examination revealed tenderness to palpation along both sides of the hindfoot and at the lateral aspect of the fifth metatarsal. The MR exam revealed peroneal tendon sheath effusion and increased signal along the margin of the peroneous longus tendon (Fig. 3a,b). At surgery, the peroneal tendon sheath was markedly edematous and contained hypertrophic synovial tissue. The peroneus longus tendon showed an area of inflammation with surface fibrosis, but it was not ruptured or split. A synovectomy was performed.

Case 2

A 53-year-old woman complained of long-standing lateral ankle pain. She had suffered an ankle injury during aerobics >10 years earlier. On physical exam there was retrofibular swelling and tenderness. The MR exam revealed a separation of the peroneus brevis tendon in the peroneal tunnel, creating a multipartite appearance to the tendon (Fig. 4a). Below the tip of the fibula, reunification of the peroneus brevis components lent a "flame-shaped" appearance to the tendon (Fig. 4b). The anterior talofibular ligament was thickened and irregular, consistent with a prior injury. At surgery, a 3 cm longitudinal split of the peroneus brevis tendon, centered over the tip of the fibula, was confirmed. The superior peroneal retinaculum was lax, and the peroneal tendons moved freely over the posterolateral edge of the fibula. A primary re-
swelling and tenderness, most pronounced posterior and inferior to the lateral malleolus. An MR exam (Fig. 5a) revealed findings of peroneal tenosynovitis, and below the tip of the fibula, a flame-shaped appearance of the peroneus brevis tendon was present, suggesting a longitudinal tendon split. Signal changes in the tarsal sinus indicated a talocalcaneal intersosseous ligament sprain (Fig. 5b). At surgery, a large, chronic-appearing longitudinal tear was seen in a flattened peroneus brevis tendon; a smaller split, not suspected at MR, was also present in the peroneus longus tendon laterally. There was synovial hypertrophy throughout the peroneal tendon sheath. The superior peroneal retinaculum was lax, allowing lateral subluxation of the peroneal tendons. The peroneal tendon splits were repaired, and the retinaculum was tightened and repaired.

Case 4

A 24-year-old man reported left lateral ankle pain with tenderness and swelling of 4 year duration. Physical examination was notable for tenderness and swelling over the peroneal tendon sheath. The MR examination showed an enlarged peroneal trochlea. At the level of the tip of the fibula, there was a multipartite appearance of the peroneus longus tendon, suggesting longitudinal splitting of the tendon (Fig. 6). Surgery confirmed a 3 cm longitudinal tear along the medial surface of the peroneus longus ten-
DISCUSSION

Chronic lateral ankle pain commonly results after an ankle sprain. Causes for persistent lateral ankle symptoms include ligamentous instability, loose bodies, osteochondral lesions, tibial-talar or subtalar arthrosis, anterolateral impingement (5), sinus tarsi syndrome, and peroneal tendon dysfunction. Most patients with peroneal tendonopathy have a history of remote or recurrent ankle sprains. On physical examination they may have swelling and focal tenderness behind the lateral malleolus. Pain and palpable tendon subluxation may be evident on resisted inversion of the foot (6). Peroneal tendon ruptures rarely present acutely after a single insult; reported cases typically involve the peroneus longus, often at the level of the cuboid, and result from direct trauma (3), forced supination (3,7), or inversion injuries in mild planar flexion (8).

An ankle “sprain” may precipitate peroneal tendon derangement by injuring the peroneal retinaculum rather than the tendons themselves. Acute peroneal tendon dislocation has been described in forced dorsiflexion injuries of the ankle sustained in skiing (9,10) and may also result from inversion injuries that occur with the foot in minimal flexion (8). Retinacular injuries occasionally cause a characteristic cortical avulsion fracture on the lateral margin of the fibula (10).

Retinacular insufficiency leads to peroneal tendon subluxation, which may in turn predispose to mechanical attrition of the peroneus brevis tendon as it repeatedly slides over the lateral edge of the fibular groove or tip of the fibula (11,12). Consequently, partial ruptures of the peroneus brevis tendon take the characteristic form of longitudinal tendon splits centered at the tip of the fibula (12). The more posterior position of the peroneus longus tendon in the fibroosseous peroneal tunnel tends to protect it from mechanical attrition during subluxation (11,13). Peroneal tenography can detect tenosynovitis, but is inaccurate in diagnosing longitudinal splits of the peroneal tendons (8).

Peroneal tendon subluxation may be aggravated by a shallow or absent fibular groove (14) or by ankle instability (1). Other anatomic factors may also predispose to peroneal tendonopathy. These include a large peroneal trochlea (Case 4), which has been associated with peroneal tendonitis (15). An accessory tendon, the peroneus quartus, may crowd the peroneal tunnel and contribute to mechanical tendon attrition (16). A peroneus quartus tendon might be mistaken on MR examination for splitting of the peroneus brevis tendon (Fig. 7). There are multiple variants of the peroneus quartus, including the peroneus accessorius, peroneus digiti minimi, and peroneocuboides (17). The most common variant is a supernumerary tendon arising from the peroneus brevis muscle belly that attaches to the peroneal trochlea (17). The peroneal trochlea may be enlarged in such cases. The peroneus quartus tendon is posteromedially situated in the peroneal tunnel and is smaller than the other two tendons (18). It should be distinguishable from a tendon split on MR exam by its depicted course on serial images and by its regular margin and round contour.

In our experience, the most valuable MR sequence for evaluating the peroneal tendons is an axial, double echo, SE scan. These images are improved if the foot is positioned in mild plantar flexion. Oblique axial images perpendicular to the tendon course are also useful, but for technical reasons oblique images may have poorer signal-to-noise ratio and diminished resolution. Axial images around the tip of the fibula should be closely scrutinized, as tendon splits are centered at this level. There may be a “blind area” at the precise level of the tip of the fibula due to volume averaging. Artifactual signal changes in the tendons may also result from the “magic angle” phenomenon (19), which typically occurs where the tendons change direction below the tip of the fibula. Analyzing T2-weighted images and positioning the foot in mild plantar flexion help resolve true from artifactual signal changes in the peroneal tendons.

Peroneal tendonitis is manifested on MR by tendon sheath effusion and/or synovitis and possibly minor signal abnormalities within the tendons them-
selves. These changes may give the tendons ill defined margins. A partial rupture or longitudinal tendon split should be suspected when a "multipartite" appearance of the tendon is noted in the peroneal tunnel, indicating a separation of tendon fibers. This multipartite appearance is more specific for longitudinal splitting than severe flattening of the peroneus brevis, which can be seen in asymptomatic subjects. On axial images below the tip of the fibula, the deranged peroneus brevis tendon may have an "arrowhead" or "flame-shaped" appearance in cases of longitudinal splitting, as the separate tendon fascicles reunite below the longitudinal rent.

Peroneal tendonitis is usually responsive to conservative measures, but may occasionally require open decompression and synovectomy. Symptomatic peroneal tendon splits may respond well to primary surgical repair of the split (8). More severe partial ruptures with attrition of the tendon may require peroneus brevis to longus tenodesis (or vice versa) (1). At surgery, a torn or insufficient peroneal retinaculum should be repaired; reconstructive procedures to deepen the peroneal tunnel have also been advocated in cases of tendon subluxation (9,10). The extent and severity of a partial peroneal tendon rupture may influence surgical management. Estimation of the extent of tendon derangement may be possible at MR evaluation. This estimation, like the diagnosis of derangement, is best made on axial images through the tendons.

REFERENCES