

Advances in the Diagnosis and Treatment of Sacral Cysts

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Abstract: Sacral cysts have become a neurological disease that has received widespread attention in recent years. Its etiology and pathogenesis are still unclear, and it is more commonly believed to be the result of the interaction of multiple factors, which leads to clinical symptoms such as chronic low back pain and dysfunction of urinary and fecal functions. The disease is detected and diagnosed by magnetic resonance imaging, and treatment options include conservative treatment, interventional therapy, and surgical removal. However, there is no consensus on the diagnosis and treatment of sacral cysts, which has led to stagnation in the diagnosis and treatment of this disease. This article summarizes the definition, epidemiological characteristics, etiology and pathogenesis, diagnosis and treatment of this disease, in order to provide certain reference for clinical work.

Keywords: Sacral Cyst; Etiology; Pathogenesis; Microsurgery; Treatment.

1. Introduction

Sacral cysts are spinal cysts occurring in the sacral canal, which were firstly discovered and described by Tarlov by chance, and usually have no obvious symptoms. Some patients may present with low back pain, lower extremity weakness, pain, and sexual dysfunction. As there are many controversies in the current understanding of this disease and its treatment is not standardized, this article will attempt to delve into this important topic from several perspectives, including its definition, epidemiology, etiology and pathogenesis, diagnosis and treatment methods.

2. Epidemiology

Sacral cyst is a cystic neurologic lesion within the sacral canal. It is a "blob" between the nerve lining and the fasciculus in the sacral canal, filled with cerebrospinal fluid, and is also known as an intrasacral spinal cyst. This lesion is usually due to an abnormality in the internal structure of the sacral canal, where there is a fistula between the wall of the sac and the subarachnoid space, and when the pressure of the cerebrospinal fluid increases, the cerebrospinal fluid rushes through these weak points and forms a cyst [1]. In the past, some foreign researchers divided spinal cysts into three types: type I includes spinal cysts without neural tissue; type II includes spinal cysts with neural tissue; and type III includes cysts located under the dura mater. Of the many types, neural fascicular cysts are the most prevalent, accounting for the vast majority of cases [2]. The incidence and prevalence of sacral cysts also varies among different regions and ethnic groups. The prevalence may be higher in certain regions or ethnic groups, which may be related to local habits, environmental factors, and so on. According to a retrospective study [3], sacral cysts were present and detected in 13.2% of adult patients, with a greater proportion of female patients (68%). Surprisingly, the study did not find any pediatric patients, and it is hypothesized that the prevalence of the disease may be proportional to age, with a mean number of cysts per patient of (2.0 ± 1.2) .

3. Etiology and Pathogenesis

Although there is still no completely unified academic knowledge of the mechanism of sacral cysts, most sacral cysts occur due to congenital diseases, which can also lead to arachnoid hernia, which can lead to sacral cysts. Paulsen [4] put forward the theory of "ball valves", suggesting that, when people do coughing, strenuous exercise or Valsalva, abdominal pressure increases, which will cause an increase in intracranial pressure, which will open the hidden space between the nerve membrane and the endothelium to become more open, thus creating a unidirectional valve, Paulsen [4] proposed the "ball valve" theory, suggesting that when people cough, exercise strenuously or Valsalva, the abdominal pressure increases, which will increase the intracranial pressure, which will open up the hidden space between the nerve membrane and the endothelium, making it more open, thus forming a unidirectional flap, which, if continued, will increase in size until it presses on the peripheral nerves, causing serious neurological disorders. Hulens M [5] analyzed 17 patients and suggested that pathologically elevated cerebrospinal fluid pressure would not only dilate some nerve root sheaths to form sacral cysts, but also damage axons in the undilated nerve root sheaths and neurons in the dorsal root ganglia. Potts MB et al [6] found that if patients suffered trauma to the sacrococcygeal region in their daily lives, it would cause rupture of the blood vessels between the outer membrane of the nerve root and the fasciculus to hemorrhage, resulting in injurious changes. Degeneration of the tissue surrounding the nerve root is also a cause of cyst formation.

4. Clinical Symptoms and Diagnosis

Sacral cysts are commonly referred to as a cystic disease consisting of the neural fascia membranes, spinal membranes, and arachnoid membranes. Most people usually have no clinical signs until they are diagnosed with sacral cysts. Some patients may present with pain, neurologic dysfunction, cauda equina syndrome, and cyst compression symptoms. Among them, pain is the most common symptom [7], which is mainly

manifested as lumbar pain or sciatica, which mostly has a chronic developmental process and can be present for a long time. The nature of pain is mostly dull or aching pain, and in severe cases, severe pain or burning pain can occur. When the pressure in the spinal canal increases [8], such as prolonged standing, prolonged sitting, exertion, coughing, etc., the accumulation of cerebrospinal fluid in the sacral canal can lead to symptom aggravation, and patients may manifest a series of neurological dysfunctions, such as lower extremity muscle weakness, muscle atrophy, hypesthesia, ankle reflexes abnormalities, and so on. Among them, hypesthesia is the most common symptom, mostly appearing in the distal part of the lower limbs with a stocking-like distribution. Some huge cysts can compress the cauda equina nerve, causing cauda equina syndrome, symptoms often manifested as dysuria, perineal sensory abnormalities and so on. In severe cases, urinary and fecal incontinence may occur. When the huge cysts compress the rectum, patients may experience abdominal pain and distension, loss of appetite, and difficulty in defecation. When the cyst presses on the bladder, it can lead to frequent urination, urgency and painful urination. Some patients may also experience lower extremity vascular symptoms such as varicose veins and thrombophlebitis. In addition, sacral cysts may lead to scoliosis, pelvic tilt and other skeletal deformities [9].

The clinical presentation of sacral cysts may have similarities with a variety of diseases, and therefore can be mistaken for lumbar disc herniation, arachnoid cysts, or tumors in the sacral canal, leading to diagnostic errors. A lumbar disc herniation usually results in abnormalities of lumbar spinal structures and obvious signs of nerve root compression, such as abnormal sensation or decreased muscle strength. Arachnoid cysts are usually located in the subarachnoid space within the skull or in the upper part of the spine. Tumors within the sacral canal usually result in more severe symptoms of nerve compression and show up as substantial masses on imaging. Sun P et al [10] reported a 42-year-old male patient with a history of spermatorrhea for >10 years that was misdiagnosed as a genitourinary disorder. MRI showed two cysts in the sacral canal. Symptoms disappeared after surgical removal of the cysts. Hentzen C et al [11] included 65 women and after analysis found that various symptoms caused by sacral cysts were associated with sacral somatic nerve injury.

For the diagnosis of sacral cysts, it is mainly dependent on the patient's imaging [12]. At present, MRI, CT, ultrasound and other examinations are mainly available in the clinic. A brief physical examination is required for the first diagnosis of the patient. The motor and sensory functions of the lumbar base and lower limbs are mainly tested. During the examination, the doctor will instruct the patient to perform confrontational movements to observe the local muscle strength, and at the same time gently touch the patient's skin with the tip of a needle or a cotton swab to ask about their feelings. Sacral cysts can be clarified through the patient's specific reaction during the examination. CT technology can clearly show the bony damage and occupying lesions in the spinal canal, especially widely used in showing sacral lesions, which can help to distinguish other spinal degenerative lesions and more accurately assess the severity of the disease. MRI: It is a commonly used modality in the imaging examination, and it belongs to the category of The gold standard for diagnosing sacral cysts. The number, size, location and internal structure of the cysts can be visualized,

which not only clarifies the disease, but also allows us to understand the specific type of sacral cyst, which can be very helpful in the later stages of treatment. Although ultrasonography can help us to visualize the potential traffic hole fistula between the cysts and the subarachnoid space of the spinal cord more clearly, it still cannot fully reveal the exact location of the cysts, therefore, ultrasonography is more widely used in the diagnosis of sacral cysts, especially in infants aged 3-4 months. In addition, it can detect intramedullary malformations caused by sacral recesses and structural changes within the spinal cord with hip asymmetry, thus guiding the clinician's treatment plan more accurately.

5. Treatment Modalities

The treatment of sacral cysts includes conservative treatment, interventional therapy or surgery. For asymptomatic patients, observation can be made without treatment; for those who have symptoms, especially those whose nerve compression symptoms have seriously affected their daily work and life, treatment should be chosen based on the severity of the disease and the patient's willingness to be treated. The main purpose of treatment is to relieve nerve compression symptoms and improve the quality of life of patients.

Some studies [13] suggest that for patients who need further intervention, medication can be tried. Currently, commonly used medications include painkillers and non-steroidal anti-inflammatory drugs (NSAIDs). As an initial treatment, pharmacologic therapy is effective in patients with mild symptoms, and Mitra et al [14] reported two cases of successful conservative treatment. Mitra et al [14] reported two cases of successful conservative treatment, one of which was relieved by oral steroids and the other by epidural steroid injection, and Langdown et al [15] reported three patients who refused surgical treatment and tolerated frequent episodes of symptoms, and no significant changes in the cysts were detected on regular imaging follow-up.

Currently, there are four types of surgical treatments for sacral cysts: (1) CT scanning puncture of the cyst and tamponade; (2) autologous tissue tamponade + nerve root cuff plasty; (3) open surgery as well as microscopic techniques; and (4) shunt surgery

It has been pointed out [16] that CT-guided cystocentesis alone has a high recurrence rate. On this basis, new and improved techniques were developed. Dr Joshi N et al [17] attempted to use CT-guided cystocentesis + fibrin gel injection tamponade, and the results of the 6-month postoperative follow-up showed that the patients did not experience any recurrence of the cysts, however, surprisingly, 75% of the patient's developed complications of aseptic meningitis after the procedure. Jiang W [18] et al. included 82 patients and compared this method with conservative treatment and concluded that this method could be the treatment of choice. Researchers [19] have attempted to improve the symptoms of sacral cysts by cyst-subarachnoid shunting, a technique that aims to reduce trauma during cyst surgery by balancing the pressure between the dural sac and the cyst, and it is particularly effective in treating single cysts. However, it is important to be wary of the potential risk of surgical failure or concomitant infection with each of the shunts currently practiced in the clinic. Some scholars [20] adopted autologous tissue tamponade + nerve root cuff plasty in 22 patients with sacral cysts, and after retrospective analysis, it was found that the patients' preoperative pain

symptoms were significantly relieved, and no cyst recurrence was seen in the review. Recent studies have shown [21] that this method is more helpful for the recovery of already damaged nerve function and has fewer postoperative complications, so it is increasingly used in clinical practice. Paredes et al [22] conducted a retrospective analysis of 31 cases and found that there were more complications of pure open surgical resection of cysts, mainly cerebrospinal fluid leakage and wound infection. Microsurgical techniques can effectively remove the sacral lamina (or form it) and, guided by electrophysiologic monitoring, have the potential to preserve the nerve roots attached to the cystic wall and its periphery, thus effectively eradicating the dead space, and finally closing the neck of the cyst for complete healing. Burke JF et al [23] found that the risk of neurologic injury could be reduced by microsurgery and can further improve somatic and autonomic function after enrolling 23 adults in their study.

Summary: The treatment principle of sacral cysts should be centered on the principles of low trauma, high symptomatic relief rate, high cure rate, low recurrence rate, and low perioperative complications, based on which the appropriate treatment plan should be selected according to the specific conditions of the patients. At present, there are still many gaps in the study of sacral cysts, so it is still necessary for researchers to further explore and summarize more valuable experience, to provide more favorable guidance for clinical treatment.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Ethics Statement

Written informed consent was obtained from the patient for the publication of any potentially identifiable images or data included in this article.

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