CHAPTER **37**

CUBOID SYNDROME

Thomas J. Chang, DPM
Arman A. Kirakosian, DPM

INTRODUCTION

Cuboid syndrome is characterized in many different journals and literature; however, the best working definition is a "minor disruption or subluxation of the structural congruity of the calcaneal cuboid portion of the midtarsal joint." This has been a problem along the lateral column, which has been described in many peer-reviewed journals including physical therapy journal, journals of sport medicine, and podiatric journals.

Cuboid syndrome is defined as a minor disruption or subluxation of the structural congruity of the calcaneocuboid portion of the midtarsal joint. The disruption of the cuboid usually irritates the peroneus longus tendon and the surrounding joint capsule, and ligaments. Approximately 4-5% of athletes present with this condition. And there are others like Jennings and Davies (2005) who reported that 6.7% of their patients who presented with plantar flexion and inversion ankle sprain were further diagnosed with cuboid syndrome. There are certain sports that predisposed to cuboid syndrome such as professional ballet dancers, which account for approximately 17% of all reported foot and ankle injuries. Marshall and Hamilton in 1992 reported that male ballet dancers with cuboid syndrome presented with an acute injury as a result of serious repetitive jumps where the foot is continuously pronated. In female ballet dancers, cuboid syndrome resulted from multiple microtraumas to the ligaments during the maneuver requiring maximum flexibility.

Cuboid syndrome is also referred to in the literature as subluxed cuboid, locked cuboid, dropped cuboid, cuboid fault syndrome, lateral plantar neuritis, and peroneal cuboid syndrome. Because of the inconsistent terminology, cuboid syndrome remains a poorly understood condition in both athletic and nonathletic populations. Most of the time cuboid syndrome is a mistreated and misdiagnosed condition.

ANATOMY

The cuboid is unique for the simple fact it is the only bone in the foot that articulates with both the tarsometatarsal joint (Lisfranc complex) and the midtarsal joint (Chopart's joint), and is the only bone linking the lateral column to the transverse plantar arch. Also the cuboid acts as a keystone of the rigid and static lateral column giving inherent stability to the foot. The cuboid is well secured in the lateral column by many ligaments, specifically the dorsal and plantar calcaneocuboid, dorsal and plantar cuboideonavicular, dorsal and plantar cuboideometatarsal, and the long plantar ligament. These ligaments are more taut dorsomedially than plantar laterally. Therefore, the calcaneocuboid joint will rotate around a medially positioned axis. When there is subtle cuboid movement, it is the proximal plantar medial edge of the cuboid that appears to drop downward.

ETIOLOGY

There are several proposed etiologies that may result in cuboid syndrome. The 2 that are the most consistent throughout the literature are plantar flexion/inversion ankle sprains and an overuse syndrome. Plantar flexion and inversion ankle sprains account for the majority of the cases. Some other factors include improper orthotics, uneven running terrain, faulty shoe, inversion ankle sprain, and pronated foot structure. These factors are not direct causes of cuboid syndrome but can increase the likelihood. The degree and direction of the force of the peroneus longus and the position of the subtalar joint are thought of as contributing factors in the etiology of cuboid syndrome.

A study in 2002 from the training program in Oakewood Downriver in Michigan reported that a painful lateral column can be seen after plantar fascia release. We discussed the fact that immediate weight bearing on any type of release of the plantar fascia can cause increased stress and strain along the lateral band of that fascia, which has been

seen with all the EPF procedures as well as with other lateral column issues. At this time, early weight bearing in the first week or so after plantar fascia release will cause increased strain in the area, in the past non-weight bearing for 3 weeks was standard after plantar fascia release. We did not really see much of a concern for lateral column pain that is evident now.

EXAMINATION

Blakeslee and Morris, in 1987 published a classic article regarding cuboid syndrome and described it on the midtarsal joint. Most of the time, this is a medial eversion of the cuboid where there is a frontal plane rotation in the medial portion of the cuboid drop plantar. This can cause irritation to the joint capsule but can also cause irritation along the peroneal tendons at the peroneal groove to hold the peroneus longus tendon to the first metatarsal base. We have seen this to be a concern with causing pain both at the calcaneocuboid joint and also the fourth and fifth metatarsal base cuboid joint. The peroneal tendons can be examined as well to see if there is secondary irritation to these structures. The peroneus brevis and longus can be isolated and usually the longus can have pain along the cuboid groove as was discussed earlier.

There are several reasons why the lateral column may hurt. This may be due to arthrosis along the lateral column joints as well as potential subluxation from sprains and injuries. Trauma can cause malposition of the cuboid, and the loading of the cuboid in the lateral column can also be determined by the foot type, which is going to cause a lot more stress along that area.

Patients will present with pain that developed quickly or gradually occurred over time as a sequela to an inversion ankle sprain. Pain is usually elicited over the cuboid and may radiate into the plantar medial arch or distally along the fourth metatarsal. If the subluxation is severe enough and a plantar subluxation occurs, a slight sulcus may be visible over the dorsum of the cuboid and a lump on the plantar surface. Pain and point of tenderness may be elicited over the extensor digitorum brevis muscle in the sinus tarsi and the region of the peroneal groove. However, if pain is located predominately over the calcaneocuboid joint, cuboid-fifth metatarsal articulations, or fourth and fifth metatarsal articulations an alternative diagnosis may be the case. The midtarsal adduction test can be performed by the clinician stabilizing the ankle and the subtalar joint with the right (proximal) hand, while the left (distal) hand applies the adduction force. Also, the midtarsal supination test can be performed where the clinician stabilizes the subtalar joint and ankle with right (proximal) hand, while the left (distal) hand applies the supination motion (inversion, plantar flexion, and forefoot adduction).

DIFFERENTIAL DIAGNOSES

Similar injuries can present the same way on the lateral column such as a Jones fracture, fracture of the anterior calcaneal process, tarsal coalition, peroneal and extensor digitorum brevis tendonitis, subluxing peroneal tendons, sinus tarsi syndrome, lateral plantar nerve entrapement, Lisfranc's injuries, stress fractures of the cubiod, meniscoid of the ankle, and malalignment of the lateral ankle and subtalar joints.

TREATMENT

Cubiod manipulation responds exceptionally well. Other methods of conservative treatment include therapeutic exercise, low-dye arch taping, and padding. The manipulation as described by Newell and Woodle in 1981 is termed as the "black snake heel whip" or "cuboid whip." Have the patient standing with the knee flexed to 90 degrees or lying in prone position with the knee flexed to approximately 70 degrees. The clinician must position the knee in flexion to reduce the stress of the gastroc and also to avoid stretching the superficial peroneal nerve. Immediately after the manipulation, ice needs to be applied to the lateral column to reduce pain and inflammation. The use of low intensity pulsed ultrasound is also warranted to facilitate collagen synthesis and should be increased to continuous ultrasound. A cuboid pad can be constructed using a piece of one-eighth to one-quarter-inch felt approximately one-and a half inches wide and measuring the distance from the calcaneocuboid articulation to the cuboid-fifth metatarsal articulation to determine the length, normally 2-3 inches. Make sure the pad does not extend past the styloid process of the fifth metatarsal, and it is then held in place by a low dye taping technique. Other treatments can include arthrodesis of the calcaneocuboid joint if all the other conservative modalities fail.

Dextrose injections can also be a form of soft tissue and joint stabilization. This has been described in prolotherapy articles and orthopedics and chiropractic journals and the goals are to stiffen at the capsular and strengthen the joint and hopefully minimize the chance of joint laxity and continue subluxations. This is done with sterile preparation and 1 cc injection of 50% dextrose to the calcaneocuboid joint. There has also been discussion by Weinheimer and Christansen of heating the capsule or capsular shrinkage from a thermal imbrication treatment for chronic joint instability. There are also options of stabilizing the joint; the

most direct being a calcaneo-cuboid joint fusion. This is different than the bone block distraction arthrodesis for painful flatfoot. This would be an in-situ fusion of the calcaneocuboid joint and preservation of the distal fourth and fifth metatarsal base cuboid joint. In many of these lateral column loading foot-types, there is usually a slightly adducted or supinated foot type that may contribute to the problem and a lateral column shortening that occurs from an in-situ fusion other than that causing mechanical difficulties to the normal functioning of the foot.

The approach to this is essentially a linear incision from the sinus tarsi towards the fourth and fifth metatarsal base junction to the cuboid. Dissection is carried down through the fascia and the fascia is lifted, additionally the EDB muscle belly is also lifted to access the calcaneal cuboid joint. The CC joint is often the main target tissue underneath the muscle belly, which is easy to access. The peroneal tendons were reflected plantarly and many times a joint debridement with curettage and joint preparation is all that is necessary. There is really minimal need to change the angular positions of the joint and a small joint distracter is very useful for axial distraction. After the joint has been repaired and subchondral bone plate has been pulverized, we can go ahead and compress the joint with the mini distracter and then provide staple fixation. This can be with 90 degree staples for rotational stability. We can also use compression type staples. The anterior peak of the calcaneus is a nice area to place a screw from proximal to distal with the head very nicely within the bone mass in this area. Again, the abduction is noted out the foot. Post fusion does not seem to mechanically affect the foot in anyway that is of concern.

Non-weight bearing is important for 6 weeks of protection and depending on radiographic consolidation, we can initially get the patient walking in approximately 6-8 weeks.

The follow-up study at the California College of Podiatric Medicine showed 14 patients who underwent this calcaneocuboid joint procedure for cuboid syndrome. The union rate was roughly 2 months with the variation of 6 weeks to 12 weeks with 10 females and four males; none of them went on to residual subluxation. There were patients who have residual pain in the distal joint, which will be discussed below. The normal approach to this area will only be the fourth and fifth metatarsal base cuboid joint fusion. This is something that was routinely done in the past for Lisfranc's fracture dislocation where the joints of Lisfranc's articulation were fused 1-5. This has been done for many years and has been the standard.

In 1996, the Journal of Bone and Joint Surgery presented 2 articles, both of them discussed the fact that the fusion of the lateral column leaves a very stiff foot and there may be other options. Komenda and Myerson also discussed that the patients that had lateral column pain following fusion required dorsiflexory osteotomy to take away stress from the lateral column. The fourth and fifth metatarsal base cuboid had tremendous triplanar movement, which is contrary to the medial 3 joints along the Lisfranc's articulation. In 1989, Ouzounian and Shereff measured sagittal plane and frontal plane movement of the lateral column joints and there was upwards of three to four times as many millimeters of movement compared with the first, second, and third metatarsocuneiform joint. This was a significant difference compared with the medial column part, and triplanar movement was also described by Nester and his counterpart in England showing three-dimensional kinematics of joint movement.

At times when the fourth and fifth metatarsal base cuboid joint and calcaneocuboid joint were fused along the lateral column, this was extremely debilitating for the patients and there were times when the lateral column needed to move and ended up fracturing central within the cuboid. This shows the necessity of lateral column movement and it is important to not to fuse both joints because there is not meaningful compensation along the lateral column. The medial column has both the talonavicular and naviculocuneiform joint for movement and this is something that I feel is important to maintain. I do feel that the saddle-shaped configuration of the calcaneocuboid joint does not allow good triplanar movement even if the distal joint is fused. For reasons of arthrosis and chronic degeneration, it is recommended that the fourth and fifth metatarsal base cuboid joint be resected versus fused because this still provides movement along that distal lateral column. The styloid process and peroneus brevis attachment are preserved but only the articular portion of the fourth and fifth metatarsal to the cuboid are resected.

We started performing this procedure back in the 1990s: it is recommended to take essentially about 1 cm from the fourth and fifth metatarsal base cuboid and then there can be placement of the soft tissue spacers or even spherical spacers in this area to maintain the length. In 2002, Bartlett and Anderson described something called the Anchovy procedure, which was just a Bartlett portion of the extensor tendon, which was placed into the joint space in this area.

We have also used percutaneous Kirschner-wire fixation, similar to a Keller arthroplasty to hold the joint space and not allow scarring into this region as well. There are currently spherical shaped surgical products that are used to hold out the joint space. These essentially will distract and keep the length of the fourth and fifth

metatarsal to the cuboid. They are biologically inert and do not cause any further problems. Some other concerns have been subsidence of the implant into the cuboid due to a section of the structural stability of the subchondral bone. The current recommendation is to leave the subchondral bone plate intact in the cuboid and go ahead and resect the base distally and prepare the fears for placement at the level of the cuboid but only into isolated positions. The subchondral bone being intact will minimize the subsidence of the implant proximally with range of motion and stress to the area.

The current recommendation also is to consider leaving the fourth and fifth metatarsal base in the case of a Lisfranc fracture dislocation at four or five is realigned many times. This is not painful. If it is painful, then the recommendations can be future resection but not arthrodesis as has been described and performed in the past.

In terms of the Charcot arthropathy and medial column and lateral column stabilization, the recommendation still is to leave a lateral column intact especially at the distal fourth and fifth metatarsal base cuboid area. If there is an early need for arthrodesisin the neuropathic foot, this would serve to be functional even though it still is going to be stiff. Joint resection in a Charcot patient is not recommended because of overloading to the third metatarsal and fifth metatarsal stress fracture that may occur.