CLINICAL REPORT

Electromyographic Abnormalities Associated with Symptomatic Sacral Tarlov Cysts

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■ **Abstract:** Tarlov or perineural cysts (TC) are commonly overlooked as a cause of sacral and ischial pain, and urogenital and bowel problems. TC can be seen on MRI, but are often considered asymptomatic. This is especially true for smaller cysts. Moreover, there are only few diagnostic characteristics that can be used to confirm that the cysts are the cause of the symptoms. As a consequence, a lot of controversy remains regarding the clinical importance of TC. Because of this underdiagnosed condition, patients often suffer for several years from unrecognized chronic neuropathic pain and neurological conditions. In this article, case reports of three patients with giant and smaller symptomatic sacral cysts are presented, in which electromyographic testing was performed to demonstrate nerve damage.

We suggest that electromyography of the sacral nerve roots can be a reasonable tool for the diagnosis of symptomatic TC, as well as for the differentiation from other pathological entities causing sacral and ischial pain. Moreover, using electromyography it was also documented that smaller cysts of < 1 cm can cause nerve damage. Therefore incidence of symptomatic TC may be higher than initially thought. ■

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INTRODUCTION

Tarlov or perineural cysts (TC) are pathological dilations of the nerve root sheath near the dorsal root ganglion and are most frequently located in the sacrum. They were discovered in 1938 by Tarlov while performing postmortem dissections to study the filum terminale. While at first he believed they were asymptomatic, he later recognized their clinical significance, namely the cause of sacral and sciatic pain, and neurological problems.[1,2]

Since then, extensive insight has been gained. Many case reports, as well as experience with large series, have been reported in the literature. Despite a considerable number of scientific publications,[2–26] this clinical entity remains controversial, and TC are almost always thought to be unrelated to the patient's symptoms.[3–5] Yet the pathological entity "symptomatic Tarlov cysts (STC)," is well defined and includes progressive debilitating sacral, ischial, and pelvic pain, neurological symptoms, bladder, sexual, and bowel disorders.[2–4,6–10] Debilitating incapacity to sit is a typical characteristic.[4] Many patients also report headaches.[3,4]

Tarlov or perineural cysts patients, more women than men,[11–13] can be left undiagnosed and misunderstood

for many years. As a consequence, they often develop depression[4,11] and may ultimately be referred for psychological or psychiatric evaluation. The chronic neuropathic pain and the urogenital and bowel dysfunction caused by TC affects to a significant extent the physical, social, and psychological aspects of life and thus the quality of life.[3,4]

In the literature, usually only larger cysts are suspected to be symptomatic,[14] or are selected as a target for interventional therapy, such as fibrin glue injection or surgery.[7,15–17] It is not clear whether there is a size above which cysts become symptomatic.

Nerve conduction studies (NCS) and electromyographic testing (EMG) for the diagnosis of symptomatic TC have not been comprehensively described in the literature. Therefore, in our case series, NCS and EMG performed by a senior neurophysiologist were implemented. The aim of this study was to demonstrate the use of this minimally invasive technique to document axonal injury of the nerve roots that harbor the cysts. If the documented nerve injury is in accordance with the patient's symptoms, this may facilitate the diagnosis of small and large STC and distinguish their symptoms from other conditions causing sacral and ischial pain, and urogenital and bowel symptoms.

CASE REPORT 1

A 54-year-old woman presented with 2 months of progressively increasing pain in the posterior left thigh. Pain was aggravated during jogging and sitting. When lying supine, she experienced local pain at the left side of the sacrum. Numbness of the soles of both feet was also reported. A MRI of the lumbar spine was within normal limits. MRI of the sacrum, however, showed a giant TC of 36 mm diameter that eroded the entire anteroposterior diameter of the left side of the S2 vertebra. (Figure 1A) Smaller dilations of the nerve root sheath eroding the neural foramina were seen at the level of vertebra S2 on the right (12 mm), S1 on the right (14 mm) and the left (11 mm), and L5 on the right (7 mm) and the left (8 mm). Over the next few months, her pain aggravated, and she developed weakness and additional pain in both legs and feet, neurogenic claudication, gait disturbances, constipation, dyspareunia, and urinary frequency and retention. The pain score on the Numerical Pain Rating Scale (NPRS) varied from 5/10 to 7/10.

Clinical examination revealed tenderness on sacral pressure, diminished sensation of the pinprick test on the soles of the feet, decreased extension strength of the left foot and toes (3/5), and absent Achilles tendon reflex on the left side and diminished on the right side. Atrophy of the intrinsic foot muscles was seen. Incapacity increased over the next 6 months. An electrodiagnostic study was performed. Nerve conduction studies showed a slightly decreased velocity (37 m/s) (cutoff 39 m/s) of the sural nerve on the left, which was more difficult to elicit, and a normal velocity at the limit on the right (39 m/s) with an amplitude of 6 μV (cut-off 6 μV) on both sides, which was also at the limit. The motor conduction velocity of the peroneal nerve was within normal limits. The S1 Hoffmann reflexes (the electrophysiological equivalent of the Achilles tendon reflexes) were delayed on both sides. Needle EMG of nerve root L5-, S2-, S3-, and S4-innervated muscles showed abnormalities in all of these myotomes, especially in the S2 tibial nerve-innervated intrinsic foot muscles. This included spontaneous denervation activity and pronounced neurogenic motor unit potentials as well as signs of reinnervation.

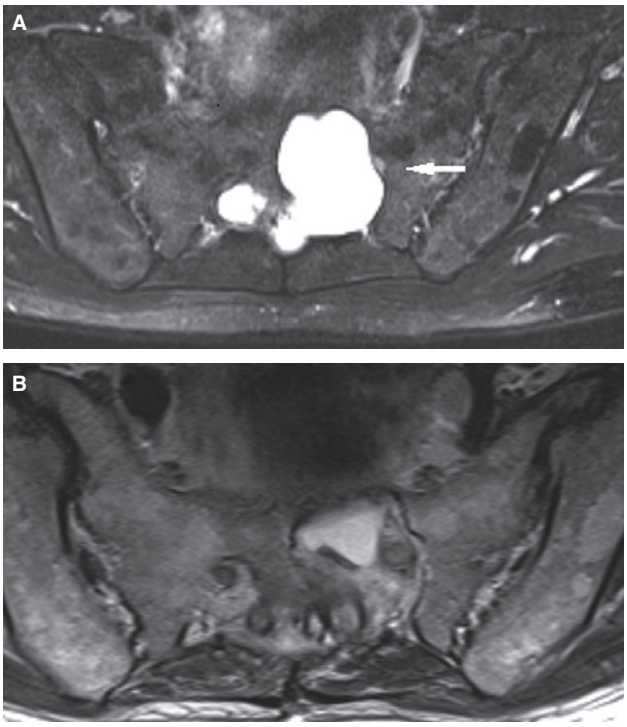

Figure 1. Case 1. T2 weighted axial MRI at the level of the S2 vertebra. (A) Preoperative view demonstrating a large perineural cyst at the level of the S2 vertebra on the left and a smaller on the right. The white arrow indicates the compressed nerve root S2. (B) Postoperative view at 3 months demonstrating a decreased volume of the cysts; the sacral nerves on the right and the left are wrapped with bovine pericard such that it has a caliber of more normal sacral nerve roots; the cysts are no longer compressing the adjacent nerve roots.

Nerve conduction studies/EMG confirmed axonal damage. Consequently, based on these positive electrodiagnostic findings, the typical history of sacral and radicular pain in combination with bladder and bowel symptoms, and the clinical examination, it was concluded that the TC identified on the MRI were the probable cause of the nerve damage.

Narcotic analgesics were prescribed. CT-guided aspiration followed by the injection of 9 mL fibrin glue (Tisseel Baxter)[5] did not relieve the symptoms. Because of the progression of the neurological symptoms, the most appropriate course of treatment for the patient was surgical decompression. The patient had surgery 8 months later, the delay was due to unavailability of an experienced surgeon. Five cysts were surgically corrected under EMG monitoring, fluoroscopy, and microscopy. Surgery was concentrated on the ostium, where spinal fluid and nerve root fibers enter the cyst. Reconstruction of the nerve root sheath and the sacral lamina was performed according to the technique of Feigenbaum and Henderson[4]) (Figure 1B shows post-surgical view).

Postoperative NCS/EMG at 6 months showed improvement of the sural nerve conduction (increased from 37 to 45 m/s on the left and from 39 to 42 m/s on the right). There were slightly more satellite potentials (a sign of reinnervation) in the left L5 and left S2 myotomes. Since reinnervation is a slow process, electrodiagnostic follow-up at 6 months may be too early to detect significant changes.

Six months after the surgery, neurological and pain symptoms had gradually improved. The patient had weaned off narcotic analgesics and was able to return to work. Her score on the NPRS varied from 0/10 to 4/10.

CASE REPORT 2

A 43-year-old woman complained of a painful burning and tingling sensation at the perineum and both buttocks especially while sitting, cramps in her left leg, intermittent abdominal cramps, fecal incontinence, dyspareunia, and headaches, all of which she experienced for 1.5 years. Her employment required her to be seated, but for the last 2 months, she was unable to continue to work due to this inability to sit. Her NPRS score varied from 5/10 to 7/10.

Clinical examination of the lower limbs showed no abnormalities. Previous gynecological and gastrointestinal examination, and MRI of the lumbar spine and brain were within normal limits.

Nerve conduction studies showed normal conduction velocity and amplitude of the sural and peroneal nerve on both sides and the latency of the S1 Hoffmann reflexes were within normal limits. Needle EMG of the L5 to S2 myotomes revealed denervation potentials, neurogenic motor unit potentials, and some reinnervation potentials, all limited to the S2-innervated intrinsic foot muscles at the left. Needle EMG of the external anal sphincter was within normal limits; however, the ano-anal reflex on the left was significantly delayed, and the amplitude was significantly diminished.

Review of her previous MRI of the lumbosacral spine revealed a small TC at the level of S2 bilaterally. Subsequently, a MRI focusing on the sacrum was executed, which showed a dilation of the arachnoidal nerve root sheath at the level of S2 on the right (9 mm) as well as on the left (6 mm) (Figure 2A).

She received a fluoroscopic guided left S2 nerve block, with ropivacaine and steroids. The enlarged S2 nerve

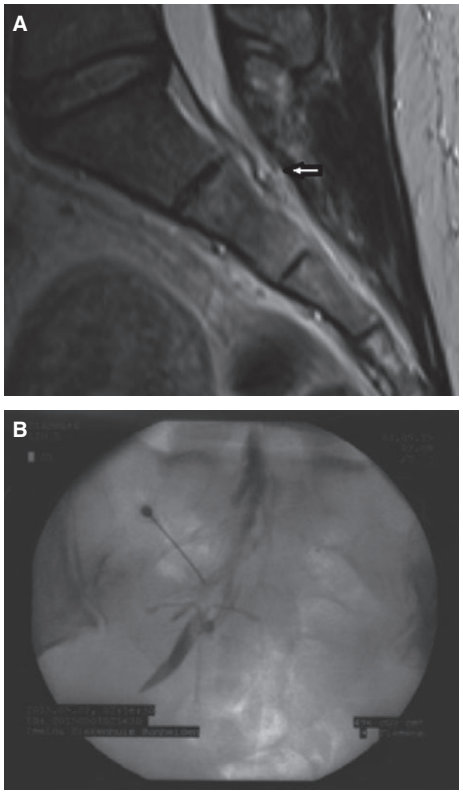

Figure 2. Case 2. (A) T2-weighted sagittal MRI at sacral level demonstrating a small perineural cyst at the level of the S2 vertebra (white arrow). (B) Radioscopic image of nerve root block procedure with contrast medium via the left neuroforamen S1S2 (patient in prone position), demonstrating the S2 root nerve sheath wherein the contours of the cyst are visible (at the tip of the needle). Superposition of an intrauterine device in situ.

root sheath was visualized with injection of contrast fluid (Figure 2B). This injection relieved the pain for about 24 hours. Two weeks later, a pulsed radiofrequency treatment was performed at the same level, which reduced the pain for 48 hours without altering the other symptoms. Gabapentin had no effect. Since all other possible causes for the symptoms had been ruled out, it was concluded that the small TC at the level of vertebra S2 on the left was the likely cause of her symptoms. Two years after the initial symptoms, she used oxycontin 5 mg twice daily, and lying down in supine position several times a day helped to keep her pain under control. The patient was scheduled for surgery.

CASE REPORT 3

This 40-year-old woman presented with pain in the right buttock and posterior upper thigh which she had experienced for 15 years. At that time, she had a car accident and she first observed slight pain in the right leg, which progressively aggravated after child deliveries 10 and 12 years ago. Furthermore, she reported intermittent anal cramps, a few times a gluteal cramp, constipation, and headaches. The leg pain aggravated when sitting and was relieved when lying down or when she rested her leg on another chair in front of her.

Clinical signs were absent, except for a painful perineum on gynecological palpation.

An electrodiagnostic evaluation, which was performed 12 years after the initial symptoms, showed neurogenic abnormalities in the external anal sphincter on the right. There were no signs of active denervation, but poor contraction patterns, unstable chronic neurogenic motor unit potentials, and signs of chronic persisting reinnervation were present. This type of reinnervation with continuous reinnervation attempts that do not stabilize may indicate a source of ongoing irritation.

The right ano-anal reflex was significantly delayed when compared to the left. Other possible causes of her symptoms, such as lumbar nerve root compression, gynecological problems, tendinopathies, and degenerative or arthritic features were ruled out. Pudendal neuritis was diagnosed, but the actual cause remained unidentified.

She received several consecutive treatments, such as steroid injections at the insertion of the hamstrings on the ischial tuberosity, facet blocks of L4L5 and L5S1, sacroiliac injections, radiofrequency procedures of the facet joints and the sacroiliac joint, pudendal nerve blocks, injections of the piriformis muscle, and physical therapy. None of these interventions had a satisfactory effect.

Three years later, when reviewing the initial MRI of the sacrum, three sacral TC were seen on the right, located at the level of vertebra S1 (12 mm), S2 (9 mm), and S3 (12 mm). Tramadol partially relieved the pain. The patient did not want to undergo any further investigations or interventions. She was partly able to control her leg pain caused by casual sitting, by modifying her sitting position as described above.

Her current NPRS score varied from 0/10 to 7/10.

Table 1 summarizes cyst location, size, symptoms, and the nerve root responsible for the symptoms, as well as the NCS/EMG findings for each case.

DISCUSSION

Tarlov or perineural cysts, are dilations of the nerve root sheath near the dorsal root ganglion.[1,2] It is hypothesized that under increased hydrostatic pressure a valve mechanism allows cerebrospinal fluid to get trapped inside the nerve root, between endoneurium and perineurium.[2,7,18] The prevalence of TC is estimated to be 5% of the general population.[12] The reported prevalence partly depends on cyst size from which lesions were labeled TC. Patients often have multiple cysts, and more women than men harbor symptomatic TC.[2,11,13,18] One-fifth of the TC were found to be symptomatic.[12] It is not clear whether there is a size above which TC may become symptomatic. Langdown et al.[18] suggested that it is not the size of the cyst but its proximity to the nerve root and the presence of a valve mechanism that predicts symptom development and progression.

Davis et al. used flow-sensitive frequencies MRI studies to differentiate TC with a valve mechanism from those without a valve mechanism. They concluded that there was no significant difference in the size between symptomatic and asymptomatic TC. However, they found a clear difference in the context of communication, as all asymptomatic TC were shown to communicate, while all symptomatic TC did not communicate.[19] These findings are in accordance with the recent report of Sun et al., who microscopically analyzed resected TC. They concluded that enlargement of TC, and not the size of the cyst, leads to progression of symptoms. Due to nerve root irritation caused by the pressure inside the cyst, patients may begin to feel pain

Table 1. Cyst Location, Size, Symptoms, the Nerve Root Responsible for the Symptoms, and the EMG Findings for Each Case

	Case 1	Case 2	Case 3
Cysts: side, vertebral level and (size)	R S2 (12 mm) L S2 (36 mm) R S1 (14 mm) L S1 (11 mm) R L5 (7 mm) L L5 (8 mm)	R S2 (9 mm) L S2 (6 mm)	R S1 (12 mm) R S2 (9 mm) R S3 (12 mm)
Radicular pain in the back of the leg (L5–S2)	R + L more when sitting also in the L5 dermatome	R + L more when sitting R muscle cramps	R only when sitting
Perineal pain (S2–S5)	Present	Present	Present
Bladder/sphincter symptoms (S2–S4)	Retention	None	None
Bowel/sphincter symptoms (S2–S4)	Constipation	Abdominal cramps fecal incontinence	Anal cramps constipation
Other symptoms	L decreased extension strength foot and toes (L5, S1); R + L atrophy of intrinsic foot muscles (S2); neurogenic claudication and gait disturbances (L5–S2); dyspareunia (S3–S5); headaches	Dyspareunia; headaches	Headaches
EMG sural nerve response R + L	Delayed, lower amplitude	Normal	Not performed
Hoffmann reflexes R + L (height)	Delayed R 35.0 ms L 35.6 ms (1.80 m)	Normal R 29.6 m L 28.8 m (1.61 m)	Not performed
L5: extensor digitorum longus or gluteus medius muscle (L5) R + L	R normal L no pathological denervation; max. contr.: poor intermediary MUPs; polyphasic and polyturns +(+); normal amplitude; unstable; reinnervation potentials +(+)	R normal L no pathological denervation; max. contr.: polyphasic and polyturns MUPs +	Not performed
S1: gastrocnemius muscle R + L	Normal	Normal	Not performed
S2: flexor hallucis brevis and flexor digiti quinti pedis muscle R + L	R prolonged insertion, fibrillation potentials (+) & positive sharp waves (+) max. contr.: poorer +; MUPs of higher amplitude ++(+); very polymorph; strongly unstable & satellite potentials + L prolonged insertion (+); max. contr.: poorer ++; MUPs of higher amplitude ++; polymorph, unstable & reinnervation potentials +	R normal L pathological denervation +; max. contr polyphasic and polyturns +(+); reïnnervation (+)	Not performed
(S2)S3S4: anal sphincter	Not performed	R + L no pathological denervation; max. contr.: polyphasic (+)	R: no pathological denervation; max. contr.: poor intermediar pattern; polyphasic and polyturns ++(+); reinnervation potentials +(+) L: normal
(S2)S3S4: anoanal reflex	Not performed	R delayed: 84.7 ms; lower amplitude on maximal stimulation: 1200 μV L normal: 34.8 ms, 3000 μV	R delayed: 68.2 ms L normal: 28.8 ms (amplitude not reported)

L, Left; R, right; MUP, motor unit potential; (+), discrete; +, slight; ++, moderate; +++, severe; MUP, motor unit potentials; max. contr., maximal contraction. For the measurements of the cyst, the largest diameter was reported.

or paraesthesia early. And as a consequence, even very small TC can cause severe pain.[8]

Symptoms of this clinical entity depend on the affected nerve root and include the following: pain, numbness, cramps, tingling or decreased sensation in the sacrum, the perineum, the legs and the feet; neurogenic claudication; foot-drop; neurogenic bladder symptoms (retention); bowel symptoms (constipation and abdominal pain); sexual dysfunction (dyspareunia, persistent genital arousal syndrome and impotence); and urinary and fecal sphincter disturbances.[3,4,6–8,10,15,16,20–23] Patients typically have a debilitating incapacity to sit,[4,24] which severely limits their employment and social activities.[4]

Symptoms are the result of irritation, stretching or compression of the nerve root fibers that are present in the wall or in the cavity of the cyst, as well as compression of the neighboring nerve roots.[2,4,6,10] The

sacral pain can partly be the result of bone erosion.[2,4] TC patients frequently also report headaches, which might reflect hydrostatic and intracranial pressure disturbances.[3,4,21] Despite that it is well documented that TC can be a cause of these debilitating symptoms, in clinical practice, controversy remains and this pathological entity is widely underrecognized,[3–5] especially when the cysts are small. Consequently, most of the STC remain undiagnosed for many years.[4] In a case reported by Hiers et al.[3], the patient became increasingly disabled and suffered for more than 20 years before she was finally diagnosed. In 13 patients selected for surgery in a study of Neulen et al.[17], symptoms had been present for 8.7 ± 11.5 years (from 6 months to 30 years). In the meantime, patients may have consulted a variety of physicians, such as neurologists, physiatrists, orthopedic surgeons, neurosurgeons, urologists, gynecologists, internists, pain specialists, or psychiatrists.[3,4,14,21] This is partly also because patients do not mention bladder, bowel, or sexual symptoms when consulting a back specialist, or do not mention low back or leg pain, when consulting a gynecologist or urologist.[3] Moreover, most doctors fail to ask patients about these other symptoms, because they are unaware of the existence and presentation of STC.

Other confounding conditions must be ruled out first. For instance, degenerative disorders, disk hernia causing radicular compression, gynecological, urological, and internal disorders. Even when the cyst is suspected, only very few clinical signs on physical examination may be present to confirm that this is the true cause of the patient's symptoms. Possible clinical signs are diminished sensory perception to pinprick on the soles of the feet, the back of the legs or the perineum, weak or absent Achilles tendon reflexes, and weakness or atrophy of the foot muscles. If clinical examination provides no decisive answers, then it is generally concluded that the pain must be originating from something other than the cyst.

More invasive diagnostic methods may be used preoperatively, such as CT myelography, nerve root block, and aspiration of the cyst.[3,5,6,24] A diagnostic nerve root block would be a good choice. However, there is a risk of puncturing the cyst, causing damage to the nerve fibers in the cyst or the cyst wall, infection, bleeding, or dural leak. Because confusion remains about the true cause of the pain and that smaller cysts are usually considered not to cause any symptoms, a low risk, minimally invasive electrodiagnostic study was used to correlate its findings with the patient's symptoms and the MRI images.

NCS/EMG examination for STC has been described in the literature, although not extensively. According to Cattaneo et al., TC cause mostly sensory disturbances, because of their location at the dorsal root ganglion. They described sural nerve disturbances in 5 of 10 symptomatic patients with sacral TC. They did not find alterations of the motor conduction velocity or the F-waves.[25] This is in agreement with our first patient in which, when using the same reference values for conduction velocity and amplitude as Cattaneo et al., similar sural nerve disturbances were found, but no motor conduction abnormalities.

In addition, in our case series, the S1 Hoffmann reflexes were studied. A delayed response on both sides in case 1 was found, which is consistent with a radiculopathy of S1.

However, in a cohort of 32 Italian STC patients, all were reported to have normal NCS findings. The examination consisted of the assessment of sensory and motor nerve conductions and amplitudes, and F-wave studies, but the normal reference values were not reported and Hoffmann reflexes or needle EMG were not performed.[11]

In a case study published by Baek et al., a right lumbar radiculopathy was found on EMG. This patient had TC on nerve root S1, S2, and S3 bilaterally and was suffering from paresthesia and numbness in the feet, gait difficulties and diminished sensation on pinprick in the legs and feet. However, the details of the NCS/EMG were not reported.[20]

Nadler et al. performed an electrodiagnostic study in a patient with a TC at the level of S2 which compressed the adjacent nerve roots and found a significant prolongation of the S1 Hoffmann reflex on the affected side, when compared to the unaffected side. Needle EMG confirmed chronic axonal injury, in the left lower paraspinal muscles and corresponding S1 appendicular muscles.[26] This is in accordance with the findings in case 1, in which signs of axonal degeneration in the L5 and S2 myotomes were found, especially on the left.

In clinical practice, most of the needle EMG are performed for the diagnosis and the evaluation of the severity of radiculopathies due to disk herniations. For this pathology, typically only myotomes L3 to S1 are examined, but not the sacral nerve roots S2 to S4, where TC most frequently are located. This may explain why electrodiagnostic studies in the differential diagnosis of sacral and ischial pain due to radiculopathy is often reported being within normal limits. Therefore, needle EMG of the tibial nerve-innervated intrinsic foot mus-

cles, which are supplied by nerve root S2 was also performed. This way, in patients harboring small cysts on the level of vertebra S2 and S3, such as in case 3, axonal damage of S2 can be documented. Furthermore, a needle EMG of the external anal sphincter was performed and/or the ano-anal reflex examined. This way, nerve damage of S3 and S4 was demonstrated (as in cases 2 and 3).

Case report 2 is an example of a patient with severe neurologic symptoms, such as fecal incontinence, who showed no abnormalities on physical examination. However, NCS/EMG helped to establish the TC as the probable cause of the symptoms. Moreover, when examining the sacral nerve roots, it was found that cysts as small as 6 mm, such as in Case 2, can cause nerve compression. This is in accordance with the study of Sun et al.[8], who found that even very small cysts may become symptomatic. It was also found that in patients with multiple TC, several cysts can simultaneously be responsible for axonal injury and clinical symptoms. This was the situation in our first patient who had multiple cysts, and in our second patient who had one cyst on both sides. Pain and/or needle EMG abnormalities in both cases occurred in, respectively, the dermatomes and myotomes on both sides. This may at least partly explain why treating only the largest cyst, for instance, by performing aspiration and fibrin glue injection may not be satisfactory.

A positive electrodiagnostic study provides additional information about side and level of the affected nerve(s). As multiple cysts are common, this minimally invasive procedure can replace the more invasive diagnostic block to prevent possible complications inherent to interventional procedures. Once the diagnosis is established, however, treatment options are limited as there is no consensus about the treatment of choice.[3,16]

Interventional therapy may consist of aspiration of the cyst followed by fibrin glue injection, but only few centers perform this technique. About 65% to 85.7% of the patients have good to excellent results to improvement in their symptoms.[5,9] However, recurrence of the symptoms occurs and intraprocedural bleeding or nerve injury make subsequent surgery more difficult.[4,8] Arachnoiditis from fibrin glue entering in the thecal sac may occur. However, a good patient selection can prevent this complication.[5] Satisfactory long-term results have been reported up to 6 years.[15,27]

In general, microsurgery would be the treatment of choice in order to relieve nerve root compression.[4,8] However, the surgery is delicate, because of the high hydrostatic pressures, fragility of the tissues, and the presence of the nerve root fibers in the cyst or the cyst wall that lead to high incidences of complications such as dural leak or nerve damage.[28] A technique for reconstruction of the nerve root sheath should be used to prevent recurrence.[4,8] Only a few centers have adequate expertise, and therefore, the surgery is not commonly available.[4,6,8,16–18] In a review on surgerical series, 38% to 100% improvement of symptoms was reported. However, the quality of the evidence was poor due to methodological issues.[29]

Often, only pain relief can be offered. Nerve root block with steroids, in our experience, mainly has a diagnostic role, due to the short-term effect on the pain. Moreover, the nerve root may be punctured more easily, as it is dilated. For the neuropathic pain, tricyclics, gabapentin, opioid medication, or ultimately even spinal cord stimulation or an intrathecal morphine pump are used.[3,4] Obviously, these therapies have no effect on the neurological impairment. Even in the absence of interventional therapy, NCS/EMG is still justified, as it is minimally invasive and provides a diagnosis for these patients, who may be suffering for many years from unexplained neuropathic pain. It is important for both patient and doctor to have a better understanding of their condition. A correct diagnosis also shields them from more unnecessary technical and often painful diagnostic or interventional procedures, or even surgeries, and consequently also for the disappointment of the ineffectiveness of yet another intervention.[3–5]

In conclusion, "STC" is a well-defined clinical entity including sacral and ischial pain, urogenital and bowel symptoms and probably headaches. Unfortunately, this condition is frequently neglected, especially when the TC are small. Moreover, clinical examination reveals no or only few signs, and therefore, STC are difficult to differentiate from other clinical entities with similar symptoms. Therefore, an electrodiagnostic study to demonstrate nerve root damage was performed and the results were correlated with the patients' symptoms.

Nerve conduction studies/EMG examination should include studies of the sural nerve and the Hoffmann reflexes, as well as a needle EMG of the sacral-innervated myotomes: the gastrocnemius muscle, the tibial nerve-innervated intrinsic foot muscles, the external anal sphincter, and when possible the ano-anal reflex. It was also demonstrated that cysts as small as 6 mm, as in this case report, can cause nerve damage and debilitating symptoms.

In patients with sacral and ischial or perineal pain, especially when in combination with urogenital and bowel symptoms, the presence of TC should be taken into consideration.

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