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Ganglion Cysts of the Proximal Tibiofibular Joint: Low Risk of Recurrence After Total Cyst Excision

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Abstract

Background Peroneal nerve neuropathy due to compression from tumors or tumor-like lesions such as ganglion cysts is rare. Few case series have been published and reported local recurrence rates are high, while secondary procedures are frequently employed.

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All ICMJE Conflict of Interest Forms for authors and *Clinical Orthopaedics and Related Research*® editors and board members are on file with the publication and can be viewed on request. Each author certifies that his or her institution approved the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research. This work was performed at the Microsurgery Department, KAT General Hospital, Athens, Greece and the Orthopedic Oncology Department at General Oncological Hospital Kifisias “Agiou Anargyroi,” Athens, Greece.

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Questions/purposes (1) What are the demographics of patients with ganglion cysts of the proximal tibiofibular joint, and what proportion of them present with intraneural cysts and peroneal nerve palsy? (2) What Musculoskeletal Tumor Society (MSTS) scores do patients with this condition achieve after decompression surgery with removal of the ganglion cyst, but no arthrodesis of the tibiofibular joint? (3) What proportion of patients experience local recurrence after surgery?

Methods Between 2009 to 2018, 30 patients (29 primary cases) were treated for chronic peroneal palsy or neuropathy due to ganglion cysts of the proximal tibiofibular joint at two tertiary orthopaedic medical centers with total resection of the cystic lesion. MRI with contrast and electromyography (EMG) were performed preoperatively in all patients. The minimum follow-up for this series was 1 year (median 48 months, range 13 to 120); 14% (4 of 29) were lost to follow-up before that time. The MSTS score was recorded preoperatively, at 6 weeks postoperatively, and at most-recent follow-up.

Results A total of 90% of the patients were male (26 of 29 patients) and the median age was 67 years (range 20 to 76). In all, 17% (5 of 29) were treated due to intraneural ganglia. Twenty-eight percent (8 of 29) presented with complete peroneal palsy (foot drop). The mean MSTS score improved from $67 \pm 12\%$ before surgery to $89 \pm 12\%$ at 6 weeks postoperative ($p < 0.001$) and to $92 \pm 9\%$ at final follow up ($p = 0.003$, comparison with 6 weeks postop). All patients improved their scores. A total of 8% (2 of 25 patients) experienced local recurrence after surgery.

Conclusion Ganglion cysts of the proximal tibiofibular joint occurred more often as extraneural lesions in older male patients in this small series. Total excision was associated with improved functional outcome and low risk of neurologic

damage and local recurrence, and we did not use any more complex reconstructive procedures. Tendon transfers may be performed simultaneously in older patients to stabilize the ankle joint, while younger patients may recover after decompression alone, although larger randomized studies are needed to confirm our preliminary observations.

Level of Evidence Level IV, therapeutic study.

Introduction

Although ganglion cysts are the most common benign tumors or tumor-like lesions of the hand [21], they are only rarely located in the proximal tibiofibular joint [9, 13, 16, 22]. Ganglion cysts in that location may present as a painless mass or cause neuropathic symptoms because of peroneal nerve compression [8]. Their anatomic proximity to the peroneal nerve makes their treatment challenging, and the frequency of local recurrence has been reported to be as high as 25% for primary lesions [16], since piecemeal resection is frequently employed.

Few series about ganglion cysts of the proximal tibiofibular joint have been published, and most previous studies have been case reports. Relapse is common after treatment, especially in patients who present with recurrent lesions, and when lesions recur, sometimes larger procedures like excision arthroplasty or arthrodesis of the proximal tibiofibular joint are performed [10, 13, 16, 23]. But considerable controversy remains about how to treat them, with some authors suggesting observation or aspiration, and others recommending intralesional or en bloc resection [3, 4, 6, 8, 10, 11, 13, 16, 18, 19, 22, 23].

We therefore asked: (1) What are the demographics of patients with ganglion cysts of the proximal tibiofibular joint, and what proportion of them present with intraneural cysts and peroneal nerve palsy? (2) What Musculoskeletal Tumor Society (MSTS) scores do patients with this condition achieve after decompression surgery with removal of the ganglion cyst, but no arthrodesis of the tibiofibular joint? (3) What proportion of patients experience local recurrence after surgery?

Patients and Methods

This retrospective study was performed in two tertiary centers from 2009 to 2018, during which time we treated 30 patients for proximal tibiofibular joint (PTFJ) ganglion cysts causing chronic peroneal palsy or neuropathy. One patient presented with a recurrent cyst treated surgically elsewhere and was excluded from analysis, whereas all others were primary lesions. All included patients underwent preoperative MRI with contrast and electromyography (EMG), and in selected patients, we performed

diagnostic aspiration of the typical gelatinous material. We aspirated the typical gelatinous fluid and cytologic preparation to try to exclude the presence of other conditions (like synovial sarcoma) based on surgeon preference. MRI findings were typical in all patients, including a low signal on T1 sequences, high signal on T2 sequences, a homogenous appearance, only peripheral enhancement of the cyst after contrast injection, and a communicating stalk with the joint (not always present) [1, 4, 8, 13]. The final inclusion criteria for this study were patients with a ganglion cyst in this location and neurologic symptoms (true peroneal palsy, pain, or paresthesia); we followed a wait-and-see approach in patients with asymptomatic lesions, and we did not include patients with asymptomatic lesions in this report.

During the study period, we performed decompression surgery with marginal excision of the ganglion in all patients. Twenty-four percent (7 of 29) of patients underwent this procedure with simultaneous tendon transfer of the posterior tibialis because of a combination of a complete peroneal palsy and advanced age, which we used as a relative indication for the tendon transfer. One younger patient with foot drop was treated with decompression surgery only.

Surgical Technique

The operation was performed with the patient in the semilateral decubitus position, with the knee in slight flexion and under a tourniquet. The surgeons used loupe magnification of x 3.5 or x 4.5, depending on their preference; we did not use a surgical microscope. A lateral lazy S incision was made below the fibular head, which was used as a reference mark (Fig. 1). The incision was long enough to allow for muscle dissection in the anterior compartment, as well as proximal identification of the common peroneal nerve beneath the biceps tendon (Fig. 2). An intraneural ganglion cyst along the deep peroneal nerve was identified (Fig. 3), and cyst dissection/neurolysis was performed inside the peroneal muscles (Fig. 4). The cystic specimen was delivered and sent for histologic analysis (Fig. 5). A long posterior plaster splint with 30° of knee



Fig. 1 A lazy S incision was performed below the fibular head, which is outlined in this image.



Fig. 2 Identifying the common peroneal nerve proximally beneath the biceps tendon, as shown here, is an essential step of the procedure.



Fig. 3 A-B (A) Axial MRI (proton density-weighted fat-suppressed images) and (B) sagittal MRI (T2-weighted images) at the corresponding level depict a swollen common peroneal nerve with an intraneural ganglion cyst.

flexion was used for protection in the immediate post-operative period until sutures were removed and thereafter a rehabilitation program was implemented.

In patients older than 65 years, we typically performed a posterior tibialis tendon transfer subcutaneously to the lateral cuneiform through a circumferential route and stabilization with a staple at the time of index surgery, as described by others [12, 17].

Follow-up Routine

The diagnosis was confirmed histologically in all patients. The minimum follow-up for this series was 1 year (median 48 months, range 13 to 120); 14% (4 of 29) were lost to follow-up before that time. All patients were followed with

clinical examinations; MRIs were used when the care team believed they were indicated (in general, these indications were signs suggestive of possible recurrence such as fullness, swelling, or new or worsening neurological symptoms). Five of 25 patients underwent postoperative MRI. EMG studies were typically repeated 6 weeks after surgery unless the preoperative EMG was normal and no neurological deficits were noted after surgery. The MSTS score [5] was recorded before surgery, 6 weeks after surgery, and at most recent follow-up (Table 1).

Statistical Analysis

We used IBM SPSS Statistics for Windows, version 19.0 (IBM Corp, Armonk, NY, USA), for the statistical

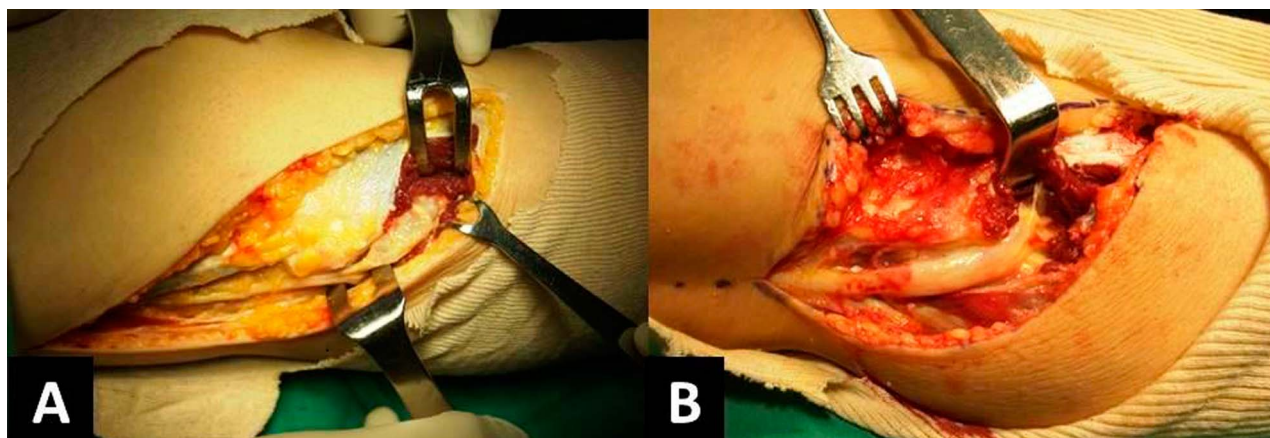


Fig. 4 A-B Dissection of the ganglion cyst in the anterior compartment during the (A) initial stages of the procedure and (B) toward the end of the operation.



Fig. 5 This image shows the surgical specimen from the resected ganglion cyst.

analysis. More specifically, we conducted a paired-samples t-test to compare mean values of MSTS scores pre- and postoperatively and at final follow-up (whole cohort), and between intraneural/ extraneural ganglion cysts (independent samples t-test). We also compared mean ages between patients with foot drop and the rest of the cohort (independent samples t-test) and the association between foot drop and intraneural ganglia (Fisher’s exact test).

Results

A total of 90% of the patients were male (26 of 29 patients) and the median age was 67 years (range 20 to 76 years) (Table 1). In 69% (20 of 29 patients) cysts were found on the right lower extremity. A total of 17% (5 of 29) were treated for intraneural ganglia. We observed no association between foot drop and presence of intraneural cysts: two of five in the intraneural group versus 25% (6 of 24) in the extraneural group ($p = 0.589$, phi coefficient = -0.12). Twenty-eight percent (8 of 29) of patients presented with complete peroneal palsy (foot drop). No difference in age

was noted between those patients and the rest of the cohort (66 ± 19 years versus 59 ± 13 years, mean difference: 6.7 [95% CI -5.8 to 19.3]; $p = 0.3$). From those patients, 1 of 8 recovered after cyst excision (a 20-year-old female), while 7 of 8 (patients older than 65 years) underwent tendon transfer during the index operation. In the tendon transfer group, two patients developed soft-tissue infection that resolved after incision and drainage, while one patient sustained a rupture of the transferred tendon 4 months postoperatively.

The mean MSTS score improved from $67 \pm 12\%$ before surgery to $89 \pm 12\%$ at 6 weeks postoperative (mean difference -22 [95% CI -25 to -20]; $p < 0.001$) and to $92 \pm 9\%$ at final follow up (mean difference -3 [95% CI -4.4 to -1]; $p = 0.003$, compared with data obtained at 6 weeks after surgery). When we compared preoperative MSTS scores with extra- or intraneural ganglion cysts, we noted no difference (mean score $67 \pm 13\%$ versus $65 \pm 8\%$, mean difference 2 [95% CI -10.2 to 14.5]; $p = 0.7$). Scores at latest follow-up likewise were no different with the numbers available (mean score $92 \pm 10\%$ versus $90 \pm 7\%$, mean difference 2 [95% CI -7.7 to 12.1]; $p = 0.7$).

A total of 8% (2 of 25 patients) experienced local recurrence after surgery. None of these patients underwent reoperation because they were asymptomatic, and they opted for surveillance.

Discussion

The proximal tibiofibular joint is a rare location for one of the most commonly encountered pseudotumors, especially in the hand [7, 21]. The prevalence is well below 1% among all patients undergoing MRI to evaluate knee pain (ranging from 0.09% [8] to 0.76% [9]). The first patient

Table 1. Characteristics of patients

Patient	Sex	Age	Right /left extremity	Type	Neurological status	Excision	Tendon transfer	Complication	Recurrence	Follow-up (months)	MSTS preoperative score	MSTS postoperative score	MSTS final
1	M	76	L	Intraneural	Foot drop	Yes	Yes	No	No	105	53	73	80
2	M	70	R	Extraneural		Yes	No	No	No	70	73	93	97
3	M	55	R	Extraneural		Yes	No	No	No	60	83	93	90
4	M	44	R	Extraneural		Yes	No	No	No	30	63	100	100
5	M	64	R	Extraneural		Yes	No	No	No	28	57	83	80
6	M	59	R	Extraneural		Yes	No	No	No	62	73	100	100
7	M	68	L	Intraneural		Yes	No	No	No	45	63	83	87
8	M	68	L	Extraneural	Foot drop	Yes	Yes	No	No	82	50	63	73
9	M	68	L	Extraneural		Yes	No	No	No	30	83	100	100
10	M	76	L	Extraneural	Foot drop	Yes	Yes	Soft-tissue infection	No	60	47	63	73
11	W	59	R	Extraneural		Yes	No	No	No	29	73	97	93
12	M	62	R	Extraneural		Yes	No	No	No	16	73	93	100
13	M	73	L	Extraneural		Yes	No	No	No	36	73	97	100
14	M	58	L	Extraneural		Yes	No	No	No	Lost	83	100	
15	M	73	R	Extraneural		Yes	No	No	No	Lost	57	73	
16	M	71	R	Extraneural		Yes	No	No	No	Lost	73	97	
17	M	63	R	Extraneural		Yes	No	No	No	44	63	93	97
18	M	67	R	Extraneural		Yes	No	No	No	60	83	100	100
219	M	50	R	Extraneural		Yes	No	No	No	Lost	83	100	
20	M	39	R	Extraneural		Yes	No	No	No	72	73	97	100
21	M	28	R	Extraneural		Yes	No	No	Yes	13	73	100	100
22	M	72	L	Extraneural	Foot drop	Yes	Yes	Soft-tissue infection	No	32	50	73	80
23	M	75	R	Extraneural	Foot drop	Yes	Yes	Hardware failure	No	55	53	83	87
24	M	71	L	Extraneural	Foot drop	Yes	Yes	No	No	48	50	73	80
25	M	68	R	Extraneural	Foot drop	Yes	Yes	No	No	120	50	83	87
26	M	32	R	Extraneural		Yes	No	No	No	22	63	100	100
27	M	66	R	Extraneural		Yes	No	No	No	82	83	100	100
28	M	69	R	Intraneural		Yes	No	No	No	75	73	93	90
29	W	20	R	Intraneural	Foot drop	Yes	No	No	Yes	40	63	93	100

with this condition was described in 1891 by Lennander [14], and overall, only about 80 have been reported as of 2018 [13]. Therefore, we lack key information about demographics, presentations, and treatment approaches. In this small series, we present demographic data on proximal tibiofibular joint (PTJF) ganglion cysts; we found that patients achieved good functional scores and had a low risk recurrence with loupe dissection and total cyst excision.

This study had several limitations. First since this is a retrospective series, concerns like selection bias may inflate the benefits of surgical treatment. Second, almost one quarter of the patients (older patients who presented with severe motor weakness) got simultaneous tendon transfers, so that the true effect of the resection surgery cannot be accurately assessed; those patients may have experienced lower MSTS scores if they underwent resection alone. Third, postoperative MRI was performed in a minority of patients. In addition, four patients were lost to follow-up, and so the risk of local recurrence may be higher than what we report here. Finally, this is a two-surgeon series, which means there may have been some technical differences between the surgeons. However, in general, they used similar approaches, including loupe dissection, and total resection was done in all patients.

We found that most patients with tibiofibular joint ganglia presented with sensory findings, pain, or fullness, but a substantial minority (28%, 8 of 29) presented with advanced motor loss. Others have found that foot drop (motor strength 2 of 5 or less) is present in 14% to 55% of patients [13, 16, 23], but this varies widely especially in

smaller series as one would expect [8, 18, 22]. Neuropathy of the peroneal nerve or branches may be caused by a large cyst extending to the anterior compartment that compresses the nerve roots [13, 16]. We encountered ganglion cysts up to 14 cm long and 4 cm wide (Fig. 6). These cysts may also be seen in the sheath of the common peroneal nerve as intraneural cysts, following the path of least resistance [20, 23]; we found that 17% of patients presented with intraneural cysts, but that this was not related to a more severe presentation in terms of motor weakness. With regard to sex and site, we found that 90% of patients were males, which was in agreement with the study from Damron and Rock [4], two-thirds had right extremity lesions, and the median age was older than 66 years. This probably gives some insight to the etiology of PTJF ganglion cysts: Although pathogenesis is controversial [20], it may be caused by excessive pressure and repetitive injury to the periarticular capsule and ligaments, modifying the synovial or mesenchymal cells at the synovial capsular interface [15]. Two studies have suggested that arthritis at the lateral tibiofemoral or proximal tibiofibular joint is also a predisposing factor [4, 16], as might be repetitive trauma or injuries. The fact that older males (who may have a higher probability of knee arthritis) made up a large part of our series is consistent with all of this information.

Patients recovered well from the operation and improved their functional status after surgery, and even more at the time of most recent follow-up. Only one patient deteriorated after surgery (the only patient who presented with recurrent disease and developed foot drop because of



Fig. 6 A-B (A) Axial MRI (short-T1 inversion recovery images) and (B) coronal MRI (T1 fat-suppressed images) show a large (longer than 14 cm) extraneural ganglion cyst.

intraoperative damage to the peroneal nerve) suggesting that in general, the risk of neurological harm is low from this intervention. Excellent results were also reported in more than 90% from the Mayo group [23]. We did not find with the numbers available that intraneural ganglia predispose to a more severe presentation or poorer scores at later follow-up. In the previous large study with mixed

intra- or extraneural cysts (approximately same ratio) the authors also did not find intraneural ganglion to be a risk factor for worse presentation or outcome [23]. In the only other pertinent study, Pagnoux et al. [18] reported that one-third of patients with intraneural cyst presented with more severe neurologic deficit and had a prolonged recovery course.

Table 2. Summary of case series regarding treatment of proximal tibiofibular joint ganglion cysts

Study	Number of patients	Surgical technique	Local recurrence	Follow-up duration	Remarks
Milkovsky et al. [16]	13	Excision/PTFJ fusion	25% overall - 13% in primary lesions and 100% in recurrent cases	6 years (1 to 13 years)	Second resection after local recurrence is often not effective. PTFJ arthrodesis appears to be more effective surgical option after recurrence
Lateur et al. [13]	7	Excision/PTFJ fusion +/- partial fibula excision	25% in primary lesions and 100% in recurrent cases	60 months (56 to 79 months)	Recommend arthrodesis with limited fibula excision
Damron et al. [4]	12	Excision	< 10%	-	Microsurgical dissection leads to lower local recurrence rates. EMG studies were valuable in localizing the lesions when no mass was palpable
Hersekli et al. [8]	3	Excision	33%	2 years (1 to 4 years)	Neurological symptoms may not recover after excision
Pagnoux et al. [18]	3	Excision/corticosteroid injection/partial excision	50% (second intraneural case only partial excision)	3 months to 3 years	Injection of a glucocorticoid into the cyst can be used as the first-line treatment in patients without common peroneal nerve symptoms
Vatansever et al. [22]	3	Excision/one patient denied treatment	0	1 to 8 years	The initial treatment method of the PTFJ should be a marginal excision of the cyst with ligation of its stalk. In recurrent cases, either resection arthroplasty or PTFJ fusion may be selected
Wilson et al. [23]	65	Decompression of the common peroneal nerve/ resection of the articular branch/resection of the articular surface of the PTFJ	6 (9%) patients, extraneural	12 months (1 to 24 months)	The longer the time from onset of symptoms to surgery, the poorer the results. Motor recovery can continue up to 28 months postoperatively, with its maximum at 9 months. Focused on resection of peroneal articular branch and articular surface and not resection quality

PTFJ = proximal tibiofibular joint; EMG = electromyography.

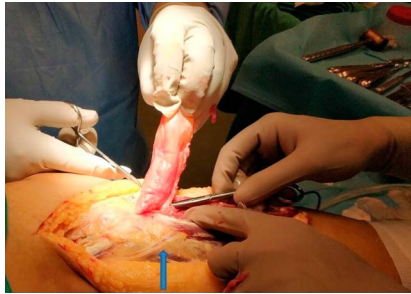


Fig. 7 A ganglion cyst is dissected from the caudal to cephalad direction until the communicating pedicle is reached and ligated (the blue arrow shows the common peroneal nerve). A color image accompanies the online version of this article.



Fig. 8 The large cyst is delivered en bloc—the black arrow shows the ligated pedicle.

Recurrence is one of the main concerns after surgical excision; local recurrence has been reported to occur in as many as 25% of patients [16]. The authors of that study

concluded that joint fusion in patients with relapse is advisable because it leads to good functional results. In a more recent series of seven patients, Lateur et al. [13] reported similar results, and recommended fusion and partial fibular head resection in patients with relapse. Another small study suggested that microsurgical dissection leads to a lower likelihood of recurrence, but with only 12 patients, it is difficult to draw firm conclusions [4]. In a small series of three patients, Hersekli et al. [8] reported no local recurrence and recommended en bloc resection for curative purposes, while one other suggested partial joint resection in patients with recurrence [10] (Table 2). The Mayo group reported smaller relapse proportions which is similar to our experience; the authors suggest a different surgical strategy focusing on peroneal nerve decompression/resection of the articular nerve branch and excision of the articular surface and instead of the quality of cyst resection [23]. We believe that several factors may explain the low risk of recurrence that we observed: Careful preoperative planning with MRI, which provides critical information about the true extension of the mass, proximity or infiltration into the peroneal nerve or branches, and the presence of a communicating stalk with the joint that should be ligated; meticulous loupe dissection of the cyst as proposed by other authors [4, 18]; and, our recommended surgical approach involving a lazy S incision centered below the fibular head, which may improve visualization and provide a wide surgical field. After dissection of the neural elements from the cyst (usually starting from the periphery and advancing to the joint (Fig. 7), we either ligate its stalk or curette it from its bony adherence (Fig. 8). We believe that excision of the

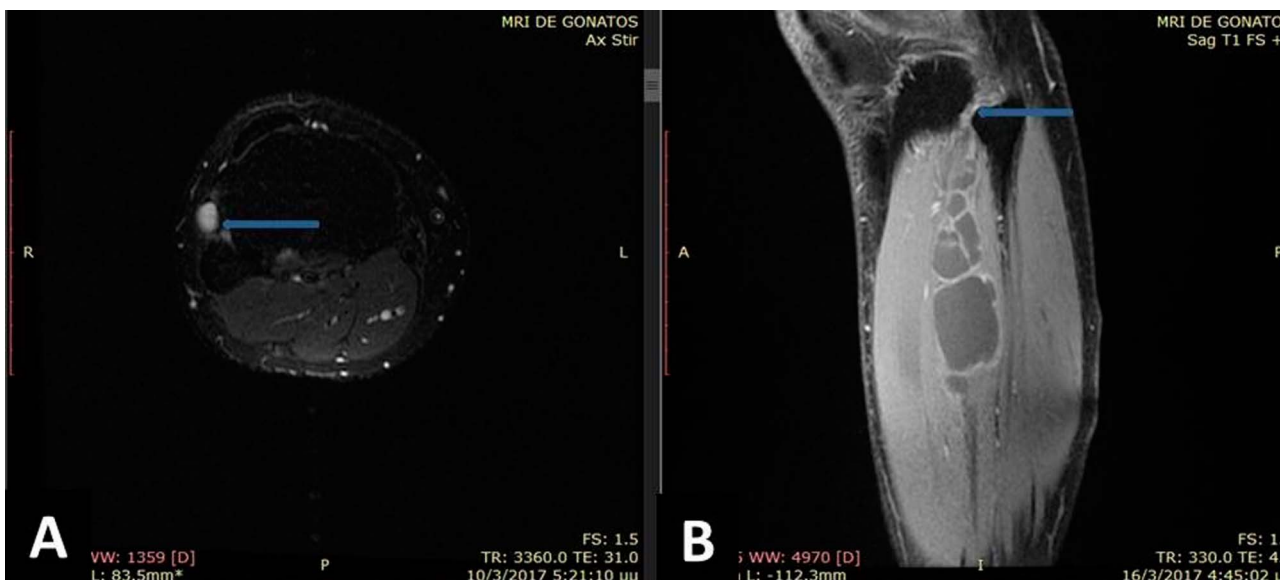


Fig. 9 A-B (A) Axial MRI (short-T1 inversion recovery images) and (B) sagittal MRI (T1 fat-suppressed images after gadolinium enhancement) depict the communicating stalk from the proximal tibiofibular joint (blue arrow). A color image accompanies the online version of this article.

ganglion stalk from the upper tibiofibular syndesmosis is vital in avoiding recurrence, as was performed in many of our patients (Fig. 9). Although other authors have recommended more-extensive operations, such as arthrodesis of the proximal tibiofibular joint or resection of the fibular head or articular surface [10, 13, 16, 18, 23], because of patient discomfort, possible complications, and the high probability of future surgery, we consider these procedures salvage operations. However, surgery is not the best choice for all patients. For patients who are not fit for surgery or who prefer a more conservative approach, an ankle-foot orthosis is reasonable [2].

In conclusion, ganglion cysts of the proximal tibiofibular joint are more frequent in older males, and in a substantial proportion they are discovered because of advanced neurological symptoms. Total excision and stalk ligation was associated with a good functional outcome in this small series, as well as with a low risk of neurologic damage or local recurrence. For these reasons, we believe that more complex reconstructive procedures may not be worth the risk associated with them. Tendon transfers may be performed at the same operative stage after cyst excision in older patients in order to stabilize the ankle joint while younger patients may recover after decompression alone, although larger studies are needed to confirm or refute this finding.

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