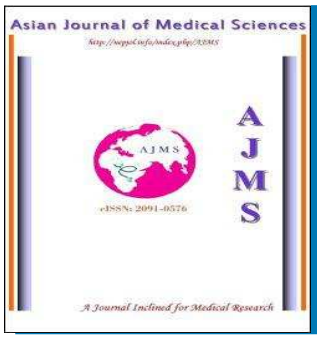

SYMPTOMATIC TARLOV CYSTS: AN MRI EVALUATION OF CASE SERIES AND LITERATURE REVIEW

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"MRI gives a definite diagnosis of Tarlov cyst in a non-invasive approach if nerve root presents within the cyst cavity or in the cyst wall eliminating the need for histological confirmation. Accurate understanding of the MRI features helps clinician make preoperative diagnosis and choose the appropriate treatment method"

ABSTRACT

Aim: To analyze the characteristics of symptomatic Tarlov cysts by MRI.

Materials and Methods: Neuroimaging and clinical outcome data were reviewed of 48 consecutive patients treated for symptomatic Tarlov cysts. All patients were scanned under Philips Gyroscan Intera 1.5T scanner with spinal surface coils. Two widely used surgical procedures were performed, 1) incision and drainage of the cyst with imbrication of the redundant nerve root sheath, and 2) exposure of the cyst, drainage of cyst contents, identification of nerve roots, and cyst wall resection combined with duraplasty. The post-operation follow-up was obtained from return visits to the neurosurgery and orthopaedic out-patient department or by telephone questionnaires.

Results: All cystic lesions showed hypointense signal intensity on T1WI and hyperintense signal intensity on T2WI, but the nerve root showed iso-intensity on T1WI and low signal intensity on T2WI. They were linear in shape on sagittal view, and hypo intense dotted spots within the cysts on traverse view. Surrounding structures of the larger cysts were compressed and had bone erosions in some cases; the spinal canal and the intervertebral foramen on the affected side were enlarged. The lesions/cyst wall showed no enhancement after gadolinium administration.

Conclusion: MRI will give a definite diagnosis of Tarlov cysts if nerve root presents within the cyst cavity or in the cyst wall; eliminating the need for histological confirmation. A correct analysis of the characteristics of symptomatic Tarlov cysts by MRI, will document its usefulness in noninvasive diagnosis and aid in exploration of the simplest treatment method.

Key words: Tarlov cyst, Magnetic resonance imaging, Myelogram, Surgical indications, Microsurgical excision.

INTRODUCTION

Tarlov cysts are meningeal dilations of the posterior spinal nerve root sheath that most often affect the lumbo-sacral region, and are located in the perineurial space, between the endoneurium and perineurium at the junction of the posterior nerve root and its ganglion. They are often multiple and small in size, with the S2/S3 nerve roots most commonly affected;[1-26] although they may be found elsewhere[27-31].The cyst wall is usually composed of dense, paucicellular collagenous bundles along with well-vascularized loose fibrous tissues. The cyst may contain neural tissue, nerve cell bodies, and occasionally, show the evidence of ischemic degeneration, trauma or repeated hemorrhage in its cavity or beneath the perineurium of the root. This cyst was first described by Tarlov IM in 1938, as dilations of the nerve root sheaths and abnormal sacs filled with cerebrospinal fluid (CSF) that could possibly lead to progressive painful radiculopathy. He postulated that these cysts had no communication with the subarachnoid space[1]. Since first described, there has been a significant amount of controversy regarding their origin, clinical significance, pathophysiology and management. This was further simplified by Goyal et al,[2] and Nabors et al, [3] in two simple classifications of spinal cysts. According to Goyal, Tarlov cysts/perineurial cysts are formed within the nerve root sheath at dorsal root ganglion; whereas, Nabors have classified it in type II extradural spinal meningeal cysts with nerve root fibers in the cyst wall. They assumed that both the Tarlov cyst and nerve root diverticula are almost the same lesions on the basis of CT myelography. They also revealed that these cysts communicated with the spinal subarachnoid space and hence proposed a congenital origin related to spinal arachnoid proliferation.

The exact etiology of Tarlov cysts remains unclear; several cases have history of trauma, old hemorrhage, infections, congenital, iatrogenic, and possibly a familial tendency[2-7]. The cysts are found incidentally during computed tomographic (CT) or magnetic resonance imaging (MRI) examination of the spine, and also on gynecological ultrasound imaging[9-14]. Therefore, the final diagnosis of Tarlov cyst is not radiological but rather, a histopathological diagnosis[20]. Here, we reviewed the pathogenesis, imaging findings and simple treatment methods for symptomatic Tarlov cysts.

MATERIALS AND METHODS

We retrospectively analyzed the magnetic resonance imaging (MRI) scans and clinical outcome data of 48 cases of symptomatic Tarlov cysts. Histopathological diagnosis was confirmed by surgery for 30 patients. Of 48 patients, 12 patients with cysts in the sacral spine were excluded due to their smaller size (<1.5 cm), and 6 cases located in the cervicothoracic spine and thoracolumbar spine were also excluded because of non-surgical treatment methods that they applied to avoid possible post-surgical complications. In this study, we included 30 patients with symptomatic cyst larger than 1.5 cm in diameter. The histopathological findings satisfied the diagnostic criteria for Tarlov cysts. Of 30 patients, 8 patients were male and 22 female, and their ages ranged from 21 to 77 years (mean age: 44.1years). All patients presented with multiple complaints, like low back pain, perineal pain, vaginal or penile paraesthesia, lessen sensation over the buttocks, perineal area and lower extremity, and genitourinary/bowel dysfunction. The intervertebral disc herniation was made as our clinical diagnosis, hence, MRI examination was ordered. Written informed consent was obtained from all patients prior to MRI scanning, and the study was approved by the hospital ethics committee of Xi'an Jiao Tong University Institutional Review Board for clinical research. Philips Gyroscan Intera 1.5T scanner with spinal surface coils was used for patient scanning. MRI examination included routine sagittal T1WI

(TR=360ms, TE=10ms), sagittal T2WI (TR=2200ms, TE=120ms) and transverse T2WI (TR=3500ms, TE=120ms) sequences. Besides that, T1WI sequence was repeated after the administration of intravenous (IV) contrast medium gadolinium (Gd) in 30 patients. All patients were consecutively treated surgically at our institutions between March 2000 and April 2012, and followed up for 6 months to 3 years. Two widely used procedures were performed, 1) incision and drainage of the cyst with imbrication of the redundant nerve root sheath, and 2) exposure of the cyst, drainage of cyst contents, identification of nerve roots, and cyst wall resection combined with duraplasty. The first method was applied to treat single cysts that were completely extradural, and the second method was applied to cysts with wide neck in multiple numbers that were both intradural and extradural in nature. The follow-up was obtained from return visits to the neurosurgery and orthopaedic out-patient department or by telephone questionnaires to make sure if patient experienced previous symptoms.

RESULTS

All cases were diagnosed by MRI findings and confirmed after surgery. Of the 30 patients, 18 (60%) had single cyst, and 12 (40%) had multiple cysts. Most cysts found in all of the 30 cases presented individually in separate nerve roots, while two of them were found grouped on to a single nerve root. All multiple cysts were located at the lumbosacral region (Figure 2 and 4). The greatest number of multiple cysts found was 4. All diagnosed cysts, both multiple and single, were distributed along the nerve root. Of 30 patients, 16 cases (53.33%) had nerve root within the cyst cavity (Figure 2 and 4) and 14cases (46.66%) had nerve root adhered in the cyst wall (Figure 1b and 3). Most of our patients presented with multiple com-

Fig.1 Sagittal T2WI shows nerve root adhered to the cyst wall (a) and nerve root within the cyst cavity (b).

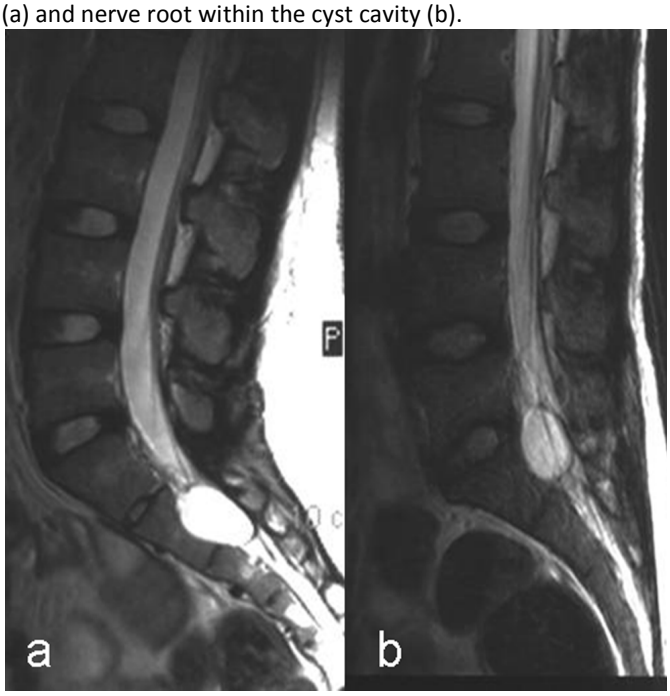
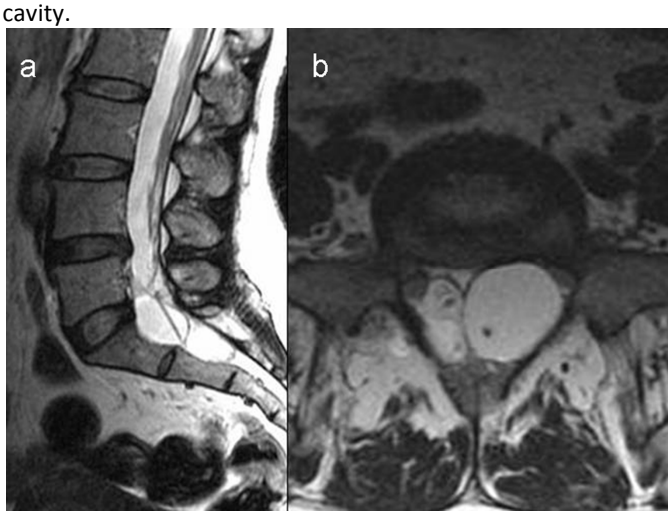


Fig.2 Sagittal T2WI (a) and transverse T2WI (b) reveal multiple cysts and low signal intensity nerve roots within the cysts cavity.



-plaints like local low back pain, perineal pain, vaginal or penile paraesthesia, sensory changes over the buttocks, perineal area and lower extremity, and genitourinary/bowel dysfunction. The majority of patients had lower back pain and sensory losses,

which shortly disappeared after surgery.

On MRI, the cystic lesion showed hypointense signal intensity on T1WI (Figure 3a) and hyperintense signal intensity on T2WI (Figure 1, 2, 3b and 4); these signal intensities were similar to that of cerebrospinal fluid (CSF), but the nerve root showed iso-intensity on T1WI and low signal intensity on T2WI.

Fig.3 Sagittal T1WI (a) and T2WI (b) reveal a large Tarlov cyst with bone erosions in S1-S2 spine. The cyst has low signal intensity in T1WI and high signal intensity in T2 weighted image. These signal intensities are similar to that of cerebrospinal fluid.

They were linear in shape on sagittal view (Figure 1), and hypointense dotted spots within the cysts on traverse view (Figure 2b and 4). All patients displayed well-demarcated cysts. Surrounding structures of the larger cysts were compressed and had bone erosions in some cases (Figure 3); the spinal canal and the intervertebral foramen on the affected side were enlarged. The lesions/cyst wall showed no enhancement after gadolinium administration (Figure 5).

Fig.4 Transverse T2 WI shows low signal intensity dotted spots of nerve roots within the cyst cavity.

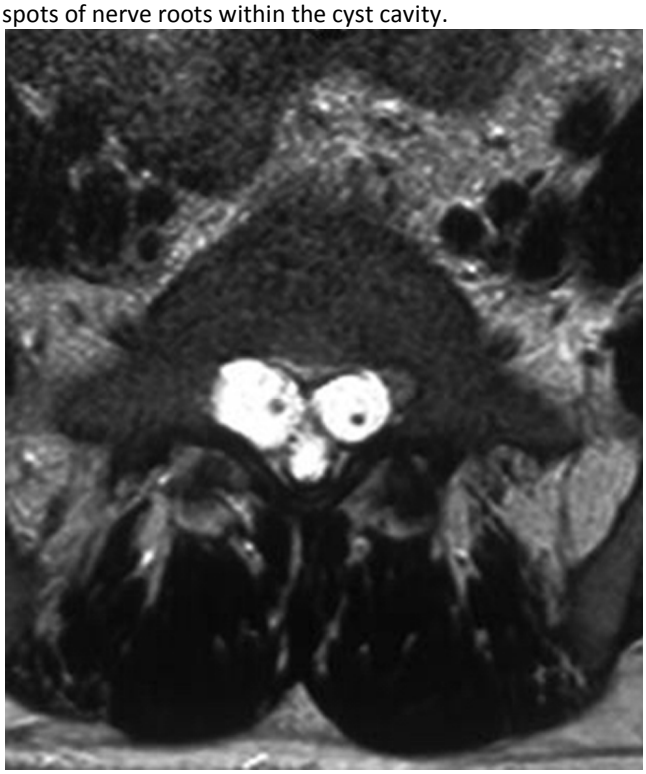


Fig.5 The T1 weighted contrast-enhanced magnetic resonance imaging of spine shows no enhancement of cysts wall after gadolinium administration.

DISCUSSION

Tarlov cysts are meningeal dilations of the posterior spinal nerve root sheath that most often affect the lumbo-sacral region. They are often multiple and small in size, with the S2/S3 nerve roots most commonly affected;[1-26] although they may be found elsewhere[27-31]. In our study, all 30 patients had cysts in the lumbo-sacral spine at L5 to S3 level but not at L1 and L5 levels. All cysts were distributed along the nerve root. Tarlov cysts are commonly found during the third and fourth decades of life and are mostly asymptomatic; [33] however, some cases in children have been reported.[30,34] According to a recent survey, women have higher prevalence of developing Tarlov cysts than men. In the survey, more than 85 percent of the respondents were female, most of whom were aged between 31 to 60 years[35]. In our study, 22 patients of Tarlov cysts were female who showed consistency with the current findings. Depending on the size and location, Tarlov cysts may cause a variety of symptoms when the cysts are large enough to compress the ventral root and cause motor deficits. The sensory nerve is involved at the onset, but as the cysts enlarge they spread to the motor nerve roots. Average cysts are 2.6 to 6 cm in diameter and are classified as large if they are greater than 1.5 cm in diameter[8,20,32]. The largest cyst found during our study was 4 cm in diameter. The common symptoms associated with Tarlov cysts are local low back pain, perineal or sciatic pain, vaginal or penile paraesthesia or sensory changes over the buttocks, perineal area and lower extremity, neurogenic claudication and genitourinary/bowel dysfunction[7,8,10,12,13,17-20,22,23,25,32,33,36-41]. Most of our patients presented with multiple complaints. The majority of patients had lower back pain and sensory losses, which shortly disappeared after surgery. Pain is the most common presentation in Tarlov cysts. Current survey also showed that an estimated 3 percent of respondents had no pain, 4.2 percent categorized their pain as very mild, 7.6 percent as mild, 31.5 percent as moderate, 38.6 percent as severe and 15.1 percent as very severe[35].

Symptoms are mostly exacerbated by maneuvers that elevate CSF pressure, such as coughing, walking, changing posture, the Valsalva maneuver, standing, lifting, and climbing stairs. The ball-valve phenomenon at the ostium of the nerve root sheath causes pressure difference in these cysts.[13,19,39] Non-specific symptoms including headache, abdominal pain,[9,10,18] intracranial hypotension,[21] pathological and sacral insufficiency fractures,[16,40] bony erosion,[7,19,24] infertility,[11,18] and threatened miscarriage have been reported in rare circumstances[14]. During the study, 4 patients showed bone erosion on CT and MRI examinations. The differential diagnosis includes meningeal diverticula, arachnoid cysts, neurofibroma, dural ectasia, synovial or ganglion cysts, ligamentum flavum cysts, ependymal cysts, epidermoid or dermoid cysts, enterogenous cysts, cold abscess, hematomas, nerve sheath tumors, intestinal cysts, cystic metastases and teratogenic cysts[6,18]. Tarlov cysts may also be misdiagnosed as ovarian cysts, and hydrosalpinges or paraovarian cysts, which may move during respiration and are more common findings on gynecological ultrasound imaging. Tarlov cysts however do not move with respiration and are posteriorly located[14]. Clear understanding of imaging findings and clinical correlations, such as signal intensity of the cyst (compare to CSF), location of the lesion (intra or extradural), epidural fat compression, cyst wall thickness, contrast enhancement of the cyst wall, patients age, and metastatic primary lesions may help to differentiate Tarlov cyst from other cystic diseases. The presence of nerve roots within the cyst cavity or in the cyst wall and the intravenous/intrathecal administration of contrast

material during a CT myelogram or an MRI study are the mainstay to make a differential diagnosis[3-6,10,11,16,19,20,32]. MRI is now the gold standard to diagnose spinal cystic diseases. Tarlov cysts have CSF-like signal intensity on MR scanning, that is low signal intensity on T1WI and high signal intensity on T2WI. The low signal intensity nerve roots and high signal intensity cysts can simply be distinguished on T2WI.

There is no consensus on the optimal management of Tarlov cysts. The treatment of these cysts remains conservative in case of an asymptomatic incidental finding, or watchful waiting in cases with mild symptoms. Most surgeons agree that asymptomatic Tarlov cysts should be left untreated[15,42]. Oral and epidural steroid therapy may offer a nonsurgical alternative for the treatment of symptomatic Tarlov cysts when they are smaller than 1.5 cm[26]. CT-guided percutaneous decompression and fibrin glue injection tend to be clinically encouraging and are option for non-surgical practices, but may have some post-procedure complications as shown by previous studies[43,44]. Several surgical techniques have been introduced in various literatures for the treatment of symptomatic Tarlov cysts. These techniques have proved effective in the treatment of large cysts (> 1.5cm), but have shown very little improvement in smaller cysts (<1.5 cm).[32] Simple aspiration or shunting is not recommended because the cysts tend to refill[13,42]. CT-guided percutaneous decompression and decompressive laminectomy temporarily relieved symptoms[13,31,38]. Bartels et al,[45] have elucidated the lumbo-peritoneal CSF shunting as a promising alternative. Laminectomy, partial cyst resection/fenestration of cyst wall/plication of cyst and duroplasty/myofascial flap have shown satisfactory results[10,19,25,30,38,42,46]. Several authors have explained microsurgical excision of the cyst wall combined with duraplasty as an effective and safe method of choice during the treatment of symptomatic sacral cysts,[10-12,16,17,20,38,41] but remains less useful due to the lack of skilled man power and advanced technologies. Two common methods were used during our study, 1) incision and drainage of the cyst with imbrication of the redundant nerve root sheath, and 2) exposure of the cyst, drainage of cyst contents, identification of nerve roots, and resection of the cyst wall combined with duraplasty. The first method was applied to treat single cysts that were completely extradural. Due to its extradural location and narrow cyst neck, the method was carried out by the incision and drainage of the cyst with imbrication of the redundant nerve root sheath. The second method was applied to cysts in multiple numbers with wide neck that were both intradural and extradural in nature. No history of signs/symptoms and cyst recurrence was reported during follow-up period of 4 months to 3 years after surgery. Because patients had no complaints of previous conditions during the follow-up visit, we did not order for re-MRI examination. All patients were satisfied with the treatment.

The certain limitation of present study is lack of post treatment imaging study, this is because of patients questioned the need for a follow up MRI due to the absence of all symptoms presented before treatment. Keeping in mind the financial burden imposed upon the patient we agreed not to opt for a follow up MRI.

CONCLUSION

Symptomatic Tarlov cysts are rare conditions most commonly found in the sacral spine; cervical, thoracic and lumber findings are very rare. MRI is now the gold standard for identifying the clinical manifestations and typical characteristics of Tarlov cysts. MRI will give a definite diagnosis of Tarlov cysts if nerve root presents within the cyst cavity or in the cyst wall; eliminating the need for histological confirmation. A careful history taking and an accurate understanding of the features of

MRI helps clinicians make preoperative diagnoses and choose the appropriate treatment method.

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