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SURGICAL TREATMENT OF IATROGENIC PSEUDOMENINGOCELES

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ABSTRACT

Objective: Pseudomeningocele that develops after spinal surgery is a rare complication that should be well-guided by surgeons. In the absence of proper treatment, it may increase the morbidity of the patients.

Materials and Methods: The medical records of 13 patients with iatrogenic pseudomeningocele who underwent primary dura repair with myofascial flap support and lumbar subarachnoid drainage, were retrospectively reviewed.

Results: There were four female (31%) and 9 male (69%) patients in the study cohort. The mean age of the patients was 45 years (2-68 years). Six patients had decompression with implanted fusion, 5 patients had microdiscectomy, 1 patient had untethering for tethered cord syndrome and 1 patient had intradural extramedullary tumor excision as the first operation. One patient had a pseudomeningocele at the cervical region and the other patients' lesions were at the lumbar region. Revision microdiscectomies were performed in 5 patients with recurrent/residual disc herniations, and abscess drainage was performed in 1 patient with an abscess at the operation site. Infected cases were consulted in the infectious diseases department, and antibiotherapy was given for appropriate periods. None of the patients had any additional complications and persistence or recurrence of the pseudomeningocele following dura repair and lumbar subarachnoid drainage. The complaints of all the patients were resolved.

Conclusion: Although there are cases with iatrogenic pseudomeningoceles who present spontaneous recovery in the literature, most of these cases require surgical exploration and primary repair. Surgical repair with myofascial flap support and lumbar subarachnoid drainage seems to be an effective option in patients with iatrogenic pseudomeningoceles.

Keywords: Spine surgery, complications, pseudomeningocele, lumbar subarachnoid drainage, duraplasty

INTRODUCTION

Spinal pseudomeningocele is an extradural cerebrospinal fluid (CSF) collection because of dural defects. The difference between the pseudomeningocele and congenital meningoceles is that there is no real arachnoid membrane in the pseudomeningocele. Therefore, they are called pseudomeningoceles. They may present as congenital, traumatic, or postoperative complications[1,2]. The most common type is the iatrogenic pseudomeningocele after spinal surgeries. These types of pseudomeningoceles are complications that should be well-guided by surgeons and increase morbidity. The incidence of pseudomeningocele in the literature was between 0.068% and 2%[1,3,4]. There is no consensus in the literature regarding the treatment of the spinal pseudomeningocele. This study evaluated 13 patients who had iatrogenic pseudomeningocele and their primary treatments.

MATERIALS AND METHODS

The medical records of 13 patients who presented with iatrogenic pseudomeningocele at 2 neurosurgery clinics between January 2013 and January 2020 and underwent primary dura repair with myofascial flap support and lumbar subarachnoid drainage, were retrospectively reviewed. All study protocols were performed in accordance with the ethical rules proposed in the Helsinki Declaration. Ethics committee approval was received from the Çukurova University Non-Interventional Scientific Research Ethics Committee (126/13, date: 07.10.2022). Patient demographics and medical records, including age, gender, clinical symptoms, preoperative and postoperative neurological status, and visual analog scores, first-session operative indications and applied surgeries, hospitals of first-session surgery, radiological diagnoses, treatment modalities, and postoperative complications were gathered. Contrast-enhanced spinal magnetic resonance

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imaging (MRI) was performed on all patients before surgery (Figure 1). The treatment plans of the patients who were investigated for infection were made according to the scans and opinions of the specialist in infectious disease. Before surgery, 1 gram of ampicillin-sulbactam was administered, and 1 gram of ampicillin-sulbactam was administered four times daily for three days postoperatively. Tissue and fluid samples were obtained from all the patients. Antibiotherapies were arranged by the department of infectious diseases according to their isolation and identification. Lumbar subarachnoid drainage was applied in all patients. CSF drainage was achieved in the range of 50-120 mL daily for a total of 5-7 days. After ensuring that the wound was closed, the drainage systems were pulled out under sterile conditions and the drainage sites were sutured.

Statistical Analysis

The SPSS 25.0 (IBM Corporation, Armonk, New York, United States) program was used to analyze the variables. The Mann-Whitney U test was used with the Monte Carlo results to compare the categorical variables quantitatively. The quantitative variables were described as mean ± standard deviation, the median range (maximum-minimum), and categorical variables as n (%). The variables were examined at a 95% confidence level, and $p<0.05$ was considered significant.

RESULTS

Patient Profile

There were four female (31%) and 9 male (69%) patients in the study cohort. The mean age of the patients was 45 years (2-68 years). The first operations of 4 patients were performed at our center and 9 in another neurosurgery clinic. Six patients had decompression with implanted fusion, 5 patients had microdiscectomy, 1 patient had untethering for tethered cord syndrome and 1 patient had intradural extramedullary tumor excision as the first operation. One patient had a pseudomeningocele at the cervical region and the other patients at the lumbar region (Table 1). All the patients underwent multiple lumbar punctures before the surgical treatment of pseudomeningoceles. However, the resolution of the pseudomeningoceles could not be achieved with lumbar punctures.

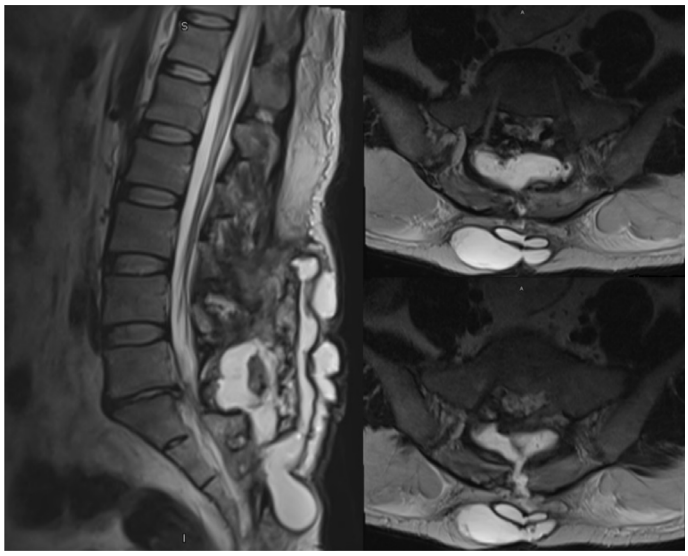

Figure 1. Sagittal and axial T2-weighted lumbar magnetic resonance images of the fifth patient revealed a giant lumbosacral iatrogenic pseudomeningocele

Patients Symptoms and Neuroimaging

The most common symptoms were wound swelling and intracranial hypotension symptoms (such as headache, nausea, vertigo, dizziness, blurry vision, diplopia, unsteady gait) (69%) (Figure 2). Other symptoms identified were lumbar back pain (46%), radiculopathy symptoms (38%), wound leakage (15%), and fever (7%), respectively (Table 1). Contrast-enhanced MRI was performed for all the patients, and pseudomeningocele sacs were identified in all patients (Figure 1). Two patients had an infection in the operation region, and 1 patient had developed an abscess formation (Table 1).

Surgery

All the patients underwent primary dura repair with myofascial support and lumbar subarachnoid drainage. Dura repair was performed by primary suturation with 4/0 silk sutures. Full-thickness pedicular muscle and fascia flaps were applied for myofascial support. Revision microdiscectomies were performed in 5 patients with recurrent/residual disc, and abscess drainage was performed in one patient with an abscess. Infected cases were consulted the infectious disease clinics, and antibiotherapy was given for appropriate periods. CSF drainage was achieved in the range of 50-120 mL daily for a total of 5-7 days. In the patient who had a pseudomeningocele in the cervical region, CSF drainage was ensured in a controlled manner from lumbar drainage and not to exceed 50 ml per day. In the literature, because of the progression to herniation in such a case, CSF drainage was performed with close follow-up[5]. The patient had pseudomeningocele repair without any additional problems. None of the patients had any additional complications or recurrence of the pseudomeningocele following dura repair and lumbar subarachnoid drainage (Table 1). The complaints of all the patients improved. All the patients were discharged after an uneventful postoperative period.

DISCUSSION

Spinal pseudomeningocele is an extradural CSF collection without an arachnoid membrane due to a small defect in the dura. It was first described as an extradural cyst by Hyndman and Gerber[6] in 1946. However, they classified the spinal pseudomeningocele as iatrogenic and traumatic in 2 groups. Miller and Elder[7] divided this pathology into 3 groups in 1968, and it was finally classified as congenital, iatrogenic, and traumatic. Congenital pseudomeningoceles are usually detected in patients with neurofibromatosis and Marfan

Table 1. Demographic characteristics of the patients

Patient	Age/ gender	Symptoms	First session pathology / treatment modality	Neuroimaging	The first operation center	Treatment modality	Complication
1	50/M	Wound swelling + intracranial hypotension	L4-5 microdiscectomy	Lumbar pseudomeningocele	AND	Dura repair + microdiscectomy + LSD	-
2	56/M	Wound leakage + lumbar back pain + left radiculopathy	L3-5 decompression with implanted fusion + implant removal*	Lumbar pseudomeningocele + abscess	AND	Dura repair + abscess drainage + LSD + antibiotherapy	-
3	28/M	Wound swelling + intracranial hypotension	L1 fracture / T11-L3 implanted fusion	Lumbar pseudomeningocele	AND	Dura repair + LSD	-
4	35/F	Wound swelling + right radiculopathy + intracranial hypotension	L2-3 + L3-4 microdiscectomy	Lumbar pseudomeningocele	OD	Dura repair + microdiscectomy + LSD	-
5	39/M	Wound swelling + intracranial hypotension	L4-S1 decompression with implanted fusion	Lumbar pseudomeningocele	AND	Dura repair + implant removal + LSD	-
6	66/M	Lumbar back pain + left radiculopathy + fever	L4-5 microdiscectomy	Lumbar pseudomeningocele + infection in the operation region	AND	Dura repair + LSD + antibiotherapy	-
7	2/M	Wound swelling	Untethering for tethered cord syndrome	Lumbar pseudomeningocele	AND	Dura repair + LSD	-
8	44/F	Wound swelling + intracranial hypotension	Cervical intradural extramedullary tumor excision	Cervical pseudomeningocele	OD	Dura repair + LSD	-
9	68/F	Lumbar back pain + intracranial hypotension	L1-S1 decompression with implanted fusion	Lumbar pseudomeningocele	AND	Dura repair + LSD + implant revision + L1-L2 decompression	-
10	57/F	Wound leakage + intracranial hypotension + lumbar back pain + left radiculopathy	L3-4 + L4-5 microdiscectomy	Lumbar pseudomeningocele	OD	Dura repair + microdiscectomy + LSD	-
11	56/M	Wound swelling + lumbar back pain + intracranial hypotension	L4-5 microdiscectomy	Lumbar pseudomeningocele	AND	Dura repair + LSD	-
12	38/M	Wound swelling + intracranial hypotension	L3-5 decompression with implanted fusion	Lumbar pseudomeningocele	AND	Dura repair + LSD	-
13	45/M	Wound swelling + lumbar back pain + left radiculopathy	L4-S1 decompression with implanted fusion	Lumbar pseudomeningocele + infection in the operation region	OD	Dura repair + LSD + antibiotherapy	-

*Implant removal was performed in a second session.
M: Male, F: Female, AND: Another neurosurgery department, OD: Our department, LSD: Lumbar subarachnoid drainage

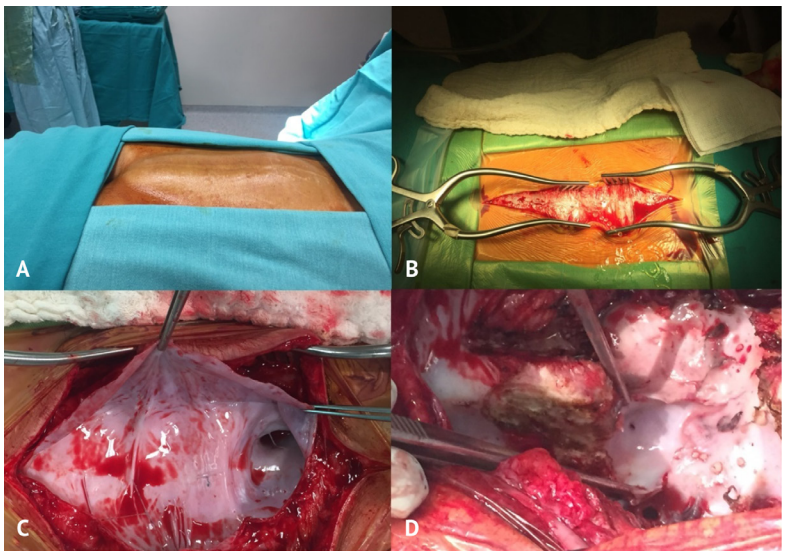

Figure 2. Peroperative images of the same patient. **(a)** Cerebrospinal fluid collection under the skin incision. **(b)** Drainage of the high-pressured collection. **(c)** Pseudomeningocele pouch. **(d)** The small defect of the dura was causing cerebrospinal fluid leakage

syndrome. They are usually located in the thoracic region and the thoracolumbar junction[4,6]. Traumatic pseudomeningoceles are the rarest forms and are usually located in the cervical and thoracic regions because of distraction injuries[8,9]. The most common forms are iatrogenic types, and they are identified as postoperative complications after spinal surgeries[2-4,10-13]. Iatrogenic pseudomeningoceles are most commonly detected in the lumbar region.

Spine surgery is linked to a wide range of intraoperative complications, including wrong-level surgery, nerve root lesions, vascular injury, and dural tearing. Dural injury is not uncommon, with reported incidence rates of 1-17.4%[13-15]. The rates of dural injury vary according to the types of surgeries. The rates were found to be 1.8% in microdiscectomies, 5.3% in laminectomies, and 17.4% in revision surgeries[16-18]. The rate of detection of iatrogenic pseudomeningoceles in the literature is in the range of 0.068-2%[1,3,4]. The iatrogenic pseudomeningoceles are classified as large (greater than 5 cm), and giant (larger than 8 cm) pseudomeningoceles due to their size[3,4,19]. Iatrogenic pseudomeningoceles can be asymptomatic or may present with clinical symptoms including back pain, radicular pain, cauda equina syndrome, or signs of intracranial hypotension, such as postural headache, dizziness, neck pain, tinnitus, vision problems, and nausea, and vomiting[1,10-13,20]. In cases where the pressure in the pseudomeningocele sac is high, leakage from the incision may be observed. In cases with excess pouch size, herniation of neural tissues into the sac can be observed. In particular, herniations are observed in the sac after pseudomeningoceles in the thoracic and lumbar region[1,8,9,11,12]. In the literature, there are cases of decerebrate rigidity or herniation symptoms because of CSF leakage[5,21]. A case of hydronephrosis induced by a pseudomeningocele extending to the retroperitoneal region was also been presented in the literature[22]. There is no consensus on the treatment of iatrogenic pseudomeningoceles in the literature. Although some cases spontaneously recovered, surgical repair is usually required[2]. Treatment modalities of pseudomeningoceles include conservative methods, epidural blood-patch applications, primary dura repair with surgical excision of the pseudomeningocele, and drainage catheters placed at the subarachnoid space[1,4,20]. Conservative methods include bed rest, prevention of leakage from the skin incision, and repetitive punctures applied to the sac[1]. In patients with spontaneous CSF leakage, the epidural blood-patch application is performed[23]. However, in patients with failure of conservative methods, intracranial hypotension symptoms, progressive myelopathy or cauda equina syndrome, and infection, surgical interventions are required[1,20].

Surgical excision of the pseudomeningocele and primary dura repair is the definitive treatment method. In patients with large dural defects, duraplasty with fascia grafts or synthetic dura grafts can be applied. Fibrin glue and myofascial flaps are also among the methods applied to provide support to the repaired dura[16,19]. After the repair, only the use of Jackson-Pratt drain or lumbar subarachnoid drainage are options for the drainage. In the literature, although it was shown that good results were obtained with the prolonged use of Jackson-Pratt drains instead of subarachnoid drainage, the general opinion is that better results are obtained with external subarachnoid drainage[5,24,25]. In this study, we performed pseudomeningocele excision, primary dura repair with myofascial flap support, and lumbar subarachnoid drainage. We did not apply any foreign material such as a dura graft or fibrin glue in any patient. In cases with large dura defects, we performed duraplasty with autologous fascia grafts and obtained positive results.

Study Limitations

There are certain limitations to this study. The main limitations are the retrospective nature of the study and the relatively small sample size (13 patients). There is also a lack of pediatric patients (only 1 patient) in this study group.

CONCLUSION

In the literature, there are some cases with iatrogenic pseudomeningoceles that present spontaneous recovery. However, most of these cases require surgical exploration and primary repair. In this study, 13 patients who were diagnosed with iatrogenic pseudomeningoceles and underwent surgery are presented. All the patients underwent pseudomeningocele excision, primary dura repair with myofascial flap support, and lumbar subarachnoid drainage. Good results were obtained in all the patients. It is important to perform the surgeries as soon as possible to reduce the risk of infection. Surgical repair and lumbar subarachnoid drainage seem to be favorable options for patients with iatrogenic pseudomeningoceles.

Ethics

Ethics Committee Approval: Ethics committee approval was received from the Çukurova University Non-Interventional Scientific Research Ethics Committee (126/13, date: 07.10.2022).
Informed Consent: Retrospective study.
Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: K.O., A.G., Concept: K.O., A.G., Design: K.O., A.G., Data Collection or Processing: E.G., M.A., O.B., Analysis or Interpretation: K.O., U.E., Literature Search: K.O., M.A., O.B., Writing: K.O., U.E.
Conflict of Interest: The authors have no conflicts of interest to declare.
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