The peroneus quartus muscle

ANATOMY AND CLINICAL RELEVANCE

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Whilst a few studies have associated various symptoms with the presence of a peroneus quartus muscle in the peroneal compartment of the leg, little is known of the clinical relevance of this muscle.

We dissected 102 cadaver legs and reviewed the magnetic resonance images of 80 patients with symptoms from the ankle. The peroneus quartus, with a number of different attachments, was present in 6.6% of the legs. It most commonly arose from the peroneus brevis muscle and inserted into the retrotrochlear eminence of the calcaneum. Associated pathology included a longitudinal tear in the tendon of peroneus brevis, possible peroneal tendon subluxation or dislocation, and a prominent retrotrochlear eminence. On the MR scans its presence was associated with pain and weakness of the ankle.

Orthopaedic surgeons and radiologists should be aware of the possible presence of the peroneus quartus muscle, not only because of possible associated pathology, but also for its potential use for surgical reconstruction.

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The peroneus quartus muscle is one of a group of accessory peroneal muscles present in man. It is said to have been first described by Otto in 1816 and was studied in depth in 1923 by Hecker,¹ who estimated its incidence to be 13% in the general population.

There are only a few studies concerning this muscle. Various anatomists have described it and given it different names according to its various origins and insertions. Sobel,

Levy and Bohné² described the anatomical variations of the muscle in a cadaver study on 124 legs with particular reference to the origins and insertions of the different anomalous muscles in the lateral compartment and suggested that these should all be referred to as variants of the same muscle, the peroneus quartus. They showed that it was present in 21.7% of cadavers.

This muscle is not only of interest from an anatomical viewpoint, but also because several case reports have described associated symptomatology including pain in the ankle, with or without previous trauma, splits or tears in peroneus brevis, subluxation or dislocation of the peroneal tendon, tendinous calcification and painful hypertrophy of the retrotrochlear eminence.³⁻¹¹ Factors described which contribute to peroneal tendinopathy include a flat convex distal fibula and the presence of pes cavus.^{12,13}

Our study had the following aims: to investigate the incidence, anatomical variations and possible pathology relating to the peroneus quartus muscle.

We divided the study into two main sections. The first was a cadaver study and the second involved reviewing MR scans of the ankle taken at the Royal National Orthopaedic Hospital, Stanmore, between 1997 and 1999.

Materials and Methods

Cadaver study. We dissected 102 cadaver legs, of which 72 belonged to 36 intact cadavers and 30 were isolated lower legs. A total of 44 legs were from male and 52 from female cadavers. In the remaining six the gender could not be identified as they had been divided at the level of the thigh. All were preserved in formalin.

Each dissection was carried out in a standard fashion with an incision which started 9 to 10 cm proximal to the lateral malleolus and ended 5 to 6 cm distal to it. The superior peroneal retinaculum was identified and the peroneal compartment was examined for the presence of an accessory tendon or muscle. If this was present, the dissection was extended and the site of its origin and insertion and passage in the retromalleolar groove were noted. A record was made of any peroneal tendon pathology such as splits, tears or attrition.

MRI study. Two consultant radiologists retrospectively reviewed 80 MRI studies of the ankle which were taken

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Fig. 1

Photograph showing the peroneus quartus muscle held with forceps (3) at its insertion in the retrotrochlear eminence (1, peroneus longus; 2, peroneus brevis).

between 1997 and 1999. The indications for the scans had included chronic ankle pain, swelling and deformity. The MRI scanner which was used was a Picker Polaris with a 1.0 Tesla magnet (Philips Medical Systems, Reigate, UK).

Axial views were examined first. The best slices to detect the presence of an accessory peroneal muscle are those at the level of the distal fibula. If a peroneus quartus muscle was present, or if there was a suspicion of it, the rest of the axial views were examined in order to define its anatomical characteristics. The sagittal views were then reviewed and other anomalies in the lateral compartment of the ankle or elsewhere were noted.

Results

A peroneus quartus was present in six of the 102 legs which were dissected. Three were identified in single isolated legs

(all male), and three were found in two intact female cadavers.

The six muscles which were identified had three different origins and three different insertions. Three arose from the peroneus brevis muscle, two from the distal fibula and one from the distal fibres of peroneus longus. Three were inserted into the retrotrochlear eminence of the calcaneum, two into the base of the fifth metatarsal and one into the cuboid. When peroneus quartus arose from peroneus longus, its tendon passed separately in the retromalleolar groove and inserted into the retrotrochlear eminence of the calcaneum which was raised to 4 mm. The contralateral eminence was also raised, although without evidence of a peroneus quartus.

The peroneus quartus muscle shown in Figure 1 arose from peroneus brevis. It passed as a separate tendon posterior to peroneus brevis and inserted into the eminence of the calcaneum.

Figures 2 and 3 show it arising from the posterolateral aspect of the distal fibula. The muscle belly was short (2 cm) and its tendon lay between peroneus longus and brevis in the retromalleolar groove and also inserted into the eminence of the calcaneum.

One female cadaver had bilateral peroneus quartus muscles with the same origin and insertion. The origin was from peroneus brevis and the insertion the base of the fifth metatarsal bone just superior to the insertion of the tendon of the peroneus brevis. The bellies of peroneus brevis and quartus were separate throughout their course. A longitudinal tear of the tendon of peroneus brevis 1 cm long was present unilaterally (left) as it curved forwards around the distal fibula.

Another peroneus quartus muscle in a male cadaver arose from the distal fibula about 12 cm proximal to its tip. It lay posterior to the peroneus brevis and sent a fleshy contribution to this muscle before passing beneath the superior peroneal retinaculum to insert into the cuboid.

Fig. 2a

Fig. 2b

Photograph (a) showing the peroneus quartus muscle (3) arising via a thin muscle belly from the distal fibula. A close-up view (b) of the insertion into the retrotrochlear eminence (3); the peroneus quartus is held with forceps (1, peroneus longus; 2, peroneus brevis).

Fig. 3

Photograph showing a close-up view of the retromalleolar region with the three peroneal tendons clearly visible; the forceps hold the peroneus quartus (1, peroneus longus; 2, peroneus brevis; 3, peroneus quartus).

Fig. 4

An MRI scan at the level of the upper talus. A third tendon (arrowheads) is apparent behind those of the peroneus longus and peroneus brevis.

Fig. 5

An MRI scan at the level of the retrochlear eminence. The insertion of the peroneus quartus (arrowhead) into the non-prominent eminence is visible.

Another cadaver had a thin and lax superior peroneal retinaculum suggesting that subluxation or dislocation of the peroneal tendons may have occurred.

MRI. Six of the 80 studies reviewed had a peroneus quartus muscle (Figs 4 and 5). Four were in men and two in women, with a mean age of 38 years (16 to 57). It was not possible to define its origin as it is impossible to distinguish between two different muscles within one common belly. The insertion was identified in five scans as the retrochlear eminence of the calcaneum. In the other scans it was more distal and was not identified. The presence of the peroneus quartus was reported in only one of the original MRI reports and described as an “atypical appearance of the peroneus brevis” which “appears to be made up of more than one tendon”.

Four of the six subjects had pathology unrelated to the lateral compartment of the ankle. The remaining two subjects with a peroneus quartus were of interest. One, a 30-year-old woman, had an 11-month history of chronic pain and swelling behind the lateral malleolus, which had failed to respond to conservative measures. The MRI had been reported as showing “oedema in the subcutaneous tissues predominantly on the lateral side of the ankle at the level of the distal fibula”, however, “the cause for this oedema is not demonstrated”. The other scan was of a 57-year-old man with chronic pain behind the lateral malleolus after an injury. Previous debridement of the peroneal tendons had not improved his symptoms. The MRI showed the presence of a peroneus quartus muscle with no other identifiable pathology of the other peroneal tendons. There were minor degenerative changes in the ankle and subtalar joints.

Discussion

Incidence of peroneus quartus. Our cadaver study and MRI review have shown an incidence of the peroneus quartus muscle of 6.6%. This contrasts significantly with the 21.7% reported by Sobel et al² in 1990 and the 13% reported by Hecker¹ in 1923.

Anatomical features. As in previous reports, we found varying anatomical characteristics of this muscle both with regard to its origin and insertion.^{14,15} The most frequent origin was from the muscle fibres of peroneus brevis and its most frequent insertion was into the retrochlear eminence of the calcaneum. There were various other origins and insertions and we believe that all these should be considered as variants of the same muscle. This reduces the terminological confusion which has existed in the past with the peroneus quartus having a multitude of names.

Clinical relevance. Our cadaver dissections showed the muscle to be associated with a longitudinal tear in the tendon of peroneus brevis, a prominent retrochlear eminence and a thin, lax superior peroneal retinaculum in three of six specimens. It is not possible to know whether these

caused symptoms. The contralateral retrotrochlear eminence in the intact female cadaver was also prominent without the presence of a peroneus quartus.

The MR scans in two patients suggest that excision of peroneus quartus might have been considered as a treatment option. In the 57-year-old man with persistent lateral ankle pain, debridement of his peroneal tendons had not relieved his symptoms and no abnormality, apart from the peroneus quartus, was seen on MR scan.

For the 30-year-old woman, the senior treating surgeon recorded that although "a hint of fullness behind the lateral malleolus" is present, "this problem remains a mystery".

Surgical relevance. We believe that orthopaedic surgeons and radiologists should be aware of the existence of this muscle, not only because of possible associated pathology, but also because of its potential use in reconstructive surgery. Mick and Lynch⁹ demonstrated this in 1987 when they recognised the presence of a peroneus quartus muscle and used it to reconstruct the retromalleolar groove and to act as a strap to stabilise the peroneal tendons in a patient with recurrent peroneal tendon dislocation.

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