Post-operative Lumbar Pseudomeningecele: Management and Evaluation

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ABSTRACT

Background: lumbar pseudomeningecele is considered as an uncommon complication of spinal surgery. Studies concerned with this complex formation are still few. Objectives: the aim of the present study was to evaluate the clinical results of treating post-operative lumbar pseudo-meningecele. Risk factors for the formation of pseudomeningecele were also discussed. Patients and Methods: this is a retrospective study done on 12 patients who developed symptomatic lumbar pseudo-meningecele after various spinal surgeries between 2000 and 2011. All patients were operated upon in Ain Shams University Hospitals (Cairo, Egypt). All patients who developed post-operative pseudomeningecele were studied clinically and radiologically (Magnetic Resonance Imaging MRI, Computed Tomography CT, X-ray of lumbosacral region) to assess the pseudo-meningecele and the neurological status before and after any procedure. All patients had a cerebrospinal fluid diversion by lumbar drainage. Three cases had satisfactory results, one patient needed a percutenous evacuation, and eight cases needed surgical repair. Results: 12 patients (7 males and 5 females) with post-operative lumbar pseudomeningecele, were included in this study. Eight patients had surgical repair. Follow up ranged from (6 to 24) months with a mean follow up of (17.4) months. The clinical state of the patients preoperatively was: back pain (58.3%), headache (25%), nausea/vomiting (16.6%) and limb pain/numbness (33.3%). Clinical outcome as described by Wang revealed excellent in 10 patients and good in 2 patients. Conclusion: iatrogenic pseudomeningecele is a rare complication of spinal surgery and should be suspected in patients submitted to lumbar surgery when delayed post operative neurological symptoms occur. Key word: pseudomeningecele, laminectomy, dural tear, cerebrospinal fluid CSF leak.

INTRODUCTION

Pseudomeningecele is a rare complication of spinal surgeries. It is an extradural accumulation of cerebrospinal fluid (CSF) in the soft tissue of the back that extravasates through the dural tear. The causes of pseudomeningecele may be classified into three categories: iatrogenic, traumatic, and congenital. By far the most common cause is iatrogenic, which results from unintended dural tears during spinal surgery. Pseudomeningecele often occurs as a complication of lumbar spinal surgery. Because different mechanisms have been used to explain the pathophysiology of pseudomeningecele, a precise definition is lacking.

Most investigators consider a pseudomeningecele as an extavasated collection of extradural CSF that result from a dural tear. Because the extradural fluid may be contained in an arachnoid-lined membrane or in a fibrous capsule, multiple terms to describe this entity exist. Pseudomeningecele has at various times, been referred to as meningecele spurious, false cyst, or pseudocysts. Some authors advocate the use of the term “meningecele” because many are found to have arachnoid –like cell lining. Most authors however, prefer the term “pseudomeningecele” because, at least initially, the lesion may not be arachnoid lined. Accordingly, it’s not a true meningecele. Simply because if the proper milieu exists, the extradural fluid collection may be reabsorbed and the communication between the intra-dural and extra-dural space may cease to exist.

The exact incidence of post-operative lumbar pseudomeningecele is unknown because many of these patients are asymptomatic. Another more likely reason is that spine surgeons are reluctant to publish negative result.

PATIENTS & METHODS

Patient’s population and study design: this is a retrospective study done at the Neurosurgery Department of Ain-Shams University Hospitals from 2000-2011. This study concerned with lumbar pseudomeningecele after spinal surgery. 12 patients (7) males and (5) females were included in this study. The age ranged from 24 years to 53 years with a mean age of 35.6 years. The mean duration of symptoms prior to surgery was 13 months with a range from 5 months to 25 months.

In this study, the 12 cases of post operative pseudomeningecele occurred after various spinal surgeries for different lesions. Six cases had recurrent
herniated lumbar intervertebral disc (4 at “L4-5” level and 2 at L5-S1 level). 5 cases had herniated lumbar intervertebral disc (4 at “L4-5” level and one at “L5-S1” level). Whereas only one patient had grade II spondylolysisis at L4-5 level.

All patients had full general and neurological examination. MRI was done to all cases before any procedure to confirm a fluid collection connecting with the dural sac Figure (1). This was repeated 3 months later to confirm the resolution and recurrence of pseudomeningeocele. CT of lumbo-sacral spine was also done to all cases to assess the site, extent, and size of the fluid collection. Plain X-ray of lumbosacral spine (antero-posterior and lateral) was done to check the alignment of the spinal vertebra. Guidelines for inclusion criteria in this study were those patients who had developed a dural tear recognized in 9 cases or not in 3 cases during surgery. Detailed reviews of charts for all of the patients were conducted to determine the method of treatment.

The patients were asked about headache, low back-pain and leg pain. A rating of "excellent" indicated complete resolution of the preoperative symptoms with no back pain; a rating of "good" indicated nearly complete resolution of the preoperative symptoms with minor back pain; and a rating of "poor" indicated symptoms that were worse than preoperative.

In this study, C.S.F diversion by lumbar drainage had a satisfactory result in treating only 3 cases with post-operative pseudomeningeocele. The lumbar drain was removed after 5-7 days. Only one asymptomatic case, with a subcutaneous lumbar collection had a percutaneous puncture done and 60 ml of cerebrospinal fluid were aspirated. After that the patient was immobilized for 5 days in Trendelenburg position with a compressive abdominal corset. Follow up MRI after two months showed marked reduction in the size of the collection which disappeared in the second control MRI 3 months thereafter. The rest of the patients (8) needed further surgical interference.

**Surgical technique and approach:**

After medication and general anesthesia, all patients were positioned prone on a Wilson frame or rolls to avoid abdominal compression and hence reduce venous congestion. The skin was opened through the old operation scar. The pseudomeningoecele sac was exposed subcutaneously. Dissection around this subcutaneous portion of the sac was done, until the defect in the lumbar fascia was encountered. The subcutaneous portion of the pseudomeningoecele sac communicated via this defect with the deeper part located beneath the lumbar fascia extending to the dura forming a para-spinal CSF collection. The cavity of the sac was opened and clear CSF was evacuated. Further laminectomy was needed in 4 cases. Cauda equina filaments were found in the cavity in a 2 cases. The inferior wall of the para-spinal portion of the sac was found glistening. In 8 cases, a hole was identified in the bottom of the pseudomeningoecele cyst (measuring about 2-3mm diameter). This hole presented the site of previous dural tear Figure (2). The extradural cyst wall was gently dissected from the dura and totally excised. The dural tear was repaired with interrupted 4.0 sutures. Interrupted figure –of- eight sutures of the myofascial layer were used to provide a watertight closure.

![Figure (1): T2W2 sagittal MRI of lumbosacral spine showing post-operative pseudomeningoecele](image)
Figure (2): Intraoperative surgical repair of lumbar pseudomeningecele. (a): position and skin incision; (b), (c): exploration of pseudomeningecele sac, (d), (e), (f): identification of site of CSF leak and its repair.

All patients were followed up clinically and radiologically. MRI lumbosacral spine (LSS) was done within two months after surgery to detect any residual cyst collection. Control MRIs were then done after (3, 6, 12 months) intervals to follow the resolvement of the psuedomeningecele.

RESULTS

Patient’s demographics as shown in table (1): 12 patients were included in this retrospective study. Seven patients (58.3%) were males and five patients (41.6%) were females. Age ranged from 24 to 53 years with a mean of 35.6 years.
Table (1): Demographic data of the patients and type of intervention.

<table>
<thead>
<tr>
<th>Patient Number</th>
<th>Age/sex Mean(\pm) SD (years)</th>
<th>Indication of initial operation</th>
<th>Level of lesion</th>
<th>Initial operation</th>
<th>Dural tear</th>
<th>Type of intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33/male</td>
<td>Recurrent herniated intervertebral disc</td>
<td>L4-5</td>
<td>microdiscectomy</td>
<td>noticed</td>
<td>Surgical repair</td>
</tr>
<tr>
<td>2</td>
<td>36/female</td>
<td>Recurrent herniated intervertebral disc</td>
<td>L4-5</td>
<td>microdiscectomy</td>
<td>noticed</td>
<td>Surgical repair</td>
</tr>
<tr>
<td>3</td>
<td>41/female</td>
<td>herniated intervertebral disc</td>
<td>L4-5</td>
<td>microdiscectomy and fenestration</td>
<td>noticed</td>
<td>Surgical repair</td>
</tr>
<tr>
<td>4</td>
<td>45/male</td>
<td>Recurrent herniated intervertebral disc</td>
<td>L5-S1</td>
<td>microdiscectomy</td>
<td>unnoticed</td>
<td>Lumbar drainage</td>
</tr>
<tr>
<td>5</td>
<td>50/male</td>
<td>Recurrent herniated intervertebral disc</td>
<td>L4-5</td>
<td>microdiscectomy</td>
<td>noticed</td>
<td>Surgical repair</td>
</tr>
<tr>
<td>6</td>
<td>53/male</td>
<td>herniated intervertebral disc</td>
<td>L4-5</td>
<td>microdiscectomy and fenestration</td>
<td>noticed</td>
<td>Lumbar drainage</td>
</tr>
<tr>
<td>7</td>
<td>24/male</td>
<td>herniated intervertebral disc</td>
<td>L5-S1</td>
<td>microdiscectomy and fenestration</td>
<td>unnoticed</td>
<td>Percutaneous evacuation</td>
</tr>
<tr>
<td>8</td>
<td>27/female</td>
<td>Spinal canal stenosis</td>
<td>L4-5</td>
<td>Laminectomy</td>
<td>noticed</td>
<td>Surgical repair</td>
</tr>
<tr>
<td>9</td>
<td>29/male</td>
<td>Spinal canal stenosis</td>
<td>L4-5</td>
<td>Laminectomy</td>
<td>noticed</td>
<td>Surgical repair</td>
</tr>
<tr>
<td>10</td>
<td>31/male</td>
<td>Recurrent herniated intervertebral disc</td>
<td>L4-5</td>
<td>microdiscectomy and fenestration</td>
<td>noticed</td>
<td>Surgical repair</td>
</tr>
<tr>
<td>11</td>
<td>29/female</td>
<td>Spinal canal stenosis</td>
<td>L4-5</td>
<td>Laminectomy</td>
<td>noticed</td>
<td>Surgical repair</td>
</tr>
<tr>
<td>12</td>
<td>30/female</td>
<td>Spondylyolysis grade II</td>
<td>L4-5</td>
<td>Laminectomy with posterior instrumentation</td>
<td>unnoticed</td>
<td>Lumbar drainage</td>
</tr>
</tbody>
</table>

SD = Standard Deviation

Presenting symptoms included back-pain, headache, nausea, vomiting, or limb pain and numbness. In table (2) the main symptoms and signs are reported.

Table (2): Presenting clinical state in 12 patients:

<table>
<thead>
<tr>
<th>Clinical state</th>
<th>No. of cases</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulging mass</td>
<td>12</td>
<td>100%</td>
</tr>
<tr>
<td>Symptoms:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i)-back pain</td>
<td>7</td>
<td>58.3%</td>
</tr>
<tr>
<td>(ii)- headache</td>
<td>3</td>
<td>25%</td>
</tr>
<tr>
<td>(iii)- nausea / vomiting</td>
<td>2</td>
<td>16.6%</td>
</tr>
<tr>
<td>(iv)-limb pain / numbness</td>
<td>4</td>
<td>33.3%</td>
</tr>
<tr>
<td>(v)-asymptomatic</td>
<td>1</td>
<td>8.3%</td>
</tr>
</tbody>
</table>
Table (3): Perioperative data of the patients and their clinical outcome

<table>
<thead>
<tr>
<th>Patient number</th>
<th>Duration of symptoms. Mean= 13± SD (5.9) months</th>
<th>Size of pseudomeningoecele (Length x Width x Depth) cms</th>
<th>Dural repair with:</th>
<th>Clinical outcome according to Wang\textsuperscript{35}</th>
<th>Complication</th>
<th>Follow up (months) Mean=17. 4± SD (5.1)</th>
<th>Recurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td>4 x 3 x 1</td>
<td>+</td>
<td>-</td>
<td>excellent</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>6 x 4 x 2</td>
<td>+</td>
<td>-</td>
<td>excellent</td>
<td>S.W.I</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>21</td>
<td>5 x 4 x 2</td>
<td>+</td>
<td>-</td>
<td>excellent</td>
<td>-</td>
<td>17</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>4 x 2 x 2</td>
<td>+</td>
<td>-</td>
<td>excellent</td>
<td>-</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>3 x 2 x 1</td>
<td>+</td>
<td>-</td>
<td>good</td>
<td>T.P.F.D</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
<td>6 x 4 x 2</td>
<td>-</td>
<td>+</td>
<td>excellent</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>24</td>
<td>6 x 5 x 3</td>
<td>+</td>
<td>-</td>
<td>excellent</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>18</td>
<td>5 x 2 x 1</td>
<td>+</td>
<td>-</td>
<td>excellent</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>17</td>
<td>7 x 6 x 4</td>
<td>-</td>
<td>-</td>
<td>excellent</td>
<td>-</td>
<td>22</td>
</tr>
<tr>
<td>10</td>
<td>7</td>
<td>5 x 3 x 1</td>
<td>+</td>
<td>-</td>
<td>excellent</td>
<td>-</td>
<td>24</td>
</tr>
<tr>
<td>11</td>
<td>9</td>
<td>3 x 2 x 1</td>
<td>+</td>
<td>-</td>
<td>excellent</td>
<td>-</td>
<td>19</td>
</tr>
<tr>
<td>12</td>
<td>10</td>
<td>8 x 7 x 5</td>
<td>-</td>
<td>+</td>
<td>good</td>
<td>-</td>
<td>21</td>
</tr>
</tbody>
</table>

+= Present;
-= Absent
S.W.I = Superficial Wound Infection
T.P.F.D = Temporary Partial Foot Drop

All patients were under follow up for at least 6 months (range 6-24 months; mean 17.4 months). No operative mortality was recorded in these 12 patients. Mild temporary neurological deterioration (partial foot drop) was seen in the early post operative period in one patient who had an entrapped nerve root within the pseudomeningoecele. Within a few weeks, this patient improved and became neurologically free. Superficial wound infection was noticed in one patient, that responded well to antibiotics (anti staphylococcus for 10 days). Perioperative data and clinical outcome are shown in table (3). In nine cases there was a dural tear in the initial surgery, and in three they were unnoticed. Attempts for dural repair with sutures in the initial operation were done. Three tears were successfully repaired with sutures. Muscle graft was used in 6 tears which were not easily accessible because of their far-antrolateral location.

The mean size of pseudomeningoecele was 5.1 cm in length, 3.6 cm in width and 2.1 cm in depth as measured by MRI. In only two cases, a patch of deep fascia graft was used to repair complex laterally located dural tears. No CSF leaks or wound collection was found in the post-operative period. No recurrence was recorded except in one case which developed recollection after 3 months post-operatively. Aspiration of CSF collection was done with the insertion of a lumbar drainage for one week -undercover of broad spectrum antibiotics- and the collection disappeared. All patients were reassessed with full neurological examination and MRI (LSS) within the first postoperative 3 months, and every 6 months thereafter for the first two years.

**DISCUSSION**

A dural tear is one of the most common complications encountered in spine surgeries. Its incidence ranges from 1% to 17\%\textsuperscript{27,2,4,7,35,16,18,9,10}. A general belief is that spine surgeons tend to underestimate the frequency of this complication\textsuperscript{17}. Reported risk factors for incurring a durotomy include older age, revision surgery, anatomic variation, thinning of dura and inexperience of the surgeon\textsuperscript{13,30,3}. This study includes 12 patients with clinically and radiologically post-operative lumbar pseudomeningoecele, this include 7 (58.3 %) males and 5 (41.6 %) females. Mean age is 35.6 years with range (24-53 years). All patients showed pseudomeningoecele with clinical presentation with a mean duration of symptoms of 13 months.

Weng Y et al.\textsuperscript{36} reported in their retrospective study which was between October 2000 and March 2008, that there were 11 patients who developed symptomatic pseudomeningoeceles after spinal surgery. This included 7 (63.6%) males and 4 (36.3%) females whose ages ranged from 19 to 68 years (means 40.8 years). The mean duration of symptoms prior to intervention was 2.5 months, with a range of 1 to 4 months.

Tosun B et al.\textsuperscript{34} stated in their retrospective study which was between 2006 and 2010 that there were 5 patients who developed symptomatic...
pseudomeningoecele after spinal surgery. This included (60%) males and (40%) females whose ages ranged from 19 to 67 years (mean 40.2 years).

As regard the presenting symptoms and signs in this study, there were back pain (58.3%), headache (25%), nausea or vomiting (16.6%), limb pain (33.3%) and asymptomatic (8.3%). Follow up was done for all patients for at least 6 months (range 6-24 months) with mean of 17.4 months. Weng Y et al.35 reported in their series that the commonest symptoms were back pain (63%), headache (55%), nausea or vomiting (36%) and pain or numbness in the limbs (18%). Follow up was done of all patients for at least 8 months with a mean of 16.5 months.

Tosun B et al.34 reported in their study that the commonest symptoms were back pain, headache, nausea and vomiting. Numbness in the legs or radiculopathy were not encountered.

As regard the clinical outcome and complication, in this study, 9 (74.9%) patients had an excellent outcome and 2 (16.6%) patients had a good outcome as described by Wang35. In this study superficial wound infection was noticed in one patient and completely resolved with antibiotics. Temporary partial foot drop was the second complication which was recorded in another patient. Recurrence of pseudomeningoecele after surgical repair was only seen in one patient. Aspiration of CSF collection was done with the insertion of a lumbar drainage and the collection disappeared.

Tosun B. et al.34 stated in their series that complication such as neurological deficits or superficial or deep wound infections did not develop. Recurrences of pseudomeningoecele after the treatment were not seen in any patients. Nine patients had an excellent outcome, 2 a good outcome and one a poor outcome.

Weng Y et al.36 reported in their study that complications such as neurological deficits, wound infection, or deep infection was not observed. A recurrence of pseudomeningoecele during the follow up period was not observed for their study population.

In this study, dural tear in the initial surgery was noticed in nine cases, out of twelve. Three dural tears were successfully repaired with sutures. Those six cases with a durotomy located in a difficult site (far/interanterolateral) muscle graft was used.

Weng Y. et al.36 stated in their study that dural tears during the initial surgery were noticed in all patients who subsequently sustained postoperative pseudomeningoecele. The entire dural tear had been primarily repaired at that time.

Tosun B. et al.34 reported in their series that dural tears during the initial surgery were not recognized during the surgical operation. Post operative pseudomeningoecele resulted from a tear in the dura mater and pia-arachnoid that is un-noticed and is left open during surgery33,35,26,25. If the dura mater and pia-arachnoid are torn, CSF extravasates into the paraspinal soft tissue space. More cases of pseudomeningoecele developed in the lumbar region than other areas. This observation is in accordance with this study and with other studies37,19,22,14. This may be because CSF in the lumbar region is under a higher hydrostatic pressure than that in the cervical spine in the upright posture, and because more surgical procedure is carried out on the lumbar spine12.

A pseudomeningoecele should be considered in patients with recurrent back pain, radicular pain, or a persistent headache after spinal surgery which is matching with our study11,25.

Nerve roots may subsequently herniated via the dural and arachnoid tears leading to radicular pain and may be motor deficits. Headache may be the result of a reduction in CSF volume and lowered intracranial pressure11,25,8.

Most authors consider MRI to be the most effective non-invasive diagnostic tool that can accurately assess the size and the site of pseudomeningoecele. In this study MRI was done to all patients before any procedure and was repeated 3 months later to confirm the formation, resolution and recurrence of pseudomeningoecele.

According to the literature, recommendations, for the treatment of dural tears have included primary repair, closed subarachnoid drainage, grafts consisting of muscle, fat or fascia, blood patches, and bed rest16,18,9,6,5,21,20,15.

A dural tear that is observed during the spinal surgery should certainly be repaired primarily due to the well known risks of CSF leakage. There is a general consensus that, if possible, the surgeon should perform a primary suture closure33. Adequate exposure of the tear is necessary for the proper repair of the dural tear. Paraspinal muscles and fascia should always be re-approximated tightly. Otherwise extradural anatomic dead space that is created by surgical procedures leading to the leakage of CSF may not be obliterated. The relatively significant sub-periosteal dissection with resultant lateral muscle retraction can result in a larger dead space into which CSF can leak after closure. With minimally invasive procedure, the resulting dead space is significantly small33.

Unnoticed or unrepaird dural tears may stay asymptomatic, but sometimes lead to a pseudomeningoecele formation. The prevalence of this complication remains unknown35. There are few reports of clinical outcomes after incidental durotomy in the literature. Sin et al.30 reported that the overall outcome of the patients would not be affected adversely by the presence of a dural tear. On the contrary, Saxler et al.27 reported poorer clinical outcome after surgery in patients with an incidental durotomy.
In this study, dural tears which were not noticed intra-operatively in 3 patients were due to their small size. This small size of the dural defects might be reason for success without surgical intervention in those 3 patients. So, prompt identification and careful closure of the dural defect at the time of the index surgery should be the treatment of choice. Dural tears were identified in 8 patients at the time of initial surgery that lead to subsequent symptomatic pseudomeningecele formation and reoperation. This implied that the initial leaks of CSF were not completely closed even though the entire dural tear had been repaired by primary closure at that time. This again emphasizes the importance of having a more careful attention in dealing with intra-operative CSF leaks.

Comparisons among different treatment modalities (either conservative or surgical) for pseudomeningecele may be considered as one of some limitations of the present study due to the small number of the patients. Such limitations may be discussed in the future studies.

CONCLUSION

Iatrogenic pseudomeningecele is a rare complication of spinal surgery and should be suspected in patients submitted to lumbar surgery when delayed post operative neurological symptoms occur, even many months or years after the initial surgery. There is no distinct treatment guideline according to the etiology in the current literature. Any dural opening made during lumbar surgery should be tightly and carefully closed at the time of the original procedure.

REFERENCES