Lumbar Cerebrospinal Fluid Drainage for Symptomatic Sacral Nerve Root Cysts: An Adjuvant Diagnostic Procedure and/or Alternative Treatment? Technical Case Report

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OBJECTIVE AND IMPORTANCE: The treatment of symptomatic sacral nerve root cysts is difficult and challenging. A major role has been ascribed to the hydrostatic and pulsatile forces of cerebrospinal fluid (CSF) for the symptomatology of sacral nerve root cysts. Theoretically, lowering those pressures should have a beneficial effect on the symptoms. Lowering the hydrostatic and pulsatile pressures may be achieved by lumbar CSF drainage. The effect of lumbar CSF drainage on the symptomatology of sacral nerve root cysts is described.

CLINICAL PRESENTATION: Three patients suffered from leg and/or low back pain as a result of sacral nerve root cysts.

INTERVENTION: First, CSF was drained through an external lumbar drain that was connected to a CSF bag. Mobilization was not restricted. All patients became free of symptoms. Eventually, a lumboperitoneal shunt was inserted in two patients. Those two patients remained free of complaints for 11 and 9 months, respectively.

CONCLUSION: To our knowledge, this is the first report that clearly establishes the role of CSF forces in the symptomatology of sacral nerve root cysts. Lumbar external CSF drainage is a diagnostic tool to investigate the clinical significance of sacral nerve root cyst(s). Lumboperitoneal CSF shunting is a promising alternative in the treatment of symptomatic sacral nerve root cysts.

Key words: CSF diversion, Lumboperitoneal shunt, Meningeal cyst, Perineural cyst, Sacral nerve root cyst

Sacral nerve root cysts are observed relatively frequently during neuroradiological investigations (11). The neuroradiological appearance of nerve root cysts has been extensively discussed in the literature (1, 2, 4, 5, 7, 8, 16–18, 20, 22, 24, 26–28) and is beyond the scope of this article. Although most of these cysts, whether they are perineural cysts, meningeal diverticula, or arachnoid nerve root sheath dilatations, are asymptomatic and occur incidentally, some produce symptoms.

In general, surgical treatment is recommended for symptomatic sacral nerve root cysts. In the literature, three surgical options are described, i.e., simple decompressive sacral laminectomy, cyst and nerve root resection, and incision and drainage of the cyst, with imbrication of the redundant nerve root sheath (6, 7, 9, 11–13, 15, 17, 18, 21, 22, 28). Although favorable results are reported, surgical failures have also been described, especially after decompressive laminectomy. Multiple cysts are a challenging problem for the physician, i.e., which cysts are symptomatic and should all or just one cyst be treated? Considering this and other theoretical pathophysiological aspects, we looked for an alternative treatment.

A major role has been ascribed to the hydrostatic and pulsatile forces of cerebrospinal fluid (CSF) in the cause of (symptomatic) nerve root cysts. However, experimental data or studies reporting the effects of manipulating the hydrostatic pressure or pressure waves, to our knowledge, have never been reported in the literature. Assuming lumbar CSF drainage will lessen the hydrostatic pressure and dampen the CSF pressure waves, it seems plausible that the pressure within the sacral nerve root cyst will also diminish, as will the compression of the adjacent nerve root, and have a beneficial effect on the symptoms of the patient. We present our preliminary experience with lumbar CSF drainage in three patients who demonstrated symptomatic sacral nerve root cysts.

CASE REPORTS

Patient 1

A 48-year-old woman visited our department for a third opinion. She revealed a history of long-lasting low back pain that had worsened during the past 4 years and that had started to irradiate through the dorsolateral side of the right leg to the lateral foot. Walking, standing, sitting, coughing, and sneezing intensified the complaints, whereas the recumbent position had a favorable effect on the pain. In the morning, she experienced less pain. In the same trajectory as the pain, she noticed paresthesias. For 6 months, she also complained of urge and stress incontinence of urine. Because of the severity of the pain, she was unable to work.
Neurological examination was normal except for hypesthesia on the lateral side of the right calf and foot, and an absent ankle jerk on the right side. The straight leg raising sign was negative. Urodynamic evaluation revealed an contractile bladder, probably resulting from motor denervation with normal closing pressure. No significant postvoid residual was observed.

Myelography revealed two sacral nerve root cysts on the right side that were clearly seen 10 minutes after intrathecal injection of metrizamide. Computed tomography performed after myelography also disclosed the cysts, but also showed erosion of the sacrum. These findings were confirmed by magnetic resonance imaging (Fig. 1).

After providing informed consent, the patient agreed to observation of the effect on her complaints with lumbar external CSF drainage. A spinal catheter was introduced at L3-L4 and was connected to an external CSF bag. Mobility was not restricted; she was allowed to walk, sit, etc. One day after the introduction of lumbar CSF drainage, she was completely free of pain. The next day, she complained of postural headaches. The external CSF bag was raised to 10 cm above the level of the iliac crest while sitting, walking, or laying down. During the next 5 days, she did not experience any pain in the back, leg, or head. The hypesthesia persisted, as did the micturition disturbances. After the removal of the catheter, all symptoms returned. A lumboperitoneal shunt was inserted. For 6 weeks, she was free of low back and leg pain. However, she complained of a slight postural headache. After 6 weeks, the headaches diminished and the pain in the low back and leg returned. A plain radiographic examination of the lumbar spine disclosed a dislocation of the spinal catheter. A new catheter was inserted, and a PS Medical Delta Valve Performance Level 2 (Medtronic PS Medical, Goleta) was interposed. Eleven months postoperatively, she still remained free of low back and leg pain, and the headache did not return. Micturition was normal. She felt reinvigorated.

**Patient 2**

One year before admission to our clinic, a 50-year-old woman had undergone, at another facility, a lumbar discectomy at L5-S1 because of left-sided leg pain and micturition disturbances. During surgery, nerve root cysts were observed and left untreated. The patient was admitted because of persisting pain in the left leg that sometimes irradiated to the left foot. The severity of her complaints was directly proportional to the level of daily activities. The pain was most severe while sitting, whereas, in the recumbent position, she felt very little pain. During activities that increased intra-abdominal pressure, the pain did not worsen. Because of the pain, she started working part-time (as a secretary). Neurological examination was uneventful, except for an absent left-sided ankle jerk. Magnetic resonance imaging disclosed multiple sacral nerve root cysts, especially on the left side (Fig. 2),

![FIGURE 1. Myelogram (A) disclosing two sacral nerve root cysts on the right side (arrows). Computed tomographic scan (B) obtained after myelography not only showed the right-sided cysts compromising the nerve root S1, but also enlargement of the foramen. Axial T1-weighted (C) and T2-weighted (D) magnetic resonance images, sagittal T1-weighted (E), and T2-weighted images and coronal T1-weighted (F) images confirmed the presence of right-sided sacral cysts compromising the nerve root.](image)

After informed consent was obtained, a spinal catheter was introduced at L3-L4 and connected to an external CSF bag. The zero level of the CSF bag was fixed at 10 cm above the iliac crest. Mobility was not restricted. For 5 days, she was completely free of leg pain. She noticed an increased mobility of the lower back. However, on day 6, she suffered from a severe postural headache that was not relieved by raising the CSF bag. The catheter was removed; the headache disappeared, and the previous complaints returned. The possibility of a lumboperitoneal shunt was discussed, but she emphatically refused because of an extreme fear of receiving an infection from an internal device.

**Patient 3**

A 63-year-old woman presented with a 6-month history of low back pain radiating to the right forefoot. The pain did not worsen during the day. Occasionally, the patient noticed a loss of sensibility in the medial right foot. Neurological examination was normal. Magnetic resonance imaging revealed a sacral nerve root cyst (Fig. 3).

![FIGURE 2. Axial T1-weighted (A) image showing a large sacral nerve root cyst with foraminal enlargement on the left side. At a lower sacral level (B), cysts on the right side were observed.](image)

After informed consent was obtained, a spinal catheter was introduced at L3-L4 and connected to an external CSF bag. The zero level of the CSF bag was fixed at 10 cm above the iliac crest. There were no restrictions to mobility. The day after the introduction of the external lumbar CSF drainage system, she was...
completely relieved of all complaints. On day 5, she complained of a headache that responded to raising the CSF bag. On day 7, the system was removed. For 3 weeks, she remained free of symptoms. Subsequently, the symptoms returned. A lumbo-peritoneal shunt with interposition of a PS Medical Delta Valve Performance Level 2 was implanted. The postoperative course was uneventful, and 9 months after implantation of the device, she is still free of pain.

DISCUSSION

Sacral nerve root cysts are detected relatively frequently during neuroradiological examinations (11). Although different pathologically, sacral nerve root cysts (perineural cysts, meningeal cysts or diverticula, and nerve root sheath dilatations) demonstrate similar radiographic and clinical presentations (13, 26). The neuroradiographic appearance of nerve root cysts has been described extensively in the literature (1, 2, 4, 5, 7, 8, 16–18, 20, 22, 24, 26–28).

Sacral nerve root cysts seldom become symptomatic. The presenting symptomatology consists of local or radiating pain, cociodynia, sensibility loss, dysesthesia or paresthesia, paraesthesia, or micturation disorders. The symptoms, especially the pain, often disappear in the recumbent position and recur in the upright position (2, 6, 18, 20, 25, 26, 29). A differential diagnosis includes lumbar disc disease, developmental narrowing of the lumbar vertebral canal, lumbar spondylolisthesis, lumbar metastasis, and spinal epidural infections (2, 21).

Congential, traumatic, degenerative, and inflammatory causes have been claimed for spinal nerve root cysts (perineural cysts, meningeal diverticula or cysts, and nerve root sheath dilatations), but most are idiopathic (2, 3, 7–10, 12, 14, 15, 26). Irrespective of the exact causes of the cysts, the hydrostatic and pulsatile forces of CSF are mainly held responsible for the growth of the cysts and for their becoming symptomatic. It is conceivable that the cyst will fill and enlarge while in the upright position, assuming there is a slit-like aperture functioning as a valve. Pressure waves influenced by pressure transmitted from body cavities, notably the chest and abdomen, through the venous system further enhance the enlargement of the cyst. Symptoms may arise when nerve roots are stretched or compressed against adjacent bone. While recumbent, the cyst may deflate and the symptoms may diminish or even disappear (9, 10, 12, 15, 17, 19, 20, 28). If this hypothesis is valid, one might expect a beneficial effect on the symptoms by lowering the hydrostatic pressure, especially in the upright position, and by dampening the pressure waves. Lumbar CSF drainage, either externally or internally, produces a lower hydrostatic pressure and pressure waves of a lesser magnitude. The positive effects of lumbar CSF drainage on symptomatology are demonstrated in the three patients in our report. However, we do not think the lowered pressures inside the cyst are associated with a radiologically detectable decrease in the size of the cyst. Therefore, we did not obtain postoperative radiological images. Although the hypothesis was probably valid, to our knowledge, no experimental data or observations supporting this theory have been published in the literature. In our opinion, this is the first study that demonstrates evidence supporting a major role for the hydrostatic and pulsatile forces of CSF in the symptomatology of sacral nerve root cysts.

Although some neurosurgeons express doubt whether these lesions are symptomatic or should be treated (16, 23), surgery is generally recommended for symptomatic sacral nerve root cysts. Surgical options include simple decompressive laminectomy, cyst and nerve resection, and incision and drainage of the cyst, with imbrication of the redundant nerve root sheath (6, 7, 9, 11–13, 15, 17, 18, 21, 22, 28). Simple decompression has proven not to be successful (11). Cyst and nerve root resection often results in a neurological deficit (11, 18). The last option is the most favorable, although it may be difficult to obtain a watertight closure of the redundant nerve root sleeve. Although our experience is more or less case-based (nearly all reports in the literature dealing with this subject are summaries of cases) and preliminary, we think that lumbar CSF drainage through a lumbo-peritoneal shunt may be a valuable alternative, particularly for patients who had undergone previous lower back surgery or stabilization procedures that lessen the appeal of lower back surgery, or for patients who sustained multiple nerve root cysts. Interesting problems arise for the patients who suffer from multiple nerve root cysts (Patients 1 and 2). Which of the cysts is (are) responsible for the complaints? Should all of the cysts be treated surgically or should only the cyst that is considered responsible for the symptoms cyst be operated on, and thereby risk surgical failure? External lumbar CSF drainage cannot demonstrative which cyst is responsible for the symptoms, but if the patient responds to the procedure (as in all of our cases), the effect of internal CSF drainage is more likely to be beneficial (Patients 1 and 3). The insertion of a lumbo-peritoneal shunt is much easier than any of the other surgical options mentioned above, although the complications should be considered, e.g., shunt malfunction and infection.

In conclusion, the results reported in the three patients in our study are the first in the literature, to our knowledge, that clearly support the role of the hydrostatic and pulsatile forces of CSF in the symptomatology of sacral nerve root cysts. Secondly, external lumbar CSF drainage may be used as an adjuvant diagnostic tool if any doubt exists about the clinical significance of a sacral nerve root cyst(s). Finally, although further study is needed, lumbo-peritoneal CSF shunting is a promising alternative surgical option for the treatment of sacral nerve root cysts, especially in patients in whom lower back surgery is less advisable.

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REFERENCES


COMMENTS

The authors describe the treatment of symptomatic sacral nerve root cysts with cerebrospinal fluid (CSF) drainage. Their approach is based on the postulated role of CSF hydrostatic forces in the causes of symptoms. This report of two patients not only provides insight into the pathophysiology of symptomatic sacral nerve root cysts, but also suggests a potentially useful treatment option. At the same time, several issues are raised that require further investigation.

All three patients experienced resolution of pain with lumbar drainage, and two patients experienced prolonged relief with lumboperitoneal shunting. Although a response of pain to a particular intervention is frequently misleading, these results are highly suggestive of a role for hydrostatic forces in the causes of symptoms in this condition. The first patient also experienced a resolution of urinary incontinence. Follow-up urodynamic studies might be particularly useful to provide more objective evidence of improvement in patients who demonstrated preoperative bladder symptoms. The authors state that it is unlikely that a decrease in the size of the cysts could be demonstrated radiologically after treatment. This assertion may be correct, but it should be verified with postoperative studies.

The authors used a trial of lumbar CSF drainage before recommending lumboperitoneal shunting in their patients. Although this technique may be valid for screening when lumboperitoneal shunting is being considered, it may demonstrate a poor sensitivity for determining the clinical significance of sacral nerve root cysts in patients in whom the cause of symptoms is unclear. Although CSF drainage may dampen the hydrostatic forces exerted on these cysts, it does not eliminate them. A severe postural headache might develop before relief of symptoms, resulting in trial failure. Thus, even patients who might benefit from other surgical treatments for sacral nerve root cysts might not respond to CSF drainage.

Overall, the authors demonstrate a rational approach to patients having symptomatic sacral nerve root cysts. Clearly, further investigation is necessary to establish the long-term efficacy of CSF drainage in the evaluation and treatment of those patients.

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Portland, Oregon

Bartels and van Overbeeke demonstrate the usefulness of lumboperitoneal shunting for the treatment of symptomatic sacral nerve root or perineural cysts. Many neurosurgeons have experienced great difficulty in treating this entity. Some have advocated no treatment at all, even in symptomatic patients, because many patients who demonstrate sacral nerve root or perineural cysts are asymptomatic (i.e., the cysts are identified as incidental findings on myelography). Therefore, symptomatic patients are often left untreated, perhaps inappropriately.

Bartels and van Overbeeke provide a simple and relatively safe treatment regimen that is based on physiological and hydrostatic principles. This procedure is associated with a relatively simple diagnostic test, i.e., lumbar drainage, that may be used as a trial before the placement of an internal lumboperitoneal shunt.

The authors' regimen may provide relief for many of the patients who are symptomatic from sacral nerve root or perineural cysts. However, more clinical experience is required to validate their observations. Nevertheless, the authors' simple, relatively noninvasive approach to this potentially complex problem deserves attention and recognition by the neurosurgeons who treat symptomatic sacral nerve root or perineural cysts.

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This is a provocative report that justifies further study. Sacral nerve root
cysts represent difficult management problems for two main reasons. First, they occur fairly commonly and are asymptomatic in the vast majority of patients. It is often difficult, therefore, to individually determine their causative or coincidental association in patients presenting with chronic low back or leg pain. Secondly, direct surgical approaches to these lesions, either through fenestration, excision, or placation, are fraught with risk and often unsuccessful. Although preliminary findings in this study are encouraging, it is important that this invasive, yet potentially therapeutic, procedure is critically evaluated in an appropriately designed prospective study.

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