Foot & Ankle Tips & Tricks: Posterior Ankle Pain After Ankle Sprain: Bony and Soft Tissue Impingement

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Introduction

Ankle sprains are one of the most common musculoskeletal injuries in participants of a wide range of activity types and sports. Likely due to their high prevalence and favorable prognosis, ankle sprains are often regarded as benign injuries. However, these injuries can lead to persistent pain and functional compromise. The incidence of residual symptoms after an acute ankle sprain is variable but has been reported with rates of between 40% and 50% leading to decreased performance, absence from competition in sports, occupational absence and difficulties with activities of daily living.[1,2] Posterior ankle pain after ankle sprains has been less highlighted in the literature. Persistent posterior ankle pain can develop by overuse, repetitive plantar flexion, or a traumatic event, often combined with certain anatomic features, that can lead to impingement symptoms.

Pathoanatomy

Pathoanatomic features developing posterior ankle impingement can be divided into two categories: Bony structures and soft tissue structures. The bony structures responsible for posterior ankle impingement include os trigonum or Stieda's process, also known as trigonal process, of the talus. The incidence of os trigonum of talus has been reported between 5% and 11% but Peace et al reported a prevalence rate of 30% in ballet dancers.[3,4] This structure is usually asymptomatic, but it can become symptomatic after an injury, especially in individuals participating in sports requiring repeated ankle plantar flexion. A Stieda's (trigonal) process of the talus is an abnormal elongation of the lateral tubercle of the talus and may cause symptoms similar to os trigonum.

The soft tissue structures related to posterior impingement include tendon problems such as flexor hallucis longus (FHL) tenosynovitis, posterior ankle joint capsule injury, and posterior ligament injury. FHL tendon is a secondary stabilizer of the ankle when the ankle is in full plantar flexion. It traverses the fibro-osseus groove between the lateral and medial posterior talar tubercle. It then coursed under sustantaculum tali of the calcaneus. Because of this anatomic relation, repetitive plantar flexion places constant pressure on the FHL tendon leading to tenosynovitis. In the setting of FHL tenosynovitis, various symptoms including pain and the ankle instability may stimulate posterior ankle impingement. Posterior capsular or ligament injuries can occur from repetitive hyperplantar flexion of the ankle. This repetitive microtrauma promotes fibrosis and thickening of these soft structures.[5]

Furthermore, soft tissue posterior impingement can be divided according to the location of the impingement. Posteromedial impingement most commonly arises from repetitive inversion injury with the ankle plantar-flexed. In this setting, the hypertrophic fibers of the posterior tibiotalar ligament are entrapped in the posteromedial ankle gutter. An eversion injury including a tear of the posterior tibiotalar ligament is a less common mechanism of posteromedial impingement. Koulouris et al demonstrated that the hypertrophied ligament can come in contact with the flexor tendons and partially encase the tibialis posterior (40% of cases), the FHL (16%), or the flexor digitorum longus (8%). Accessory muscles can also be associated with posterior ankle pain but much less frequently. Peroneous quartus muscle is the most common of these muscles with a reported prevalence of 7% to 22%. Additionally, an accessory flexor digitorum longus and a low FHL muscle belly can also be sources.[6–8]

Diagnosis

The diagnosis of posterior impingement is based primarily on clinical history and physical examination. Typically, patients complain of chronic or recurrent posterior ankle pain that is associated with forced plantar flexion or push-off activities. For dancers, the pain usually develops when they are in a relevé position, whether full-pointe or demi-pointe. For kicking sports, such as soccer, pain occurs while kicking the ball that requires the ankle in a hyperplantar flexed position. Any history of injury or overuse of the

ankle joint must be considered. On physical examination, pain is usually deep and there is tenderness at the posteromedial or posterolateral aspect of the ankle. Posterior ankle pain that is reproduced with passive maximal planar flexion indicates posterior ankle impingement. This is known as a positive "plantar flexion test." If passive hallux dorsiflexion motion with the ankle held in full dorsiflexion reproduces pain, then FHL tendon abnormality such as tenosynovitis may also exist. Os trigonum or Stieda's (trigonal) process pain is more often posterolateral, whereas FHL tendon problems are more posteromedial.Athletes affected by posterior ankle pain tend to have inversion motion of the foot to compensate for the loss of plantar flexion. This may increase the risk of ankle sprains, calf strain, and toe curling.

Weight-bearing plain radiographs of the foot, anteroposterior, lateral, and oblique views should be obtained. A lateral radiograph is essential to detect the presence of an os trigonum and an acute or chronic fracture of Stieda's (trigonal) process. In addition to standard radiographs, a weight-bearing lateral radiograph with the ankle in maximum plantar flexion will be helpful in investigating the likelihood of posterior impingement. However, the presence or absence of os trigonum or Stieda's (trigonal) process on a plain radiograph may not necessarily suggest clinical symptoms.

Magnetic resonance image (MRI) may reveal bone marrow edema in the os trigonum or Stieda's (trigonal) process and signal changes of posterior ankle representing inflammation and scarring of the adjacent soft tissue. Other findings such as FHL tenosynovitis or chondral injury of the posterior talus can be detected on MRI. It also provides information to determine the origin of posterior ankle pain between bony and soft tissue impingement.[9,10] Dynamic ultrasound can be useful to further evaluate posterior ankle pain. It may provide valuable information about soft tissue versus bony impingement related to posterior ankle pain through its dynamic evaluation. FHL tenosynovitis with intrasheath fluid can be detected. In addition to finding pathoanatomic structures, a local anesthetic injection can be performed under the guidance of ultrasound, which may also have diagnostic value. Computed tomography is helpful to evaluate osseous structures causing posterior impingement and to identify the presence of nondisplaced or minimally displaced fractures. Zwiers et al reported a prevalence of 30.3% in patients without posterior impingement complaints with computed tomography imaging, which is more common than previously reported (Figure 1). [11]

Treatment

The initial treatment of posterior ankle pain after ankle sprain is nonoperative and have been shown to be effective. Nonsurgical treatment includes rest, ice, medication such as nonsteroidal anti-inflammatory drugs, and avoidance of activity requiring ankle plantar flexion. Corticosteroid and anesthetic injections are also options for symptomatic relief. Mouhsine et al reported that these injections provided pain relief in 84% of cases in their study.[12] Hedrick and McBryde demonstrated that such nonoperative treatment had a success rate of 60% for posterior ankle impingement in their over 10-year follow-up study.[13] They utilized ice, rest, anti-inflammatory medications and avoidance of forced plantar flexion and local steroid

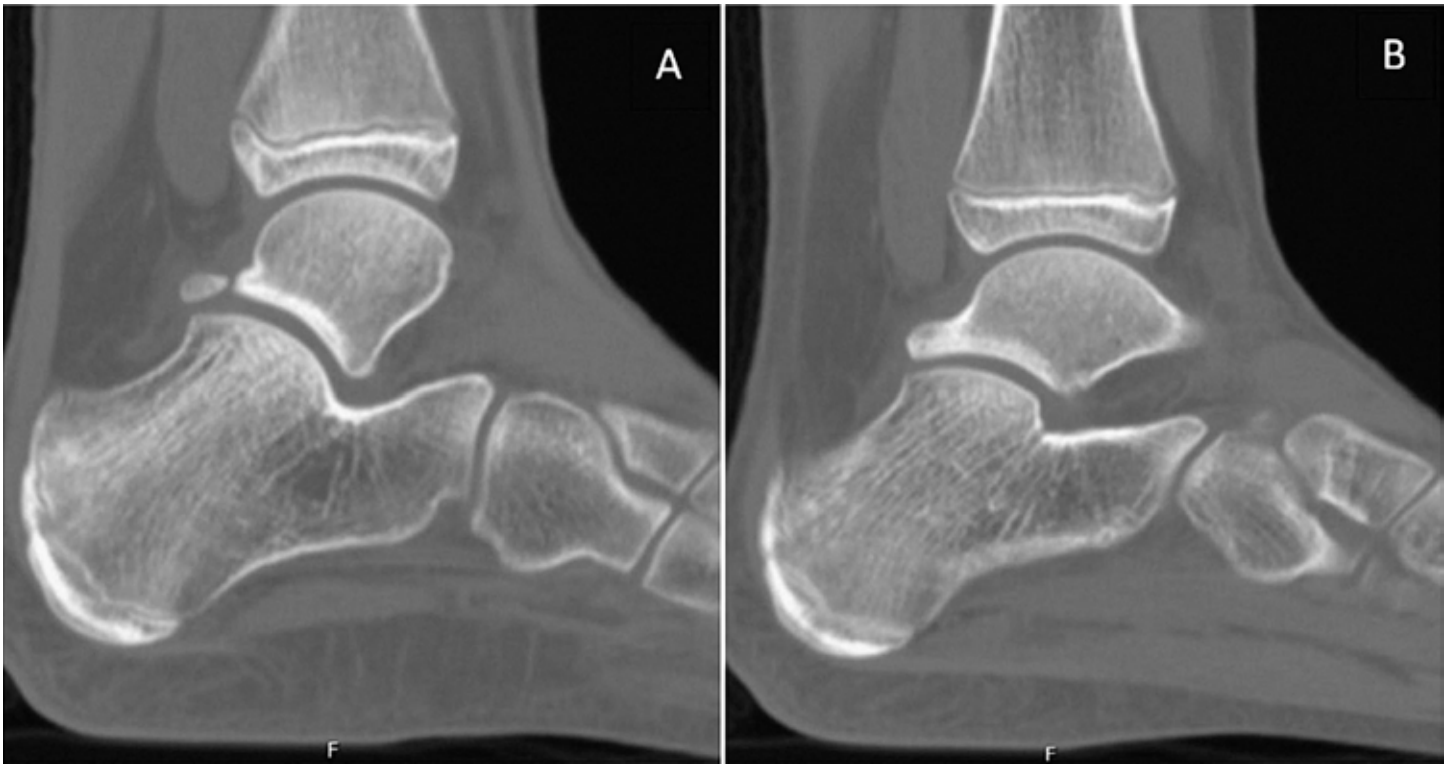

Figure 1. CT findings for posterior impingement. (A) Os trigonum of the talus; (B) Posterior process (also known as trigonal process) of the talus.

injection or temporary immobilization in a short leg walking cast in some individual cases. Albisetti et al described a nonsurgical treatment regimen for managing posterior ankle impingement in ballet dancers.[14] They restricted demi-pointe and en pointe work until the pain subsided and prescribing anti-inflammatory medication. Proprioception exercises can also strengthen and stretch the deep lower leg muscles. Nine out of 12 dancers returned to normal dancing and 3 underwent operative intervention. However, the authors indicated that it was not easy for professional athletes or dancers to take time off for conservative management. Coetzee et al suggested a treatment strategy for these professional athletes.[3]co A controlled ankle motion boot can help to treat the posterior ankle impingement if it is possible for the athlete to rest for a few weeks. Nonsteroidal anti-inflammatory drugs can be used at the same time. A dance rehabilitation program can start once the patient is able to walk pain free. They recommended a fluoroscopically guided cortisone injection if the flare-up occurs during performance season when taking time off is not possible.

Operative intervention can be considered if pain persists despite nonsurgical treatment, particularly in the athletes or dancers who want to continue training and performing. In addition, a study has shown that once there is a symptomatic osseous impingement, it seldom resolves completely without operative management. Open excision of an os trigonum is traditional and can be performed using a posteromedial or posterolateral approach. Hedrick and McBryde reported that open excision of a symptomatic os trigonum provided good to excellent results in 88% of patients in their case series.[13]

An open posteromedial approach can be used to manage posterior ankle pathology, including excision of os trigonum or Stieda's (trigonal) process. FHL tendon can be easily accessed with this approach, as many patients with posterior ankle impingement are dancers. For this approach, the patient is positioned supine with a bump under the opposite hip to externally rotate the involved leg. Most dancers have more external rotation than internal rotation in their hips, making positioning more difficult for a posterolateral approach. This is one of the advantages of using an open posteromedial approach in dancers. A thigh tourniquet is used. An incision is made centered at the os trigonum along the posteromedial ankle. The interval between flexor digitorum longus (FDL) tendon and the neurovascular bundle is used. The laciniate ligament is carefully incised. The neurovascular bundle is retracted posteriorly, and FHL tendon is identified. The sheath for the FHL tendon is routinely released to ensure that there is no stenosing tenosynovitis or impingement. If there is tenosynovitis or tear along the FHL tendon, tenosynovectomy is performed and tear of FHL is repaired. The FHL tendon is then retracted posteriorly to expose the os trigonum or Stieda's (trigonal) process. It is mobilized using a freer elevator and dissecting scissors from the surrounding tissue. The os trigonum is then removed. The Stieda's (trigonal) process of the talus is then excised using a narrow osteotome if needed. The ankle is then placed into full plantar flexion to confirm that there is no further evidence of impingement.

Some surgeons prefer the posterolateral approach as this approach is safer and easier than the posteromedial approach. The patient is in the supine position with a bump placed under the affected leg to provide adequate access to the lateral ankle. A thigh tourniquet is used. Incision is made behind the lateral malleolus. The sural nerve and its branches are carefully identified and pro- tected. An interval between the Achilles tendon and peroneal tendon is used. The posterior ankle capsule is incised, and os trigonum or Stieda's (trigonal) process are identified. They are resected completely using a freer elevator and osteotome. The FHL tendon needs to be assessed and careful inspection is required. If there is any pathology along the FHL tendon such as a low muscle belly, synovitis or nodules, or tear, then the tendon should be debrided and addressed adequately.

A third option is a posterior arthroscopy to manage posterior ankle pathology including os trigonum. The authors described their arthroscopic procedure with a step by step instruction. The procedure is performed in a prone position with 2 posterior portals: posterolateral and posteromedial. The posterolateral portal is made adjacent to the lateral border of the Achilles tendon at the level of the lateral malleolus; the posteromedial portal is created on the medial border of the Achilles tendon. An arthroscopic shaver is always with the blade facing away from the neurovascular bundle, lateral to FHL tendon. A pituitary rongeur is used to remove the os trigonum. With this arthroscopic approach, periarticular pathology such as calcification or scar tissue and pathology of the posterior ankle/subtalar joint can be diagnosed and treated. Arthroscopic procedure for posterior ankle pathology has demonstrated good results with low complication rates and early return to sports activities. Scholten et al also demonstrated that endoscopic treatment of posterior ankle impingement yielded satisfactory results comparable with the results of open surgery reported in the literature.

Comparison amongst the three procedures remains a challenge as there has not been a shared standardized outcome measurement applied all three techniques. There are only a few open surgery studies using the AOFAS scoring system. Most papers have their own nonvalidated rating system such as poor-fair-good-excellent. In 2010, Gou et al compared clinical outcomes and time to return to activity between open and endoscopic removal of the os trigonum. The posterolateral open approach was used, and the endoscopic technique described by Van Dijk was adopted in their study. They showed no difference between the 2 methods in clinical outcomes. However, patients who underwent endoscopic excision had a shorter time to return to previous sports.

Conclusion

Improper diagnosis and inappropriate treatment of posterior ankle impingement can result in persistent and chronic pain, resulting in reduced mobility and function in daily living activities and returning to sports. Posterior ankle pain is usually developed by an overuse injury or ankle trauma in patients performing repetitive forced plantar flexion

sports, often combined with specific anatomic features at the posterior talus that can cause bony and soft tissue impingement. Understanding clinical history and various causes of posterior ankle impingement is critical for proper diagnosis and proper treatment. Though most patients will improve with nonoperative management, surgeons have multiple approaches available that have shown to be effective if a patient's symptoms are refractory to medical management.

References

1. Gerber JP, Williams GN, Scoville CR, *et al.* Persistent disability associated with ankle sprains: A prospective examination of an athletic population. *Foot Ankle Int.* Epub ahead of print 1998. DOI: 10.1177/107110079801901002.

2. Smith RW, Reischl SF. Treatment of ankle sprains in young athletes. *Am J Sports Med.* Epub ahead of print 1986. DOI: 10.1177/036354658601400606.

3. Coetzee JC, Seybold JD, Moser BR, *et al.* Management of Posterior Impingement in the Ankle in Athletes and Dancers. *Foot and Ankle International.* Epub ahead of print 2015. DOI: 10.1177/1071100715595504.

4. N**ault ML, Kocher MS, Micheli LJ.** Os trigonum syndrome. *Journal of the American Academy of Orthopaedic Surgeons.* Epub ahead of print 2014. DOI: 10.5435/JAAOS-22-09-545.

5. Hamilton WG, Geppert MJ, Thompson FM. Pain in the posterior aspect of the ankle in dancers: Differential diagnosis and operative treatment. *J Bone Jt Surg - Ser A.* Epub ahead of print 1996. DOI: 10.2106/00004623-199610000-00006.

6. Regan TP, Hughston JC. Chronic ankle "sprain" secondary to anomalous peroneal tendon: a case report. *Clin Orthop Relat Res.*

7. Sobel M, Levy ME, Bohne WHO. Congenital Variations of the Peroneus Quartus Muscle: An Anatomic Study. *Foot Ankle Int.* Epub ahead of print 1990. DOI: 10.1177/107110079001100204.

8. White AA, Johnson D, Griswold DM. Chronic ankle pain associated with the peroneus accessorius. *CLINORTHOP.* Epub ahead of print 1974. DOI: 10.1097/00003086-197409000-00035.

9. Hillier JC, Peace K, Hulme A, *et al.* MRI features of foot and ankle injuries in ballet dancers. *Br J Radiol.* Epub ahead of print 2004. DOI: 10.1259/bjr/60447506.

10. Gursoy M, Dag F, Mete BD, *et al.* The anatomic variations of the posterior talofibular ligament associated with os trigonum and pathologies of related structures. *Surg Radiol Anat.* Epub ahead of print 2015. DOI: 10.1007/s00276-015-1428-5.

11. Zwiers R, Baltes TPA, Opdam KTM, *et al.* Prevalence of Os Trigonum on CT Imaging. *Foot Ankle Int.* Epub ahead of print 2018. DOI: 10.1177/1071100717740937.

12. Mouhsine E, Crevoisier X, Leyvraz PF, *et al.* Post-traumatic overload or acute syndrome of the os trigonum: A possible cause of posterior ankle impingement. *Knee Surgery, Sport Traumatol Arthrosc.* Epub ahead of print 2004. DOI: 10.1007/s00167-003-0465-5.

13. Hedrick MR, McBryde AM. Posterior ankle impingement. *Foot Ankle Int.* Epub ahead of print 1994. DOI: 10.1177/107110079401500102.

14. Albisetti W, Ometti M, Pascale V, *et al.* Clinical evaluation and treatment of posterior impingement in dancers. *Am J Phys Med Rehabil.* Epub ahead of print 2009. DOI: 10.1097/PHM.0b013e31817fa31d.