



Clinical Studies

Symptomatic intraspinal lumbosacral pseudomeningocele, a late consequence of root avulsion injury secondary to a gunshot wound

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ABSTRACT

Background: Traumatic pseudomeningocele are usually a late consequence of cervical root avulsion injury and its occurrence in lumbosacral region is rare. This pathology is mostly due to violent blunt traumatic events and usually develops outside of the spinal canal. Occasionally, a pseudomeningocele may grow inside of the spinal canal causing delayed neurological deficit due to compromise of the adjacent neural structures.

Case description: Evaluation of a delayed left lower extremity weakness in a young man with a history of a gunshot wound injury revealed an extradural pseudomeningocele arising from an S1 root avulsion injury with compressive effect on the adjacent L5 root

Outcome: Excision of the cyst wall and reinstatement of the nerve root sheath resulted in an uneventful recovery

Conclusion: To the best of our knowledge, the presented case with traumatic pseudomeningocele is the first example secondary to high velocity bullet injury. Furthermore, management of traumatic intraspinal pseudomeningocele subsequent to root avulsion injury has not been paid sufficient attention. In this paper, the surgical strategy will be discussed in detail.

Introduction

Lumbosacral root avulsion injury may rarely result in formation of a traumatic pseudomeningocele [1–5]. The mechanism of pseudomeningocele development is a rupture of the arachnoid cuff of a nerve root with the subsequent expansion of the corresponding root sleeve wall due to free and pulsatile flow of cerebrospinal fluid [6].

The first example of intraspinal traumatic lumbosacral pseudomeningocele secondary to root avulsion was reported by Nosik in 1955 and since that time roughly 30 additional cases have been published within medical literature [7]. All of these cases except one which was due to stab wound were secondary to blunt traumas.

Herein we present a young man with a remote lower leg weakness due to the gradual expansion of a traumatic intraspinal lumbosacral pseudomeningocele which was a late sequel of S1 root avulsion injury caused by a bullet injury.

Case presentation

A 20-year-old Iraqi militia member was referred to our clinic with symptoms of progressive left foot drop. He had a history of a bullet

related injury which had occurred 2 years earlier. The bullet had entered in the left paraspinal muscles and was finally embedded in contralateral psoas muscle without causing visceral injury. However, 18 months later he noticed a pin prick needle-like sensation in his left foot that gradually became associated with an accompanying weakness while standing on his heels. His neurological exam was compatible with a 2/5 weakness of the dorsiflexion of his left foot. He also clearly displayed a diminished left ankle jerk. Lumbar MRI disclosed a left sided cystic mass extending from the lower border of L4 to S1 (Figs. 1 and 2).

Operation

After an L4, L5 and upper S1 hemilaminectomy, a left sided cyst with a thickened wall lying alongside the thecal sac was demonstrated (Fig. 3). The cyst wall itself was gradually shrunk with the utilization of bipolar cautery. Subsequently, the left L5 root which had bowed at rostral pole of the cyst, was then meticulously separated from the cysts wall and released. Then, with the continuation of shrinkage, it was found that the cyst in fact has been an expansion of the S1 nerve root sheath. At this stage, the shrunken cyst was incised longitudinally along the direction of the root. Within the space and at the depth of the cavity, intact nerve rootlets with a normal continuity were clearly identified (Figs. 4

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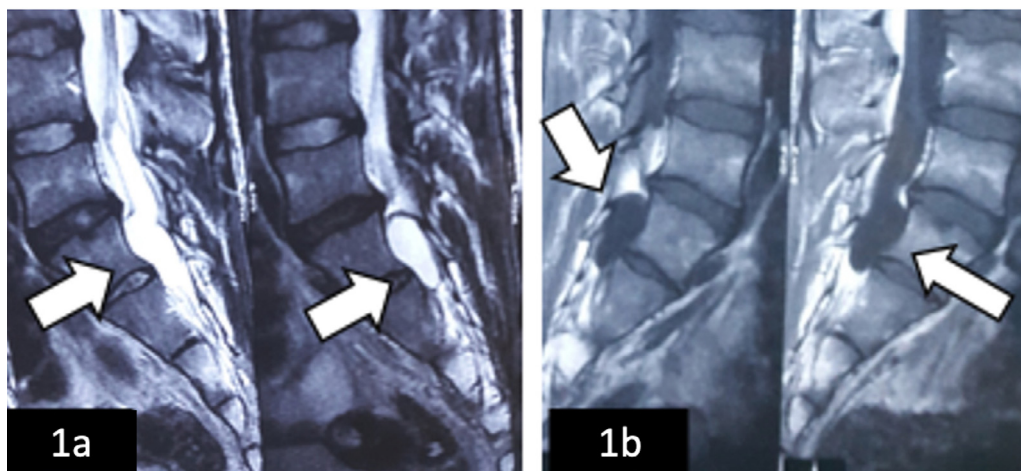


Fig. 1. Lumbosacral sagittal MRI, (a) T2 weighted image showing a hyperintense mass at the caudal part of lumbar spine; (b) T1 weighted image with hypointense mass compatible with cystic mass (white arrows).

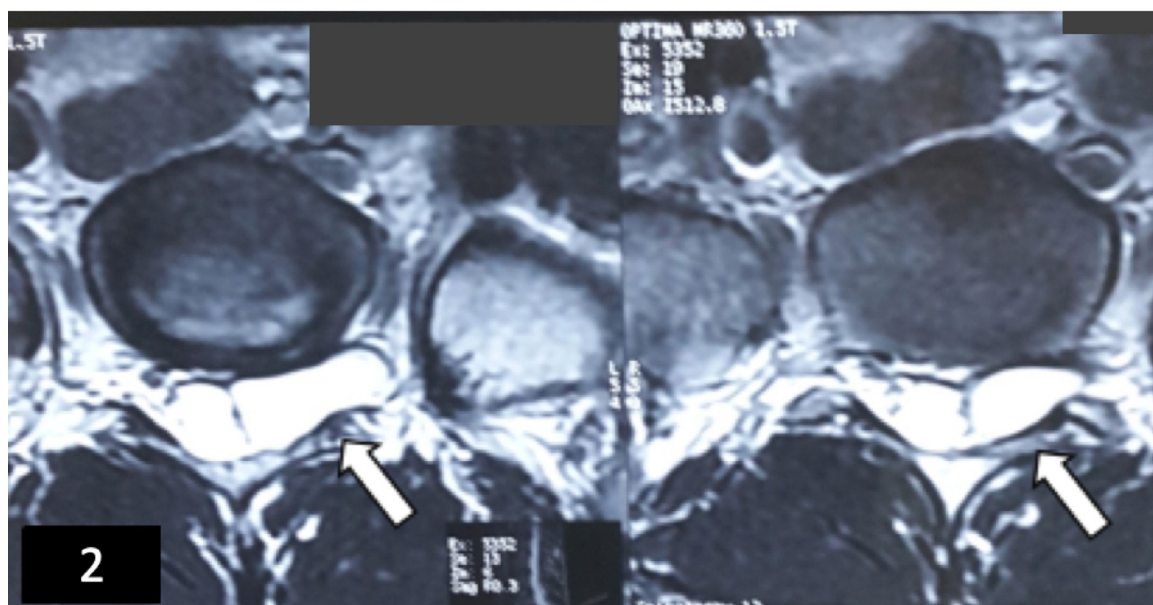


Fig. 2. Axial T2-weighted image at L5-S1 level shows a left-sided cyst with extension to the foramen (white arrows).

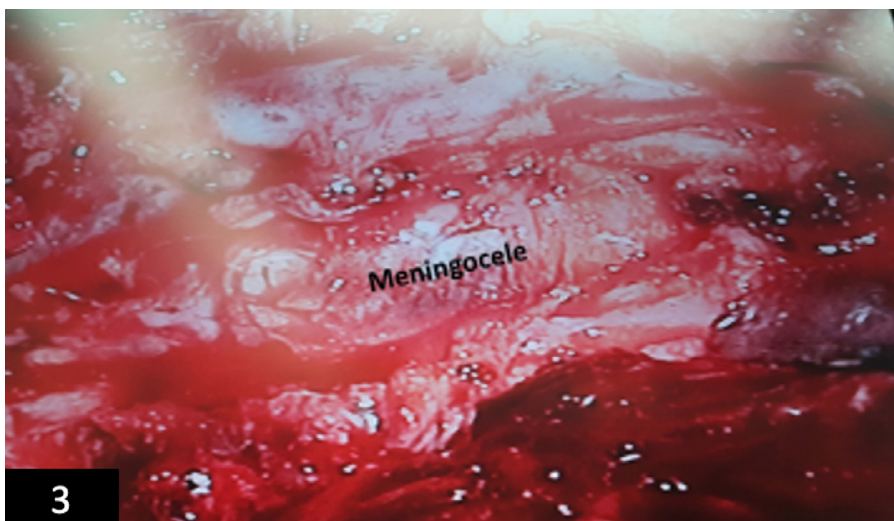


Fig. 3. Intraoperative image demonstrating the pseudomeningocele.

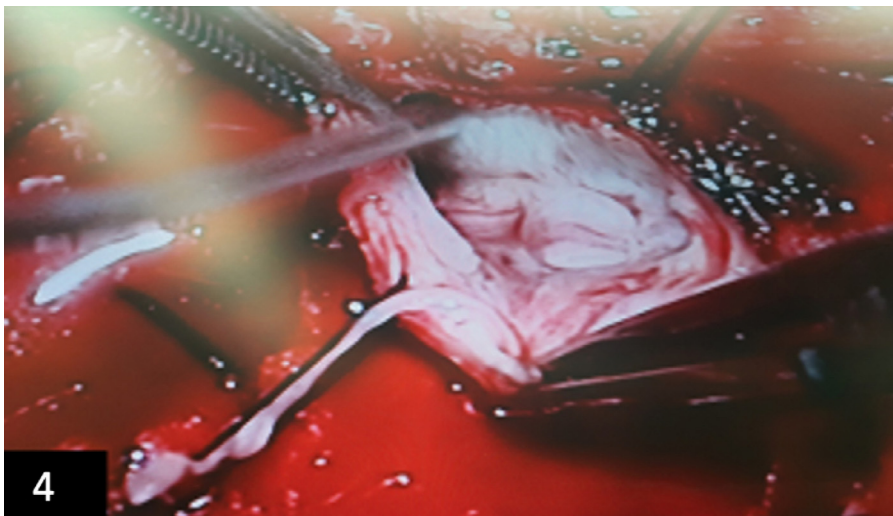


Fig. 4. Intraoperative photograph, showing expanded S1 sleeve, note that S1 rootlets are in continuity and are intact.

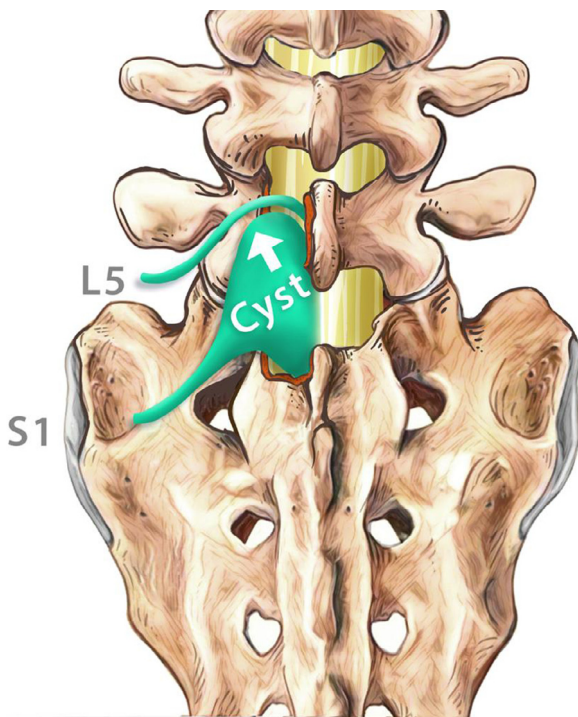


Fig. 5. Schematic drawing showing that the pseudomeningocele has arisen from left S1 root with compressive effect on L5, note bowing of L5 root.

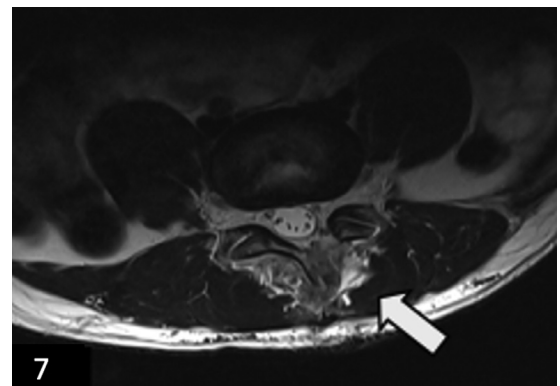


Fig. 7. postoperative T2-weight axial showing hemi-laminectomy (white arrow), note there is no cystic mass.

and 5). In addition to these findings, the slow flow of the cerebrospinal fluid could be visualized with use of the Valsalva maneuver. The final stage involved the careful excision of the excess cystic wall tissue, and reconstruction of a new root sleeve, with the suturing of the remaining edges of the cyst (Fig. 6).

Postoperative course

During a six-month follow up encounter, the patient's foot strength had improved. MRI at this stage showed no abnormal pathology (Fig. 7).



Fig. 6. Intraoperative image demonstrating L5 root, reconstructed S1 root and decompressed theca.

At three-year follow-up, he reports none of the previously mentioned deficits.

Discussion

Traumatic intraspinal pseudomeningocele formation secondary to lumbosacral root avulsion injury is a rare medical entity and has seldom been described within medical literature [1–5,7].

Pathogenesis

The dura and underlying arachnoid layer extend from the emerging point of the root for about 8–10 mm. The violent vibration of a blunt trauma being directed toward a nerve root may result in the disruption of the nerve root arachnoid sleeve [1–5]. This causes a subsequent one-way flow of the CSF into the root chamber. When this situation occurs, the nerve rootlets are usually disrupted which results in an immediate neurological deficit [1–5]. Less frequently, the corresponding rootlets may remain intact and preserve their continuity. In both scenarios, with the one-way entrance of the cerebrospinal fluid and its gradual accumulation within the root chamber, the nerve root sheath eventually expands and a cyst or a pseudomeningocele develops [1–7]. Such a pseudomeningocele may also gradually create a mass effect on adjacent nerve roots or theca causing a delayed neurological manifestation. These events will vary in time from months to years.

In fact, a very similar scenario had occurred in our patient. However, instead of the vibratory effects being induced by a blunt force trauma, the vibration was created by the bullet itself, in association with the increased abdominal pressure induced by the traversing of the bullet into the retroperitoneal region have been probably the mechanism of the avulsion.

Management: In most frequent scenario where both the arachnoid cuff and the rootlets are torn, in order to relieve the pressure on adjacent neural structures, the base of the pseudomeningocele should be sutured or tied tightly nearest to the theca.

In a less frequent scenario where the rootlets remain intact, partial excision of the cyst wall and reinstatement of the root sleeve should be done.

Conclusion

Both blunt and penetrating lumbopelvic traumatic events may result in formation of a traumatic pseudomeningocele subsequent to root

avulsion injury. A pseudomeningocele, is in fact gradual expansion of the root sleeve caused by pulsatile cerebrospinal fluid flow. Traumatic pseudomeningoceles usually develop outside the spinal column, but in rare occasions, their formation may take place in the spinal canal. An expansile pseudomeningocele may cause delayed neurological impairment due to its compressive effect on adjacent neural structures.

Declaration of competing Interest

None to declare.

Ethical approval Approved!

Consent Written informed consent was obtained from the patient for publication and corresponding images.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.xnsj.2020.100025](https://doi.org/10.1016/j.xnsj.2020.100025).

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