Tibial Intraneural Ganglia in the Tarsal Tunnel: Is There a Joint Connection?

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Intraneural ganglia are rare entities, and, as such, their pathogenesis has been extremely controversial. Recent evidence from intraneural ganglia occurring at more proximal sites—the peroneal nerve at the fibular neck (the most common site) and the tibial nerve at the knee— has suggested an articular origin rather than de novo formation. To our knowledge, of the 10 previous reports of tibial intraneural ganglia within the tarsal tunnel by others, a joint connection to the ankle joint was only identified in 2 cases. To support a hypothesis that tibial intraneural ganglia occurring within the tarsal tunnel region arise from neighboring joints, we analyzed 3 patients retrospectively, all of whom had magnetic resonance (MR) imaging and operative intervention. One of these patients was treated by a peripheral nerve surgeon specializing in foot and ankle surgery. The other 2 patients were the only ones previously published in the literature who had MR images available for reinterpretation. In none of these cases was a joint communication appreciated by radiologists interpreting the MR images preoperatively or by surgeons intraoperatively. Our review of these same cases demonstrated radiographic evidence of joint communications with the subtalar joints. Based on our findings in this article and our knowledge of intraneural ganglia occurring at more proximal sites, we believe that tibial intraneural ganglia within the tarsal tunnel originate from neighboring joints and that their connections to the joints (pedicles) are through articular branches. The importance of these connections is 2-fold: first, for their role in the pathogenesis of this entity, and second, for their potential therapeutic implications. As is highlighted by the clinical and radiographic follow-up in the 1 patient in this article and in many previously reported at other sites, intraneural cyst recurrence can occur if surgeons do not specifically address the articular connection. (The Journal of Foot & Ankle Surgery 46(1):27–31, 2007)

Key words: intraneural cyst, synovial cyst, ganglion, tarsal tunnel, tibial nerve

Intraneural ganglia are nonneoplastic lesions comprised of gelatinous fluid that is contained within a pseudocyst within the epineurium of a nerve. There have been cases of intraneural ganglia reported in many different nerves in the upper and lower limbs (1). Although the literature is fairly extensive for the peroneal nerve at the level of the fibular neck (the most common site of occurrence) (1, 2), there is little information involving the tibial nerve at the tarsal tunnel (3–11). We believe that knowledge from these peroneal intraneural ganglia is applicable to the surgeon treating such cases affecting the tibial nerve within the tarsal tunnel.

The pathogenesis of intraneural ganglia has been controversial. Despite the occurrence of these cysts nearby neighboring joints, the majority of authors still believe that these cysts are formed de novo when they do not identify a joint connection (1); we have shown that small joint connections can be demonstrated on retrospective review of these cases (1, 2, 12–15). The traditional understanding of intraneural ganglia affecting peripheral nerve has been challenged by recent findings relating to the peroneal and tibial nerves at the superior tibiofibular joint (1, 2, 12–14). The peroneal intraneural ganglia have been shown to originate from the anterior portion of this joint and dissect within the epineurium along the articular branch in the deep peroneal nerve and then proximally within the common peroneal nerve, following the path of least resistance and depending on pressure fluxes. Similar findings have been demonstrated in patients with tibial intraneural ganglia about the knee; these ganglia arise from the posterior aspect of the superior tibiofibular joint, connect through an articular branch, and dissect proximally into the tibial nerve (13, 14). The artic-

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ular origin of these intraneural ganglia has been supported with clinical, operative, imaging (ie, magnetic resonance imaging [MRI] and arthrography) and histological evidence (1, 2, 12–14).

Based on a unified theory that proposes that all intraneural ganglia are connected to neighboring joints via articular branches (1), one of the authors (R. J. S.) hypothesized that the origin of more distally located cysts, such as the tibial intraneural ganglia at the tarsal tunnel (a relatively rare site), should not differ from that of the more proximal prototypes (16). This hypothesis was purely conceptual in that it was generated without the lead author having any firsthand experience with intraneural ganglia at this particular location. The purpose of this retrospective study was to review the records of patients who had undergone treatment of intraneural ganglia in the foot and ankle region, specifically tibial intraneural ganglia within the tarsal tunnel, and to review the published literature related to this condition in an effort to see if existing information pertaining to these cases supported the hypothesis that tibial intraneural ganglia display a connection with neighboring joints.

Materials and Methods

During a presentation on peroneal intraneural ganglia occurring at the fibular neck at the Institute for Peripheral Nerve Surgery Fellowship Group held in Henderson, Nevada, on October 1, 2004, the 75 attendees were polled to determine their collective experience with intraneural ganglia in the foot and ankle region. Any surgeon who had experience with an intraneural cyst occurring in the foot and ankle region was invited to enroll his or her patient(s) in the study in the hopes of collecting a small series.

For our literature review, in an effort to identify cases of intraneural ganglia of the tibial nerve in the tarsal tunnel and others in the foot and ankle region, we searched the following major biomedical databases: PUBMED (1950 to the present), Ovid Medline (1966 to the present), the Ovid Cumulative Index to the Nursing and Allied Heath Literature (CINAHL) (1984 to the present), Scopus (full database), and Google.com, including all types of publications. Our search terms included: ganglion, ganglia, intraneural ganglia, intraneural ganglion, nerve, tibial nerve, sural nerve, peroneal nerve, saphenous nerve, plantar nerve, cyst, synovial cyst, pseudocyst, tarsal tunnel, and foot and ankle in isolation and in various combinations. We also examined the bibliographies of all relevant articles for additional candidates.

For this retrospective study, minimal inclusion criteria deemed necessary not only to corroborate an intraneural cyst and substantiate a joint connection included: preoperative MRI, operative records and photographs, and pathology for the case series, and operative and/or MRI evidence in the literature review. Information from these patients and other patients identified in a literature review of intraneural ganglia occurring in the foot and ankle region was collected and analyzed. Reinterpretation of the MRIs was done by a radiologist (K. K. A.) and the operative data by a surgeon (R. J. S.), both with experience with intraneural ganglia.

Results

Six surgeons provided information regarding their treatment of 7 limbs in 6 patients with cystic lesions, all thought to represent tibial intraneural ganglia. Before surgery, all patients had symptoms and signs consistent with tarsal tunnel syndrome. In these cases, preliminary interpretations of their MRIs suggested that the ganglia were extraneural and originated from tendon sheaths rather than joints. A review of the operative reports showed that, at the time of operation, all cysts involved the tibial nerve and/or the medial plantar nerves within the tarsal tunnel directly or indirectly and were resected. In none of these cases was a joint connection noted at the time of operation(s).

Only 1 of these patients (1 affected limb) met our inclusion criteria. Some of the clinical information about this patient was previously included in a separate publication (17). This patient was treated by a peripheral nerve surgeon experienced in foot and ankle surgery (A. L. D.). Three patients were excluded because of misdiagnosis; they were thought to have tibial intraneural ganglia by the operating surgeon; however, 2 were identified to have extraneural ganglia and 1 displayed a giant cell tumor of tendon sheath. These 3 extraneural lesions led to the development of extrinsic neural compression. Another patient was excluded from the analysis because there was no preoperative MRI performed, despite the fact that the diagnosis of intraneural ganglion was made on the basis of both surgical and pathological inspections. Another patient with bilateral intraneural ganglia who had preoperative MRIs, operative records, and histology was excluded because intraoperative photographs were not available for review.

Review of all of the available MRIs revealed evidence indicative of a connection between the cyst within the tibial nerve and the foot and ankle. In the one patient who met all of the inclusion criteria, the MRI displayed a distinct connection with the medial aspect of the subtalar joint (Fig 1). In this patient, the joint displayed MR signs of mild degenerative joint disease, and an approximately 3-cm longitudinal, tubular cyst that extended proximally from the posterior facet of the talocalcaneal articulation. This patient also displayed clinical and MRI evidence of postoperative symptomatic intraneural cyst recurrence.

Our literature search efforts identified 9 reports by others describing 10 cases of tibial intraneural ganglia within the tarsal tunnel (3–11). A joint connection was noted in only 2