Case Report
Microsurgery treatment cervical thoracic lumbar epidural arachnoid cyst intra-spinal canal

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Abstract: Objective: The study was to explore the clinical characteristics and therapies of the spinal extradural arachnoid cyst in neck and thoracolumbar segment. Methods: Retrospective analysis was conducted on 15 cases with spinal extradural arachnoid cyst in the neck and thoracolumbar segment who had obvious symptoms and were treated in our department within the period from January 2011 to November 2013. There were one case with spinal extradural arachnoid cyst in the neck segment, 12 cases with spinal extradural arachnoid cyst in the thoracolumbar segment and 2 cases with spinal extradural arachnoid cyst in the lumbar segment. The main symptom was the lumbocaudal pain. Some patients had the intermittent claudication and sensory dysfunction. Results: The cysts of 15 cases were all removed by microsurgery. During the surgery, the communication hole between the cyst and the dural sac was found out and closed after the removal of the cyst. The early symptoms of postoperative patients were improved remarkably. Within the follow-up visit for 1-32 months (19 months on average), the cyst did not reappear. The symptoms of 11 cases disappeared. The rest 4 cases were relieved and can live a normal life. Conclusions: Microsurgical treatment should be given priority to patients with obvious symptoms of the spinal extradural arachnoid cyst. The operative method was to remove the cyst, close the communication hole and reset the neural plate. Through the therapy, the symptoms were improved significantly and the recurrence rate was low.

Keywords: Arachnoid cyst, spinal canal cyst, extradural cyst, microsurgery, treatment

Introduction

Spinal extradural arachnoid cyst is a rare disease in spinal canal which can cause pain and nerve dysfunction. It can be divided into congenital and acquired spinal extradural arachnoid cyst according to the occurrence time and different incentives [1]. It appears to have a male predominance and commonly affects individuals aged 20-40 [2]. The spinal canal of thoracic and lumbar segments is often affected, there are reports about its occurrence in the spinal canal of neck and caudal parts and the cyst is often located at the dorsal part of dural sac [2]. A total of 15 cases with obvious symptoms of the spinal extradural arachnoid cyst were dealt with in our hospital within the period from January 2011 to November 2013. The clinical characteristics, surgical methods and the curative effect were explored in the following part.

Materials and methods

General data

There were 7 male cases and 8 female cases, and the age ranged from 7 years to 63 years, 37 years on average. The medical history lasted from 1 week to 20 years, with an average of 2 years. There was one case with spinal extradural arachnoid cyst in the neck segment, 12 cases with spinal extradural arachnoid cyst in the thoracolumbar segment and 2 cases with spinal extradural arachnoid cyst in the lumbar segment.

Clinical manifestations

The symptoms caused by spinal extradural arachnoid cyst resulted from the pressure on the spine and nerve by the cyst. Among the 15 cases in the study, there were 6 cases with the symptom of pain in the lumbar site, 9 cases...
with the symptom of radiating pain in lower limbs, 1 case with the hemi-amyotrophy of lower limbs, 1 case with dysuresia, 8 cases with the symptom of intermittent claudication, 6 cases with abnormal sensations and 1 case (with spinal extradural arachnoid cyst in the neck segment) with the symptom of pain in the unilateral shoulder and upper limbs. The symptom of most cases was periodic aggravation or mitigation. Examination results indicated that 6 cases had percussion pain in cyst segments, 4 cases appeared positive in the straight-leg raising test, the light sensation and touch of 6 cases lessened and the muscles of 6 cases were weakened. There was no pathological reflex.

**Imaging findings**

An oval or round hyalomere could be seen near the midline region of the vertebra of most cases through X-ray. The lateral projection showed an arc pressure trace on the anterior wall of spinal canal and the vertebral plate became thin. CT scanning showed the soft tissue shadow in the spinal canal with the same concentration with the cerebrospinal fluid, and the vertebral plate of spinal canal and the posterior part of the

**Figure 1.** Spinal extradural arachnoid cyst in Thoracic 12-lumbar 2, long T1 (A) and long T2 (B) signal, not obvious before the increase (C). The boundary of the cyst was clear and the wall was thin and the cystic fluid had the similar signal to the cerebrospinal fluid. At coronal view (D), the cysts spread to the intervertebral foramen, and in axial view (E) the cysts grew towards the right rear and the spine was pushed ahead.
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Figure 2. It can be seen that the white and semitransparent cyst adhered to the dorsal part of the dural sac (the white arrow) and the wall was complete after cutting apart the vertebral plate.

Figure 3. The cyst was separated from two ends by using the blunt dissection technique under the microscope. The site which was hard to dissect might be where the cyst pedicle was (the blue arrow).

Figure 4. Postoperative pathology showed the wall was fibrous connective tissue and no obvious covering epithelium can be seen.

centrum became thin due to the pressure. MRI examination was conducted on all the cases. 1-5 centra were involved by the cyst and the oval shadows can be seen in the spinal canal, most of which were solitary and located at the dorsal part of the dural sac. The spine moved towards the opposite side due to the pressure and the vertebral plate became thin. The cysts appeared to be long T1 or long T2 images, having the same signal intensity with the cerebrospinal fluid. It can be observed in axial view that the cysts had pushed the spine to the side, and at coronal view that the cysts spread to the intervertebral foramen (Figure 1).

Surgical treatment

Surgical indications and contraindications

The main symptoms of patients were accordant with the lesion locations, and the symptoms remarkably affected the daily life. If the patients were only diagnosed by the imaging and without relevant symptoms or the symptoms were not obvious and the development was slow, the method of regular inspections was adopted.

Surgical methods

The patients were held properly with tracheal incubation using general anesthesia in prone position. With posterior median incision, tissues were cut apart layer by layer. When the vertebral plate was collected, it could be seen that the semitransparent cystic tissues adhered to the dorsal part of the dural sac and the wall was smooth and thin (Figure 2). The cyst pushed ahead and pressed on the dural sac, which became remarkably narrow. The cyst was separated from two ends by using the blunt dissection technique under the microscope. The site which was hard to dissect might be where the cyst pedicle was (Figure 3). When the cyst was cut apart, the communication hole and the nerve root were detected in the cavity. If the nerve root was found, it should be protected properly and the pedicle should be closed by burning and cut off. Then the cyst was taken for pathological examination (Figure 4). If the incision was too large to be transfixed after the
removal of the cyst, autologous fat or fascia can be separated to adhere to the incision by biological glue. After the careful hemostasis, titanium plate was used for the reset of centrum. Then it was placed for drainage and the tissues were transfixed layer by layer.

Results

All the cases recovered well and the symptoms were all improved remarkably after the operation. 9 cases with early symptoms were significantly improved, the lumbocural pain of 6 cases disappeared or was obviously improved, among which there were 3 cases whose light sensations and nociceptive abilities of lower limbs were improved. There was 1 case suffering seroma and finally recovered after puncture and drawing as well as pressure dressing.

Within the follow-up visit for 1-32 months (19 months at average), the cysts of 15 cases did not reappear and the dural sac was in good expansion (Figure 5). The pain in the lumbar regions of 6 cases disappeared, 1 case suffered unilateral lumbar numbness but could

Figure 5. The postoperative reexamination showed that no cysts reoccurred (A-E), the dural sac was in good expansion (A-C, E) and the vertebral plate was reset satisfactorily (D).
live a normal life, and the pain in the lower limbs of 9 cases disappeared. The intermittent claudication of lower limbs of 6 cases disappeared and they could walk normally. The intermittent claudication of 1 case was improved significantly and the urination function recovered. The symptoms of 1 case with spinal extradural arachnoid cyst in the neck segment disappeared. Among the 6 cases with abnormal sensations, the symptoms of 4 cases disappeared and 2 cases were improved.

Discussions

The spinal extradural arachnoid cyst is a rare disease and accounts for 1% of the spinal space occupying lesions [3]. It occurs most frequently in the lower thoracic segment and then usually affects lumbar and sacral segments and cervical segments. Most cysts are located at posterior or lateral parts of the spinal canal and protrude towards the intervertebral foramen [3]. Nabors et al. divided the spinal cysts into three categories: I spinal extradural arachnoid cyst without nerve roots (I A) and sacral meningocele without nerve roots (I B); II spinal extradural arachnoid cyst with nerve roots; III dural cyst [3, 4]. It has been found in such kind of surgeries that there are no nerve tissues in spinal extradural arachnoid cyst in lumbar and sacral segments and cervical segments. However, in case of an accident, nerve tissues are usually examined when the cyst is cut apart. Because the anatomical structure and operation method of the spinal extradural arachnoid cyst in sacral canal are different from those of spinal extradural arachnoid cyst in other segments and there is other literature introducing it in details [5], discussions would not be made.

The pathogeny of spinal extradural arachnoid cyst is still not clear. Trauma, both infection and inflammation can cause spinal extradural arachnoid cyst whereas currently most spinal extradural arachnoid cyst without trauma is a kind of congenital disease [6]. Because the arachnoid herniated through the congenital leak in dura mater and constantly expands, the cyst is finally formed. The cavity of the cyst communicates with the subdural subarachnoid space and the communication hole is usually located at the joint between the nerve root and the sheath and it also can be located at the dorsal midline part of the dura mater or sheath [7-10]. There are three hypotheses about the expansion pathogenesis of cysts. First of all, the active secretion function of cystic wall causes the continuous increase of the fluid within the cyst and consequently the cyst expands. Secondly, the cerebrospinal fluid in the dural sac passively flows into the cavity of the cyst, which makes the cyst expand. Thirdly, the osmotic gradient between the fluid in subarachnoid space and that in the cavity of the cyst drives the fluid continuously from the subarachnoid space into the cavity of the cyst. As to the first hypothesis, most postoperative results show that the interior wall of the cyst is the fibrous connective tissue or consisted of only one layer of the fibrous connective tissue which is similar to the arachnoid and it lacks cells with the secretion function [10, 11]. Compared with the first hypothesis, the second and third hypotheses obtain more identification. The dynamics of the cerebrospinal fluid dynamic wave drives the cerebrospinal fluid into the cavity of the cyst and the membranous tissue at the communication hole between the cavity of the cyst and the subarachnoid space folded and the one-way valve structure is formed, which makes the cerebrospinal fluid not flow back. Consequently, the cyst expands continuously and the communication hole would be closed when the cyst expands to a certain extent. Then the osmotic gradient between the fluid in subarachnoid space and that in the cavity of the cyst continue to make the cyst expand [12]. In the operation on the cases in the study, 13 cases with communication holes were found. However, it was observed that there were only 2 cases with the one-way valve structure. When the cyst was cut apart, the internal pressure decreased. The one-way valve structure disappeared due to the change in the internal pressure and external pressure.

As to X-ray radiography, there is no direct significance in terms of diagnosis. The arachnoid cyst may be diagnosed only through indirect signs such as the enlargement of spinal canal, the thinning of bones, the broadening of intervertebral foramen. CT examination can make it clear whether the bone structure changed due to the damage. Spinal MRI is the optimal way to diagnose the spinal extradural arachnoid cyst.
Preoperative MRI can show the occupied segments, the size of the cyst and the growth tendency; 3D-Space can help to make it clear where the communication hole is. The clinical symptoms of spinal extradural arachnoid cyst are related to the pressure on the spine and nerve roots by the cyst. The most common symptom is the pain in back and waist. Then the radiating pain in the limbs under the lesion segments, the weakness of light sensation, the unilateral amyotrophy and the intermittent claudication are also common. The differential diagnoses include epidermoid cyst, synovial cyst, Tarlov cyst, spinal meningocele and cystic degeneration of tumor, etc. The epidermoid cyst usually appears to be equal signal or a mild high signal and the boundary is irregular; the synovial cyst is small and it can be seen that it originates from the articular surface through MRI imaging. Tarlov cyst is usually located in sacral canal and grow eccentrically, which can easily invade the intervertebral foramen and usually contained nerve tissues; most part of the cystic structure due to the spinal meningocele is located outside the spinal canal; the internal wall of the cavity of the tumor with cystic degeneration is not smooth, and when the MRI scanning is enhanced, the cystic wall is also enhanced [12].

The spinal extradural arachnoid cyst usually grows slowly. For patients who have no symptoms or whose symptoms have no effects on their life, conservative treatment and regular examination are recommended. As to patients whose symptoms have affected their life, many methods can be adopted such as puncture drainage, cyst-subarachnoid drainage and surgical removal. Because the recurrence rate of the former two methods is high, operation has become the primary method to treat the spinal extradural arachnoid cyst with remarkable symptoms [13-15]. The objectives of the operation are total removal of the cyst and closure of the communication hole [13, 16, 17]. Due to the long-term pressure by the cyst, the peripheral venous plexus of the cystic wall was abundant. When the cyst is cut apart in the operation, more bleeding may be found due to the decrease of pressure. Then careful hemostasis is necessary to continue the operation. To ensure the completeness of the cyst when the cyst has been separated can effectively decrease bleeding. The cystic pedicle is usually in the upper part, so the cyst can be separated from two ends by using the blunt dissection technique and finally the pedicle is closed by burning. Before coping with the pedicle, it should be made clear whether there is the nerve root in the cyst. If there is the nerve root, attention should be paid. If the leak in dural sac is too large to transfix, fascia, muscle or artificial spinal membrane can be used for repair and suture by biological glue. The vertebral plate is reset after the cyst is removed. The vertebral plates of some cases become too thin to reset due to the large size of the cyst or long medical history. If the segment is short, it is not necessary to reset. Pedicle screw rod can be adopted for fixation, or artificial vertebral plates can be selected to replace the original ones if the segment is long [18, 19].

The main postoperative complication of the spinal extradural arachnoid cyst is the cerebrospinal fluid leak. There was 1 case suffering cerebrospinal fluid leak in the study who was cured after the puncture drainage and pressure dressing. The curative effect by surgical removal of the spinal extradural arachnoid cyst in neck and thoracolumbar segments was satisfactory. Most symptoms after the operation were significantly improved or disappeared. Microsurgery was an effective method to cure the spinal extradural arachnoid cyst. The successful closure of the communication hole was the key of the operation which can ensure the low recurrence rate after the operation. The follow-up visit showed that the spinal extradural arachnoid cyst of the cases in the study did not recur.

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Disclosure of conflict of interest

None.

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