November 2012 Case Study

Authors: Kyle Nagle, MD, MPH; Karl Fry, PT, DPT, OCS; David Bernhardt, MD

CC: Right foot pain

HPI:
A 17 year old female cross-country runner presents with right foot pain. At a cross-country meet one and a half weeks ago, during the mass start, she was shoved and fell to the ground. She was able to finish the race; however, over the course of the next two days, she developed right foot pain that she feels is related to the fall. Pain is described as sharp and worsens with weight bearing. Her athletic trainer tried taping and padding the foot, but neither helped. Ice and ibuprofen have also been ineffective. Running four days after the onset of pain exacerbated her pain. Since then walking has been her only repetitive impact activity. Walking worsens her pain, and she has to walk on the lateral aspect of the foot to avoid placing pressure on the bottom of her foot. The pain continues to be described as a sharp pain causing a limp with walking. The patient reports a history of 2 tibial stress fractures in the past, most recently 18 months prior.

PHYSICAL EXAM:
General: Well appearing, in no acute distress, walking with antalgic gait

Right Foot Exam:

Inspection: No edema, swelling, erythema or ecchymosis.

Palpation: Tenderness over the proximal dorsal 4th and 5th metatarsals and the tendons overlying the 4th and 5th metatarsals.

ROM: Full range of motion of the ankle and foot.

Strength: 5/5 strength of all muscles in the right lower extremity

Special Tests: Negative anterior drawer. No excessive laxity with ankle inversion or eversion.

INITIAL DIFFERENTIAL DIAGNOSIS:
Bone contusion
Fracture or stress fracture of 4th or 5th metatarsal
Extensor digitorum brevis or longus tendinopathy

IMAGING:
Given the prominence of 4th and 5th metatarsal tenderness at presentation, her history of stress fracture, and short time from onset of pain, no xrays were obtained. An MRI was ordered to evaluate for metatarsal stress fracture.

MRI showed bone marrow edema in the proximal inferior cuboid and to a lesser degree the inferior aspect of subjacent calcaneus, consistent with bone contusion in the context of acute injury vs. stress reaction given history of long-distance running.
DIAGNOSIS:
Bone contusion in the context of possible cuboid subluxation

In our case, the bone marrow edema on MRI is likely the result of the acute injury and resulting bony contusion. Given the rapid onset of pain following an acute traumatic event, a stress reaction is a less likely cause of her pain, even considering her history of stress fractures and long-distance running. Traumatic cuboid fractures are very rare and unlikely to be present in this case given her mechanism of injury and radiographic findings. Cuboid stress fractures are also quite rare.
TREATMENT:
Patient was referred to Physical Therapy for further evaluation and treatment of possible cuboid subluxation with bone contusion. The physical therapist agreed that the mechanism of injury and exam were consistent with cuboid subluxation.

Physical Therapist Physical Exam:

Inspection: Ambulating with reciprocating, antalgic gait, holding foot in supination. Tendency to shift weight to left lower extremity with standing. No apparent depressions or fullness in contour of lateral foot.

Palpation: Tenderness to palpation on the plantar aspect of the right cuboid.

Range of Motion: Ankle range of motion within normal limits. Pain with passive inversion and eversion of foot.

Strength: Ankle strength 5/5 in all planes of motion without pain.

Special Tests: Able to complete double leg and single leg heel raise without worsening of symptoms, though decreased stability on single leg heel raise on right.

The physical therapist performed high velocity low amplitude thrust, “cuboid whip,” manipulation. After the manipulation, patient had decreased pain and improved ability to invert and evert foot with decreased pain. She did have some residual soreness immediately after the manipulation. The physical therapist taught the patient the appropriate taping technique with video recording on her phone so she could duplicate the technique. She was instructed to avoid running until walking pain free.

OUTCOME:
Patient cancelled her follow-up appointment, made for three days after manipulation. Follow-up phone call revealed that her pain was much improved. She had been able to return to running with only mild soreness present. She has continued to use the taping technique. With taping, she has only occasional mild pain, feeling as though the area is mildly bruised. She has been able to walk pain free and without limp as well.

DISCUSSION:
Cuboid syndrome—also called cuboid subluxation, or a dropped or locked cuboid— is an easily overlooked cause of lateral foot pain and can be difficult to diagnose both clinically and radiographically. It occurs as a result of minor disruption or subluxation of the cuboid articulations, primarily at the calcaneocuboid joint, causing pain and impaired function. It can develop either gradually or acutely. Excessive pronation and overuse resulting in repetitive micro-trauma can cause a gradual onset of cuboid syndrome. Acutely, mechanisms such as an inversion ankle sprain or any forceful eversion of the cuboid while the calcaneus is inverted can cause a loss of congruency of the calcaneocuboid joint and the pain syndrome.\(^1\)\(^2\) A patient with a history of lateral ankle sprain that does not seem to be following a normal healing course or with persistent lateral foot pain should prompt consideration of cuboid syndrome.\(^3\)

The principle motion of the cuboid is medial and lateral rotation around an anterior-posterior axis, resulting in eversion and inversion of the mid-foot. The calcaneocuboid joint is intrinsically stable due to the congruence of the articular surfaces of the cuboid and calcaneus as well as robust ligamentous
reinforcement. The peroneus longus tendon also provides support as it forms a sling around the lateral and plantar aspect of the cuboid. The cuboid functions as a pulley for the peroneus longus tendon, and the cuboid everts with peroneus longus contraction to help aid transferring load across the foot as the stance phase progresses.\textsuperscript{1,2} Some risk factors reported for developing cuboid syndrome include midtarsal instability, increased body weight, high levels of exercise and inadequate recovery, ill-fitting shoes or orthoses, training on uneven surfaces, and sprains of the foot and ankle.\textsuperscript{1} Ballet dancers may be more prone to this injury as well. One study found 17\% of foot and ankle injuries in professional ballet dancers were related to cuboid subluxation.\textsuperscript{3} The incidence of cuboid syndrome in general has been estimated as 4\% of foot injuries in athletes.\textsuperscript{4} An expanded differential for cuboid syndrome and lateral foot pain in general includes fractures or dislocations of the cuboid, calcaneous, fourth and fifth metatarsals, peroneal tendinopathy, extensor digitorum brevis tendinopathy, cuboid syndrome, calcaneonavicular coalition, sinus tarsi syndrome, lateral plantar nerve entrapment, sural nerve compression neuropathy, Lisfranc injury, and anterolateral ankle impingement.\textsuperscript{1}

Signs and symptoms of cuboid syndrome are similar to a ligament sprain. Often patients will describe diffuse lateral foot pain, centered on the calcaneocuboid joint and the 4\textsuperscript{th} and 5\textsuperscript{th} cuboid-metatarsal joints, but may radiate throughout the foot. Ecchymosis and edema may be present. An antalgic gait is common, with pain and weakness experienced more often during push-off and with lateral movements. Hopping and weight-bearing in general increase pain, while rest relieves the pain.\textsuperscript{1} Upon inspection, a slight sulcus over the dorsum of the foot and a slight prominence or fullness at the plantar aspect of the cuboid may be present.\textsuperscript{2,3} Patients may have tenderness to palpation over the dorsolateral or plantar aspect of the cuboid. In the setting of a lateral ankle sprain, severe tenderness with plantar pressure on the cuboid may indicate cuboid subluxation in addition to the lateral ankle sprain.\textsuperscript{3} Patients may also have tenderness along the peroneus longus tendon and at the origin of the extensor digitorum brevis. Ankle and foot active and passive range of motion may be limited, and resisted inversion and eversion of the foot and ankle may cause pain.\textsuperscript{1} Dorsal and plantar passive translation of the cuboid may be limited relative to the unaffected side and also cause pain.\textsuperscript{1,2}

Two other clinical maneuvers or special tests may be helpful in diagnosing cuboid syndrome. The midtarsal adduction test is performed by passively moving the foot at the midtarsal joint in a transverse plane while stabilizing the calcaneus. Similarly, the midtarsal supination test is performed by stabilizing the calcaneus and passively inverting and evertting the foot at the midtarsal joint. Pain with either of these maneuvers is considered positive and suggestive of cuboid syndrome.\textsuperscript{1}

Plain films, CT, and MRI are often not helpful. Non-weight-bearing images may not detect malalignment of midtarsal joints. Plain films can rule out frank fractures or other bony abnormality.\textsuperscript{1,2,3} Weight-bearing images may demonstrate slight plantar subluxation of the cuboid with some widening of the calcaneocuboid joint.\textsuperscript{5} MRI is not routinely obtained in the context of acute cuboid subluxation so the incidence of concurrent bone contusion found on MRI is not known.

The treatment of cuboid syndrome is primarily through manipulation and taping. Two maneuvers are commonly employed during manipulation. The first, called the “cuboid whip,” is performed with the patient lying prone. The practitioner holds the patient’s foot with his hands cupping the dorsum of the foot with thumbs on the medial plantar aspect of the cuboid. With the knee flexed and leg relaxed, the foot is rapidly brought into inversion and plantar flexion while applying pressure on the cuboid. This maneuver provides a low amplitude, high velocity thrust to the cuboid. Sometimes a shift or pop may be felt by the patient or practitioner. The second method, the “cuboid squeeze,” is a more slowly applied dorsally directed pressure to the cuboid as the practitioner stretches the foot and ankle into maximal plantar flexion and the dorsal soft tissues relax. Indications of a successful manipulation include resolution of pain, an improved ability to heel raise, and increased motion and decreased pain
with passive dorsal and plantar translation of the cuboid.\textsuperscript{1,2,3} The patient may continue to have mild soreness for a few days after manipulation, particularly if the cuboid was subluxed for a long time. Occasionally, repeat manipulations will be necessary to achieve complete resolution of symptoms. Generally, the patient should refrain from high-level activity for a few days after manipulation to prevent recurrent subluxation.\textsuperscript{3} Taping techniques focused on supporting the medial arch can then be utilized to prevent recurrence of symptoms. Padding the plantar aspect of the cuboid to prevent eversion of the cuboid may also be helpful. If the patient does not experience relief with manipulation, alternative diagnoses should be considered.\textsuperscript{1,3}

REFERENCES: