

Case Report

Abducens Nerve Palsy after Lumbar Spinal Fusion Surgery with Inadvertent Dural Tearing

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Abducens nerve palsy associated with spinal surgery is extremely rare. We report an extremely rare case of abducens nerve palsy after lumbar spinal fusion surgery with inadvertent dural tearing, which resolved spontaneously and completely. A 61-year-old previous healthy man presented with chronic lower back pain of 6 weeks duration and 2 weeks history of bilateral leg pain. He was diagnosed as having isthmic spondylolisthesis at L4-5 and L5-S1, and posterior lumbar interbody fusion was conducted on L4-5 and L5-S1. During the operation, inadvertent dural tearing occurred, which was repaired with a watertight dural closure. The patient recovered uneventfully from general anesthesia and his visual analogue pain scores decreased from 9 pre-op to 3 immediately after his operation. However, on day 2 he developed headache and nausea, which were severe when he was upright, but alleviated when supine. This led us to consider the possibility of cerebrospinal fluid leakage, and thus, he was restricted to bed. After an interval of bed rest, the severe headache disappeared, but four days after surgery he experienced diplopia during right gaze, which was caused by right-side palsy of the abducens nerve. Under conservative treatment, the diplopia gradually disappeared and was completely resolved at 5 weeks post-op.

KEY WORDS : Abducens nerve palsy · Dural tearing · Surgical complication · Lumbar fusion surgery.

INTRODUCTION

Although abducens nerve palsy has been uncommonly reported after trauma, lumbar puncture, spinal anesthesia, halo skeletal traction and other forms of intervention^{2,3,6,8-11,14}, abducens nerve palsy associated with spinal surgery is extremely rare^{2,10}. It has been hypothesized that the mechanism of abducens nerve palsy involves localized ischemia or changes in the position of the nerve which cause stretch or traction forces^{2,10}. The sixth, ninth, tenth, and twelfth cranial nerves are considered to be the most vulnerable nerves in cases of stretch injury because of their vertical or oblique courses in the cranium^{8,12}. However, to our knowledge, there have been only two reports of abducens palsy as a complication of spinal surgery^{2,10}. We report an extremely rare case of abducens nerve palsy after lumbar spinal fusion surgery with inadvertent dural tearing, which resolved spontaneously and completely.

CASE REPORT

A 61-year-old previous healthy man presented with chronic lower back pain of 6 weeks duration and 2 weeks history of bilateral leg pain, both had been aggravated for 3 weeks. The leg pain was so severe that walking was limited to 5 minutes. The patient had been treated conservatively at a local clinic, but adequate treatment with NSAIDs, narcotics and physical therapy failed to improve his complaints. Accordingly, he was referred to us for detailed examination and management. On physical examination, the patient reported paresthesia in the L4, L5, and S1 dermatomes bilaterally and walking difficulty due to severe leg pain; visual analogue pain scores (VAS) 9. A neurological examination revealed decreased knee and ankle jerk, and weakness of right ankle in dorsiflexion; grade IV. He had no urinary dysfunction and a laboratory examination failed to reveal any abnormality.

Plain radiographs showed anterior slippage of L4 on L5 and L5 on S1, and magnetic resonance (MR) imaging of lumbar spine showed severe pseudoarthrosis with bilateral pars defect. He was diagnosed as having isthmic spondylolisthesis at L4-5 and L5-S1, and posterior lumbar

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interbody fusion was conducted on L4-5 and L5-S1 (Fig. 1). During the operation, severe adhesion was found around granulation tissues at the right L4 pars defect, and despite careful dissection and granulation tissue removal, inadvertent dural tearing occurred, which was repaired with a watertight dural closure. The patient recovered uneventfully from general anesthesia and his VAS pain score decreased from 9 pre-op to 3 immediately after his operation. The next day, he was able to walk independently and we removed the Hemovac drain at the operation site. However, on day 2 he developed headache and nausea, which were severe when he was upright, but minimal when supine. This led us to consider the possibility of cerebrospinal fluid leakage, and thus, he was restricted to bed rest. After time of bed rest, the severe headache disappeared, but four days after surgery he experienced diplopia during right gaze, which was caused by right-side palsy of the abducens nerve. No additional neurological abnormalities were observed and brain MRI revealed no cerebral infarction and intracranial hypotension, which characteristic features are diffuse meningeal enhancement, small ventricles, downward dis-

placement of brainstem and subdural fluid collection (Fig. 2). Under conservative treatment, the diplopia gradually disappeared and was completely resolved at 5 weeks post-op.

DISCUSSION

Although isolated abducens nerve palsy can be caused by a pontine infarct¹⁾, it is generally agreed that abducens nerve palsy is usually associated with a stretch or traction injury of the sixth nerve, caused by localized ischemia or a change in nerve position^{2,10)}. Two main circumstances lead to stretch or traction forces on the sixth nerve.

One concerns cerebrospinal fluid (CSF) leakage, such as, during lumbar puncture, spinal anesthesia, ventricular shunting for normal pressure hydrocephalus, and during surgery on a spinal cord tumor^{2,5,6,9,11,14)}. The most common side effect of CSF leakage is a post-dural puncture headache (PDPH), which commonly occurs within 12-24 hours of puncture. In addition to PDPH, abducens nerve palsy can also occur. It has been reported abducens nerve palsy after diagnostic lumbar puncture can be uni- or bilateral, and that it usually occurs 4-14 days after lumbar puncture and resolves completely after 4 weeks to 4 months⁹⁾. In our patient, inadvertent dural tearing occurred during operation due to severe adhesion, and abducens nerve palsy occurred 4 days after surgery. Although the precise pathogenesis of abducens nerve palsy after CSF leakage is uncertain, it is generally agreed that downward sagging of the brain due to a low CSF pressure produces headache and causes cranial nerve traction, which can lead to palsy⁶⁾. In a recent report by Nakagawa et al.¹⁰⁾, the authors described a patient who developed abducens nerve palsy after surgery for a spinal cord tumor at the C1/2 level. They speculated during reduction of the deviated spinal cord by decompression that the abducens nerve was probably subjected to some degrees of mechanical stress. In addition, brain shifting following CSF leakage at surgery was considered to be a cause of the palsy.

The other circumstance that leads to stretch or traction forces being applied to the sixth nerve involves



Fig. 1. Postoperative X-rays show posterior lumbar interbody fusion on L4-5, L5-S1.

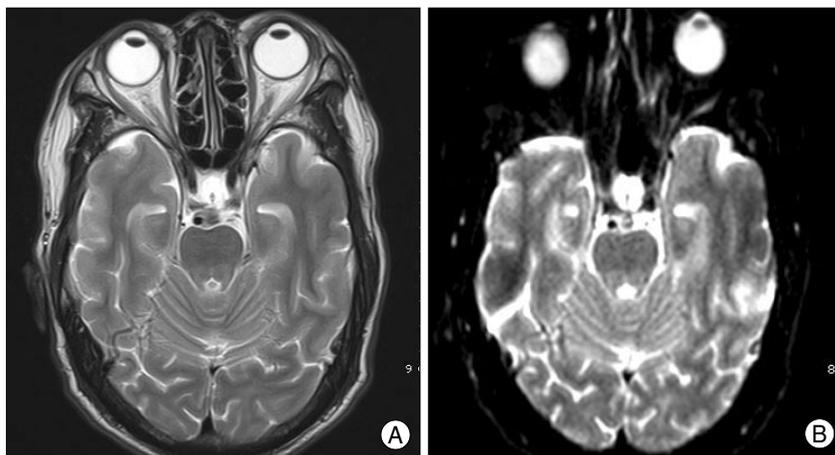


Fig. 2. Magnetic resonance images of the brain fail to reveal any brain stem infarct and intracranial hypotension after the development of abducens nerve palsy postoperatively. A : T2-weighted axial image. B : A diffusion weighted image.

traction methods, such as, halo-pelvic tractoin, halo-skeletal traction or Gardner-Wells tongs traction^{2,3,12,15}. Associations between cranial nerve injuries and various traction methods have been frequently described in the orthopedic and neurosurgical literature^{3,15}. Barsoum et al.² reported one case of diplopia due to abducens nerve palsy after applying only 5 lb of traction during spinal surgery using a Jackson table and Gardner-Wells tongs traction. Knowledge of the unique anatomy of the abducens nerve aids understanding of the obscure pathogenesis of abducens nerve palsy. The sixth nerve runs anteriorly and slightly laterally in the subarachnoid space of the posterior fossa to pierce the dura that is lateral to the dorsum sellae of the sphenoid bone. The nerve continues forward between the dura and the apex of the petrous temporal bone where it takes a sharp right-angled bend over the apex of the bone to enter the cavernous sinus. As the nerve crosses the bony ridge of the cavernous sinus at the petrosphenoidal junction, it is at risk of kinking when a force, such as, halo-traction is applied¹⁵. Furthermore, the sixth, ninth, tenth, and twelfth cranial nerves are considered to be the most vulnerable nerves to stretch injury because of their vertical or oblique course in the cranium¹². Anatomically, sole innervation of the lateral rectus muscle by the abducens nerve is also a risk factor for diplopia due to abducens nerve palsy^{2,10}. Jain⁷ found that the sixth cranial nerve can be formed by an aberrant root (found in 6% of 300 dissections), and thus, longitudinal distraction of the sixth cranial nerve due to downward distraction of the brain stem could cause it to kink, especially where aberrant roots exist.

To our knowledge, only two case reports of abducens nerve palsy during spinal surgery have been issued to date. One was of diplopia due to abducens nerve palsy after L3-L5 decompression with L2-L5 segmental instrumented fusion using a Jackson table and cranial traction², and the other case was of abducens nerve palsy after surgery for a spinal cord tumor at the C1/2 level¹⁰. Thus the presented case is the third report of this rare complication during spinal surgery.

Due to the rarity of abducens nerve palsy, its precise incidence and natural history are unknown, and optimal treatment methods are uncertain. Fortunately, it has been reported that in the majority of most patients with cranial nerve palsy, such nerve deficits tend to resolve spontaneously and completely¹⁰. Although a lumbar epidural blood patch (EBP) has been reported to be an effective treatment for a post-dural puncture headache¹³, the effectiveness of EBP in the management of abducens nerve palsy after a CSF leakage has not been determined. Dunbar et al.⁴ hypothesized that early EBP within 24 hours mini-

mizes the duration of the abducens nerve downward displacement and stretching, which reduces the likelihood of persistent palsy. However, in our patient, abducens nerve palsy after CSF leakage gradually disappeared and completely resolved at 5 weeks post-op without EBP, which prompted us to suggest that further study of the effectiveness of EBP for abducens nerve palsy will be needed.

CONCLUSION

Abducens nerve palsy is an extremely rare complication of spinal surgery. However, the present case demonstrates that abducens nerve palsy after spinal fusion surgery with inadvertent dural tearing can be successfully treated by conservative treatment without an epidural blood patch.

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