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CASE REPORT

An Isolated Posterior Spinal Aneurysm Resection in Which Intraoperative Electrophysiological Monitoring Was Successfully Used to Locate the Lesion and to Detect the Possibility of Ischemic Complications

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Study Design. A case report.
Objective. To report the successful use of electrophysiological monitoring in the surgical resection of a ruptured spinal artery (SA) aneurysm to locate the lesion, and to predict ischemic complications.
Summary of Background Data. Isolated aneurysm of the posterior SA is an extremely rare event without established treatment and diagnosis procedures. Reports describing the surgical intervention of aneurysm of the posterior SA using electrophysiological monitoring are scant.
Methods. We performed the surgical resection of a dissected posterior SA aneurysm in an older patient who presented with spinal subarachnoid hemorrhage using intraoperative electrophysiological monitoring.
Results. Intraoperatively, motor evoked potentials decreased over 50% when a distal site of the lesion was clipped, indicating that site was the posterior SA. This lead to further investigation of the vascular anatomy around the lesion, which revealed the descending part of the posterior SA buried deeply in a thick thrombus. Clipping and resection were successful, and ischemia of the posterior SA was avoided. The postoperative clinical course was good, and there was no recurrence or long-term squeal.
Conclusion. Electrophysiological monitoring might be useful when intraoperative anatomical findings of the hemodynamic structure are inadequate. Moreover, in our case, intraoperative changes in motor evoked potentials indicated the risk to occlude one of posterior SAs, although it is said that posterior circulation of spinal cord has ischemic tolerance.
Key words: electrophysiological monitoring, ischemic complication, ischemic tolerance, motor evoked potentials, pathology, posterior circulation of spinal cord, posterior spinal artery, somatosensory evoked potentials, spinal aneurysm, surgical resection.
Level of Evidence: N/A
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Aneurysms of spinal arteries (SAs) are rare, especially isolated aneurysms which were found in spinal angiograms less than 1/3000 of the time.[1] Compared with the anterior SA, occurrence is less frequent in the posterior SA, with our investigation of the literature only revealing 13 cases. The reports for the surgical intervention using electrophysiological monitoring are scant. In our case the monitoring showed the possibility of ischemia to avoid, although the risk of ischemic complication after treatment of posterior SA aneurysms have never been reported.

CASE REPORT

A 72-year-old female with no significant medical or family history was transported to our hospital with acute back pain. Magnetic resonance imaging revealed T4–T10 spinal subarachnoid hemorrhage, and preoperative superselective spinal angiography showed a suspected aneurysm or varix in an unidentifiable dilated vessel at the connecting point of the T9 radiculopial artery (Figure 1). Because intraoperative superselective angiography was unavailable to discern whether the vessel in question was the posterior SA or

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Figure 1. Left-posterior oblique view of 3D rotational angiography showing anatomical structure around the lesion. It is unclear whether the vessel (arrow heads) is the posterior spinal artery or vein.

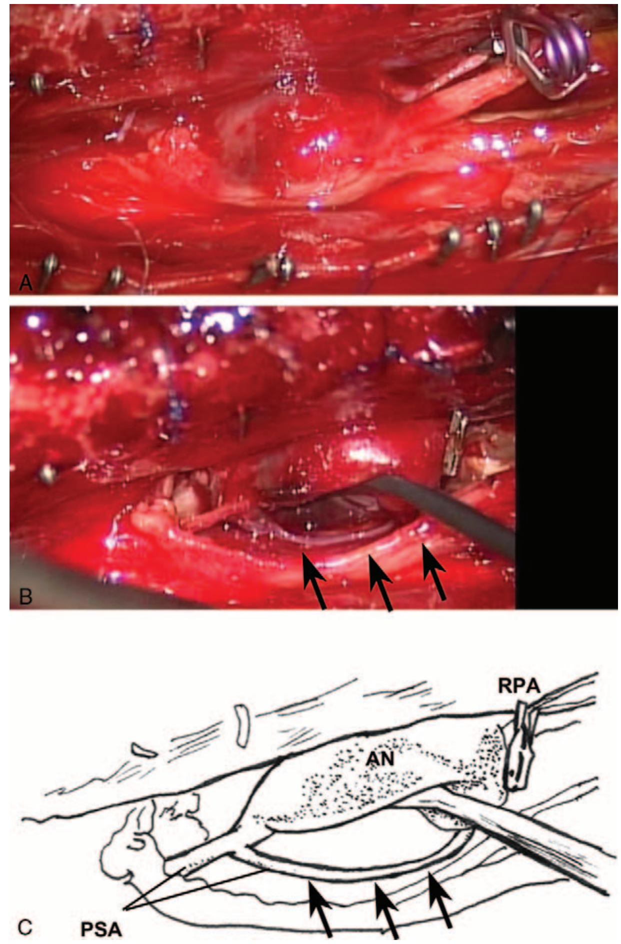

Figure 2. Intraoperative view after incision of the spinal dura mater (A). Further investigation showed a branch descending ventral to the lesion (B: arrows), with a schema (C) (orientation: left is caudal and right is rostral. The first clip was removed.).

posterior spinal vein, we used electrophysiological monitoring in the surgical intervention. Intraoperatively, total intravenous anesthesia was used, with propofol and remifentanyl. Rocuronium bromide, muscle relaxant was given initially only for intubation and no reversal agents were used. Neuroworkbench Neuropack MEB-2200 (Nihon Koden America) machine was performed manually at the time of need. Somatosensory evoked potentials (SSEPs) were elicited by stimulation of the posterior tibial nerve using percutaneous electrodes. Motor evoked potentials (MEPs) were recorded by electromyography *via* subdermal needle electrodes inserted into the tibial anterior, quadriceps and peroneus of both lower extremities. Trains of 5 square wave stimuli were applied through electrodes placed at CP2 and CFz sclap sites (interstimulus interval of 2 ms and intensity up to 150 mA). Intraoperatively, laminectomy of T5–T10 and facetectomy of left T8–T9 were undertaken, and the proximal area of the dilated lesion was located and clipped by tracking the left T9 nerve rootlet to the radiculopial artery. The lesion was obstructed by a hematoma and visibility of the draining vessel was poor (Figure 2A). After clipping of the distal site of the lesion, the amplitude of MEPs decreased by about 50% and did not recover whereas the latency and stimulation threshold of MEPs unchanged, and therefore we removed the first clip. SSEPs remained unchanged (Figure 3A, B). Based on these and the gross findings, we hypothesized that the clipped site was in the posterior SA and it was essential for maintaining hemodynamic stability. Subsequent careful manipulation revealed the descending part of the posterior SA, originating from between the clipping site and the lesion (Figure 2B). We repositioned the clip proximal to the branching point. After confirming both MEPs and SSEPs were normal, we resected the aneurysm. It was partially thrombosed. Pathological analysis revealed an interrupted internal elastic lamina and an interstitial thrombus within the media and adventitia, confirming the clinical diagnosis of a dissecting aneurysm. Postoperatively she had no neurological deficits, except for a transient urinary disturbance. A 3-week follow-up spinal angiogram showed no abnormal vessels and at a 6-month postoperative follow-up examination all symptoms had resolved.

DISCUSSION

It is said that posterior SAs have the extensive pial network on the surface of the spinal cord, and the risk of ischemic complication after one of posterior SAs was occluded in surgical and endovascular treatment have never been reported. The distribution of radiculopial arteries and the tolerance for ischemia depending on the level of the spine is still unclear. In our case, MEP monitoring suggested the possibility that obliteration of the only one of posterior SAs induced ischemia and that posterior SAs throughout the whole spine contribute in a nonuniform manner not only anatomically but hemodynamically.

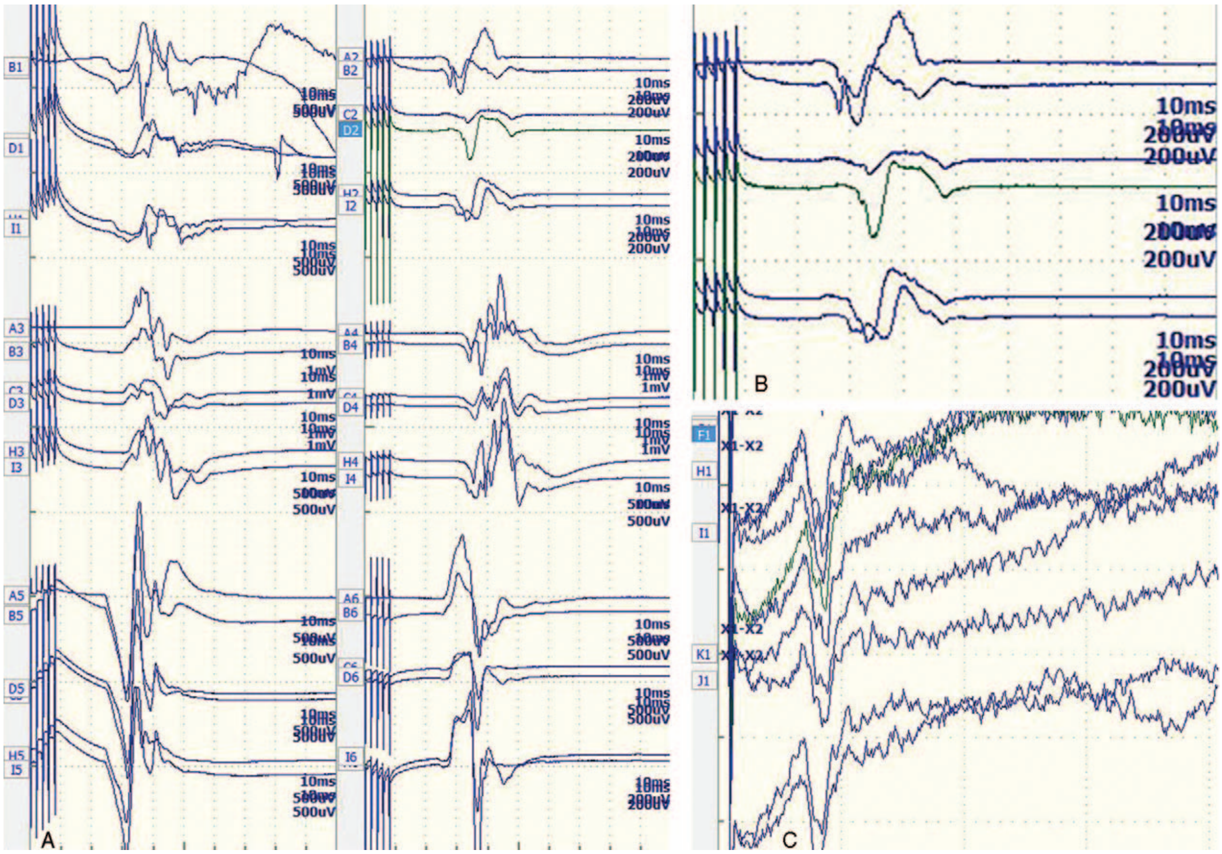

Figure 3. The amplitude of MEPs records before the clip was applied for the first time was 600 μV. The amplitude then dropped to 300 μV and returned to 400 μV when the second clip was applied (A, B). (B) An enlarged image of the upper right column of (A), MEPs of the tibial anterior at the affected side at 200 μV of calibration, whereas SSEPs remained unchanged throughout (C).

Intraoperative electrophysiological monitoring is common in orthopedic spin surgery, such as lumber fusion[2,3] and craniocervical distraction[4] because of its sensitivity and specificity for detecting intraoperative neurological injury. MEPs have been reported to be lost in a progressive fashion before SSEPs, after central nervous system impairment.[5] In our case, amplitude in MEPs dropped to 50% of the baseline amplitude. In SSEPs, there were no changes and they were likely not to be recorded during the first clipping because the signals must be averaged and be delayed.[2] We judged the changes in MEPS was a sign of ischemia induced by occlusion of the posterior SA. About other spinal vascular disorders such as spinal arteriovenous malformation, the prognostic role of intraoperative MEP monitoring in endovascular treatment has been well documented.[6] Nevertheless, reports of the monitoring in the surgical and endovascular treatment of posterior SA aneurysm are scant. In our case, we detect the possibility of ischemic complication in surgical intervention of posterior SA aneurysm by using the monitoring. It could be widespread to avoid ischemia in posterior circulation of spinal cord because it is more available than other modality such as intraoperative superselective angiography in hybrid operation room.

This case suggests that intraoperaive electrophysical monitoring during the treatment of posterior SA aneurysm can be a useful and simple modality to understand the anatomical structure around the lesion, and moreover, to detect the possible ischemia in posterior circulation of spinal cord.

➢ Key Points

- ❑ We experienced a posterior spinal artery aneurysm, an extremely rare entity.
- ❑ Electrophysiological monitoring is useful when intraoperative anatomical findings of the hemodynamic structure are inadequate.
- ❑ There is a possibility of ischemia induced by obliterating one of posterior SAs, although it is said that posterior circulation of spinal cord has ischemic tolerance, and MEPs are also useful to detect the ischemic risk.

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