exists independent of the forefoot position. Radiographic examination should include assessment of metatarsus adductus, anterior cavus, and rearfoot position. The position of the rearfoot and the amount of pronation that is occurring during gait is also important.

Conservative treatment of peroneal tendon disorders generally consists of various forms of immobilization and decreased activity. Anti-inflammatory medications have been shown to be effective, even in the absence of a true inflammatory process. Physical therapy that focuses on stretching, strengthening and proprioceptive exercises may be beneficial.[2] Functional orthotics may be necessary to control the various biomechanical components. Corticosteroid injections should be used with caution to avoid iatrogenic tendon rupture.

If patients do not respond to initial conservative measures, a magnetic resonance image (MRI) can be helpful to evaluate the extent of the tendon injury or other underlying etiologies. Fluid accumulation within the tendon sheath and tendon contour is best visualized in axial cuts (Figure 2). A peroneus brevis tear may appear as a C-shaped tendon or as increased intratendinous T-2 signal. Peroneus longus tears demonstrate a linear or round area of increased signal within the tendon.[2] It should be noted that even this in itself may be unreliable. It was recently shown by Kuwada[3] that MRI has a relatively low specificity for the diagnosis of peroneal pathology compared with other tendons around the ankle. So, although MRI is the best imaging technique for evaluating tendons, diagnosis should be based primarily on history and physical examination.

When operative intervention is considered, an understanding of the etiology of the disorder is of utmost importance in the treatment of this type of pathology. Isolated repair of the peroneal tendons may be warranted in conditions of significant peroneal tendinopathy where no overt biomechanic or structural deformity is present. This is the case in many overuse and traumatic injuries to the peroneal tendons. There also exist a number of patients with severe tendon pathology that is recalcitrant to conservative treatment that may also have a concomitant biomechanic problem that can be controlled with functional orthotics. This type of patient may benefit from isolated tendon repair and continued use of orthotics. When a patient has a significant structural deformity in addition to peroneal tendon pathology, this osseous component must also be addressed intraoperatively in order to prevent recurrence of the tendon problems.

ISOLATED TENDON REPAIR

More often than not, the extent of the pathology to the peroneal tendons cannot be fully appreciated until an intraoperative assessment is made. Patients are usually positioned in a lateral decubitus position. Incision placement is based on preoperative clinical and MRI findings, but usually extends along the course of the peroneal tendons, posterior to the fibula. The incision starts above the ankle and courses around the lateral malleolus (Figure 3). This may be

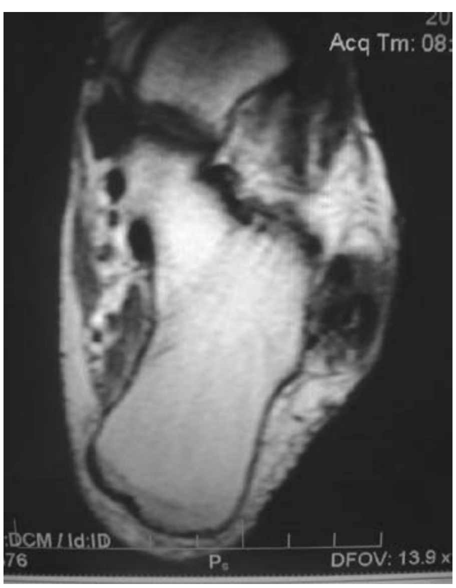

Figure 2. This axial T-1 MRI shows a large gray area indicating peroneal pathology as well as accumulation of fluid rather than the uniform black area seen in normal tendons.

Figure 3. The general incision to access the peroneal tendons is posterior to the fibula and parallel to the tendons. The proximal and distal extent of the incision will vary based on the pathology.

extended distally and proximally depending on the intraoperative findings and preoperative signs and symptoms. Care should be taken to avoid the sural nerve or to safely retract it and its branches when encountered (Figure 4).

The peroneal tendons share a common sheath starting approximately 4 cm proximal to the tip of the lateral malleolus. This should be incised to visualize the tendons (Figure 5). The peroneus longus tendon will be encountered first as this structure lies posterolateral to peroneus brevis. Often, opening of the sheath exposes a significant amount of synovial fluid or tenosynovitis surrounding the tendons. The appearance of this synovitic material is usually reddish-yellow in color and has a rubbery consistency. Increased vascularity of the tenosynovitis is indicated by the numerous small capillaries that can be seen woven around the synovial tissue (Figure 6). This inflammatory substance should be fully excised with care taken to preserve the surrounding sheath. It should be excised as far proximal and distal as possible.

Both tendons should be circumferentially examined. It should be mentioned that, with a few exceptions, the gross pathology of the peroneus brevis tendon is usually more remarkable than that of the peroneus longus tendon. Dombek et al found a peroneus brevis tear in 88% and peroneus longus tear in 13% of 40 patients treated operatively for a peroneal tendon tear.[4]

Healthy tendons have a pearly white appearance and a consistent tubular diameter along their course. If the peroneal tendons have a normal appearing diameter, but are yellowish in color, the authors have seen good results with use of the microcoblation radiofrequency (TOPAZ, Arthrocare; Sunnyvale, CA) as an isolated procedure

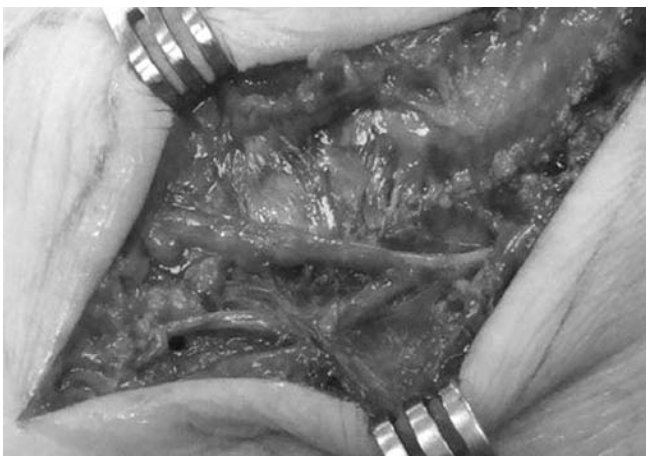

Figure 4. The sural nerve and its branches are commonly encountered and should be safely retracted to reduce postoperative neuritis.

Figure 5. The peroneal tendon sheath should be incised in a linear fashion, far enough posterior to the fibula to allow for repair of the sheath at the end of the procedure.

Figure 6. Synovitis is commonly encountered and should be excised as far distal and proximal as possible.

Figure 7. Early chronic inflammation without overt tears or hypertrophy are amenable to repair with use of the Topaz.

Figure 8. Intratendinous tears of the peroneus brevis and/or longus are commonly encountered and should be repaired if possible.

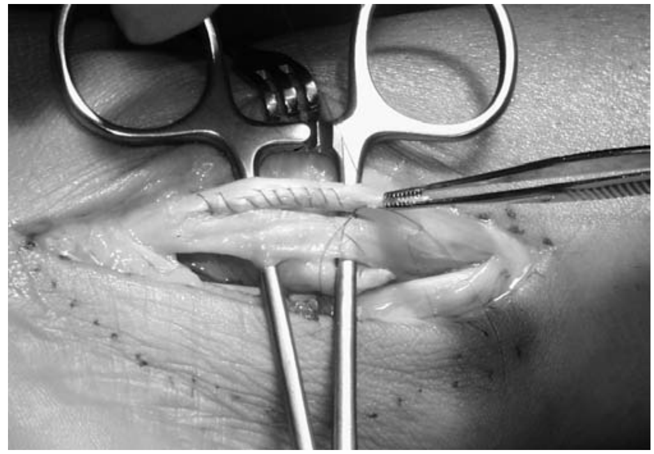

Figure 9. A 4-0 nylon suture is used to first reapproximate the inner portions of the tendon.

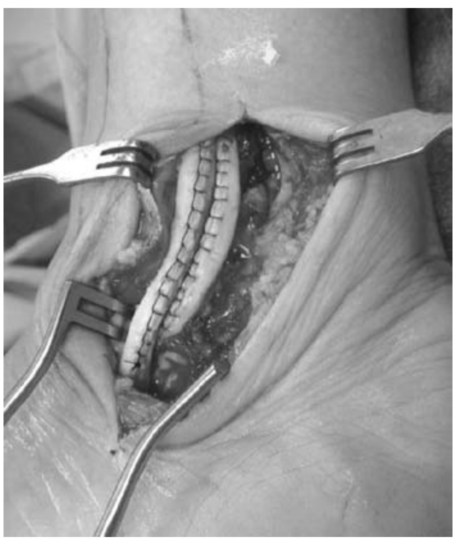

Figure 10. Once the tendon is brought together from the inside, further tubularization of the tendon is accomplished on the outside of the tendon, again using 4-0 nylon suture.

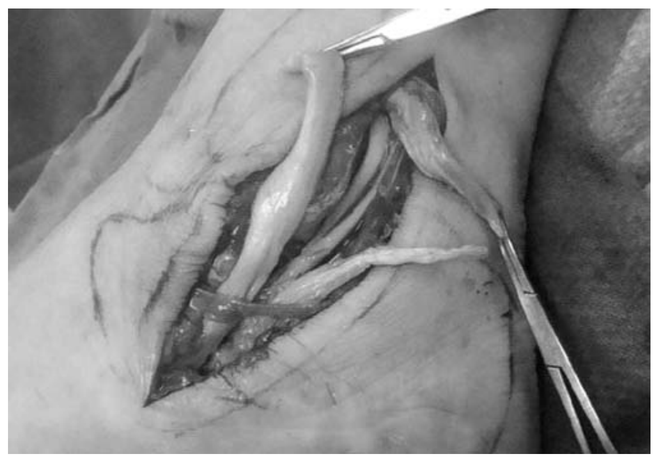

Figure 11. In this case the debridement of the hypertrophic peroneus longus tendon along with the multiple longitudinal tears in the peroneus brevis tendon resulted in significant compromise to both tendons.

(Figure 7). Theoretically, this will help to increase the vascularity necessary for the tendon to heal. If tears or hypertrophy of the tendons are noted, this needs to be addressed primarily because the TOPAZ will not reverse or correct this.

Tears of the peroneal tendons may appear in a variety of ways. Tendon healing occurs in a haphazard manner that may be clinically evident as hypertrophied tendon. The tendon should be debulked thoroughly until the size of the tendon is relatively normal. This will often reveal intrasubstance tears within the body of the tendon (Figure 8). Unhealthy appearing tendon should be debrided as much as possible without compromising the overall strength of the tendon. Once the tendon has been debrided, attempt should be made to restore the tubular structure of the tendon. It is recommended that an intratendinous running stitch be used to bring the inner portions of the tendon together (Figure 9). The authors use a 4-0 nylon suture for this purpose as it is felt that an absorbable suture will cause adverse inflammatory effects in an already avascular structure. Tubularization of the tendon is continued on the outside of the tendon, again with a 4-0 nylon running stitch (Figure 10). Less commonly, a flattened hypotrophic tendon may be encountered that also requires tubularization in a similar manner as mentioned above.

There is also an increasing popularity of utilizing xenografts to reinforce tendon repairs. It is important to remember that these grafts can act as scaffolding for the healing tendon but do not add strength to the tendon repair and should be reserved for significant voids. Generally, if the tendon pathology is so severe that debridement significantly compromises the strength of the tendon (Figure 11), anastomosis of the peroneus brevis tendon to the peroneus longus tendon is performed (Figure 12).

When a low-lying peroneus brevis muscle belly is encountered, this can be resected in the retromalleolar sulcus (Figure 13). If a peroneus quartus muscle is encountered it can be excised, which will allow a better gliding ability of the peroneus brevis and longus tendons as they course around the ankle.

Distal to the fibular malleolus, near the peroneal tubercle of the calcaneus, the tendon sheath divides as peroneus brevis courses superior and peroneus longus courses inferior to this structure. Hypertrophy of the peroneal tubercle is also implicated in peroneal tendon disorders. This can often be felt clinically on the lateral aspect of the calcaneus and observed on a calcaneal axial radiograph. This can restrict normal tendon gliding and should be addressed intraoperatively. Debulking of the tubercle is easily performed with hand instrumentation (Figures 14 and 15).

Although uncommon, peroneal subluxation may also need to be addressed intraoperatively. The literature discusses deepening of the fibular groove for correction of the subluxing peroneals. The authors find that this is rarely necessary and use a less aggressive approach. The procedure involves suturing the peroneal tendon sheath to the posterior periosteum of the fibula (Figure 16). This allows smooth gliding of the tendons while preventing the peroneal tendons from being able to sublux around the fibula.

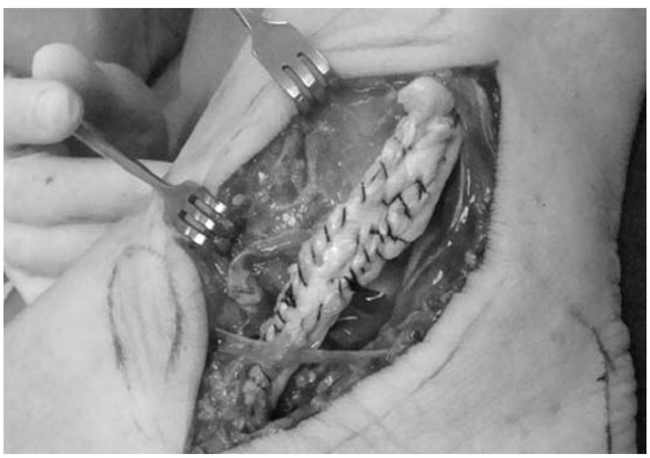

Figure 12. It was decided intraoperatively that anastomosis of the 2 tendons would result in the least detriment to the strength of each muscle.

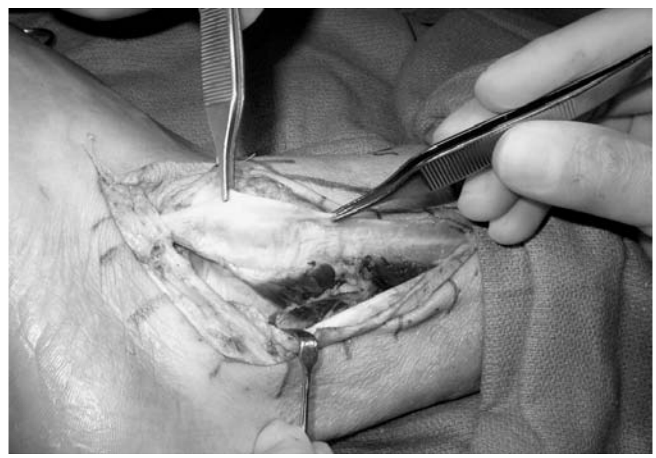

Figure 13. The peroneus brevis muscle belly extends to the level of the fibular malleolus. This can be excised to allow more room for the tendons in the retromalleolar groove.

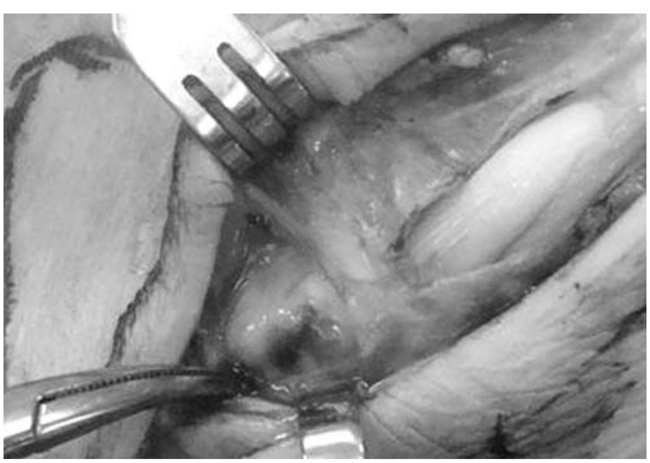

Figure 14. The end of the hemostat is pointing to a large, hypertrophic peroneal tubercle, resulting in tears of the peroneus longus tendon at this level.

Figure 15. Hand instrumentation was used to resect the prominence of the peroneal tubercle.

ADDRESSING THE OSSEOUS DEFORMITIES

In the surgical correction of peroneal tendon disorders, emphasis should be put on correction of any concomitant osseous deformity that is contributing to the pathology. The peroneal tendon disorder will not resolve with isolated repair if the osseous component is not addressed. Tendon repair is usually performed after the osseous procedures so that the tendons are put under the proper amount of tension.

Rigid Rearfoot Varus

When a nonreducible rearfoot varus deformity is present independent of the position of the forefoot, a Dwyer calcaneal osteotomy can be performed. The patient can be kept in a lateral decubitus position and the same incision may be used to access the lateral wall of the calcaneus (Figure 17). A 1-cm laterally based wedge of bone is removed from the calcaneus just inferior and posterior and parallel to the peroneus longus tendon.[1] Staples or a screw may be used for fixation (Figure 18).

Plantarflexed First Ray

When the Coleman block test reveals a neutral rearfoot independent of first ray influence (Figure 19), a dorsiflexory wedge osteotomy (DFWO) of the first metatarsal is performed. This will correct the forefoot plantarflexion and rearfoot varus alignment of the foot. A DFWO may also be necessary in severe cavus foot deformities in combination with a Dwyer or Cole osteotomy if the desired correction is not achieved with an isolated procedure. The patient should be turned into a supine position after the peroneal tendon repair is performed. A dorsomedial incision is made over the proximal aspect of the first metatarsal. A dorsally based wedge of bone is removed from the proximal one-third of the metatarsal, with care taken to not violate the plantar proximal cortex or the first metatarsal cuneiform joint. Fixation is afforded with a small cortical screw from dorsal to plantar (Figure 20).

Anterior Cavus

In the presence of a rigid cavus foot with the apex of deformity in the midfoot (Figure 21), a Cole osteotomy can be performed. A 2-incision approach is used to access the dorsolateral aspect of the cuboid and dorsomedial aspect of the navicular cuneiform joints. A 1-1.5-cm dorsally based wedge is removed from cuboid and navicular cuneiform joints (Figure 22). Fixation is afforded with 3 staples fashioned from 0.045-inch Kirschner wires. Two are inserted medially and 1 laterally. Care should be taken to avoid cutting or inserting fixation into the neighboring joints. On occasion, as mentioned above, a DFWO needs to be performed in addition to a Cole when correction of a plantarflexed first ray is not achieved (Figure 23).

Metatarsus Adductus

Patients with metatarsus adductus are also noted to have peroneal tendon disorders and lateral ankle instability. In an adult, this osseous deformity is often difficult to control with functional orthotics. If addressed surgically, the authors use a three incision approach to perform closing base wedge osteotomies of metatarsals 1-5 (Figure 24).

POSTOPERATIVE COURSE

The postoperative course is similar for isolated soft tissue repairs as those with concomitant osseous procedures. Non-weight bearing for 4 to 6 weeks is generally recommended. If an osseous procedure was performed, radiographic evidence of healing should be observed prior

Figure 16. The authors suture the tendon sheath to the periosteum of the posterior fibula, preventing the ability of the peroneal tendons to sublux around the fibula.

Figure 17. The posterior body of the calcaneus is exposed by reflecting the peroneal tendons anteriorly. A periosteal incision is made in the calcaneus in line with the desired osteotomy.

Figure 18. Postoperative radiograph after Dwyer osteotomy with staple fixation.

Figure 19. Coleman block test should be performed to determine if the rearfoot varus position is secondary to a plantarflexed first ray.

Figure 20. Radiograph showing the orientation of the DFWO and its fixation.

Figure 21. A typical lateral radiograph of a cavus foot with the apex of deformity in the midfoot.

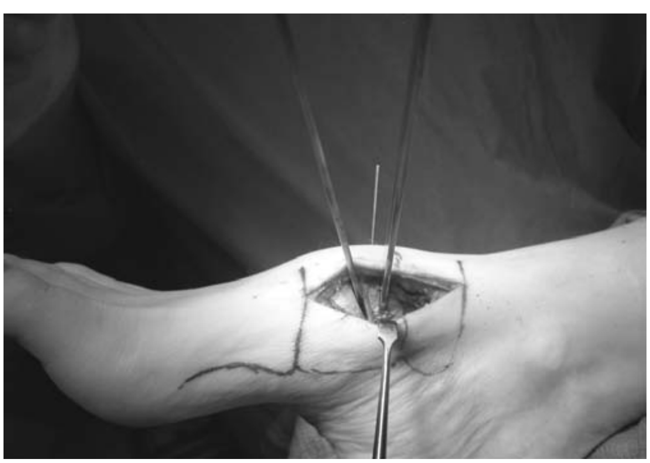

Figure 22. In a Cole osteotomy, a dorsally based wedge is removed from the navicular-cuneiform joints as well as the cuboid.

Figure 23. The Cole osteotomy is fixated with 3 staples. In this case, further correction was necessary and achieved with a DFWO.

Figure 24. The authors' preferred method for correction of metatarsus adductus in the adult is with 5 closing base wedge osteotomies

to attempting partial weight bearing. These patients are then transitioned into a walking boot for 2 weeks thereafter and can begin range of motion exercises outside of the walking boot. Once the patient is returned to normal shoegear, functional orthotics should be used to control any remaining biomechanic problems to prevent recurrence of the peroneal tendon disorder.

SUMMARY

The podiatric surgeon may encounter numerous types of intraoperative pathology when addressing peroneal tendon disorders. Although MRI can be helpful to locate the area of the pathology, primary surgical decisions should be based on preoperative signs and symptoms and intraoperative findings. The surgeon must also understand the etiology of the peroneal tendon pathology in order to fully correct the disorder. Underlying biomechanical and structural deformities that cause increased stress on the peroneal tendons must be addressed, either conservatively or surgically.

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