CASE REPORT

Transient paraparesis after anterior decompression in a patient with ossification of the cervical posterior longitudinal ligament

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Introduction

Although anterior decompression and fusion for cervical spondylotic myelopathy is very effective, there are some related complications, especially in patients with ossification of the posterior longitudinal ligament (OPLL) in the cervical spine, which is recognized as one of the causes of cervical myelopathy. Among these complications paraplegia, although rare, has a catastrophic outcome¹. This article reports a patient with OPLL in the cervical spine who developed a transient paraparesis after anterior decompression and fusion, and the related published reports are reviewed.

Case report

Twenty years previously, a 74-year-old man had experienced transient paraparesis for 2 hours after excessive flexion of his neck in an accident. With the help of his friends, he had presented to the authors within about half an hour. He had had hypoesthesia from the level of the umbilicus to the toes and in the upper extremities. Physical examination had shown motor weakness of the lower extremities (grade 0), and a positive Hoffmann sign in both upper extremities with no motor weakness. The Babinski reflex and straight leg raising tests were negative on both sides. MRI of the cervical spine revealed no obvious pathological changes. However, without any treatment, the muscular strength in his lower extremities had improved to grade 3 within two hours of the accident. In contrast, the numbness in his upper extremities had become more severe. As he had a cervical spinal cord injury without fracture or dislocation, decompression

laminectomy from C₅ to C₇ was performed, but no obvious compression of the spinal cord was observed. One year postoperatively, his sensation and motor function had improved to pre-accident levels.

In November 2009, the man returned because of motor weakness in the upper and lower extremities (grade 1 and grade 2, respectively), bowel dysfunction and hypesthesia in the upper extremities and below the level of the nipple, these symptoms having developed in the absence of any trauma. The Hoffmann sign and Babinski reflex were positive on both sides. Hyper-reflexia of the extremities was observed. CT of the cervical spine revealed OPLL of the cervical spine (from C₃ to C₇, especially at C₄–C₅) (Fig. 1a); MRI (Fig. 1b) of the cervical spine showed severe spinal cord compression at C₄–C₅ and high signal intensity change at the level of the C₅ vertebral body. Anterior decompression and fusion with titanium mesh and plate was performed at C₄–C₅ (Fig. 1c). About 2 min after the operation, the patient could not move his legs. With a provisional diagnosis of spinal cord compression by hematoma, emergency surgery was performed. However, no evidence of hematoma or other compressive factors was found. After the bone graft and plate had been put back, routine closure was performed. The patient was then delivered back to the ward and treated with methylprednisolone (MP, 30 mg/kg bolus followed by 5.4 mg/kg per hour for 23 hours)². Twenty minutes after the second operation, recovery of movement in the legs to preoperative levels was observed. One week later, the strength of the upper extremities had improved to grade 2. The other pathological symptoms and signs were still present, except that the Hoffmann sign on both sides was not obvious. Postoperative CT (Fig. 1d) showed sufficient decompression of the spinal canal at C₄–C₅.

Discussion

Surgical removal of a cervical ossified posterior longitudinal ligament via the anterior approach seems to be an

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Figure 1 (a) Preoperative CT sagittal reconstruction revealing OPLL of the cervical spine (from C₃ to C₇, especially at C₄–C₅); (b) Preoperative sagittal MRI demonstrating severe spinal cord compression at C₄–C₅ and a high signal intensity change at the level of the C₅ vertebral body; (c) Postoperative lateral radiographs showing anterior decompression and fusion with titanium mesh and a plate; (d) Postoperative CT sagittal reconstruction demonstrating sufficient decompression of the spinal canal at C₄–C₅.

appropriate surgical option, as it provides direct decompression and satisfactory results³, but it may cause unexpected complications⁴. Various complications, including cerebrospinal fluid leakage, nerve palsy and spinal cord injury, have been reported⁵. Among these complications, paraplegia is probably the most serious.

Although transient paraparesis after laminectomy or laminoplasty has been reported^{6–8}, it is not common after single-level anterior cervical surgery. The risk factors for transient paraparesis have not yet been elucidated.

Possible mechanism for transient paraparesis

Surgical insult to the spinal cord during an operation might be a cause of paraparesis¹, and any previous damage to the spinal cord might increase the risk of paraplegic complications⁹. The incidence of paraplegia caused by surgical treatment was reported to be 0.69% in an orthopaedic university hospital⁹. In this case, the patient's spinal cord had been traumatized and decompressed by laminectomy 20 years previously, which is a risk factor for OPLL¹⁰. OPLL makes surgery more difficult to perform, because the ossified mass tends to be adherent to the underlying dura mater or to replace the dura itself^{4,11,12}. Therefore, when an ossified mass is involved in a decompression operation, the risk of paraplegia is increased.

In addition, postoperative distortion of the spinal cord may occur at the level of the compression-decompression¹³, which can result in compression and ischemia of the spinal cord. If the injury is mild rather than serious, transient paraparesis may occur. Thus distortion of the spinal cord caused by surgery may be a reason for transient paraparesis.

Transient paraparesis can result from an intraspinal hematoma compressing the cervical spinal cord, which

tends to occur in patients with coagulopathies¹⁴. Though treatment for deep vein thrombosis in the left lower extremity had been given to this patient in October 2009, no evidence of hematoma was found in this case.

Some authors^{15,16} believe that concussion of the cervical spinal cord can occur with minor trauma. In this case, when the ossified posterior longitudinal ligament was removed or bone graft was inserted into the decompressed zone, concussion of the cervical spinal cord may have resulted, which could have lead to a transient paraparesis.

We believe that change in size of the spinal canal is another risk factor for transient paraparesis. During the operation, the cervical spine was in an extension position, which makes the spinal canal narrower than it is in the neutral position. The narrower spinal canal could increase any ischemia, which could lead to paraparesis. On completion of the operation, the cervical spine was put back into a neutral position and blood supply would have been restored. Thus the patient presented paraparesis immediately postoperatively, but a short time later, the paraparesis had disappeared following restoration of the blood supply.

Handling of this neurological complication

There are three main types of treatment for this neurological complication: (i) conservative management, for example, by treating with MP, in cases with early progressive improvement; (ii) emergency surgical decompression in cases with acute deterioration and severe neurological deficit, because early decompression can prevent progression into permanent neurological deficits, such as destruction of the anterior horn cells, nuclear disintegration, perikaryal swelling, and infarction of the spinal cord; and (iii) percutaneous drainage in cases with extensive dorsal

hematomas which are difficult to deal with by anterior surgery¹⁷, and where posterior surgery would cause additional damage to the skeletal musculature.

Preventive measures

Although the exact cause of transient paraparesis is unknown, we believe some preventive measures are crucial in order to avoid devastating results. Firstly, the operation should be performed meticulously, achieving the goal of complete decompression while not insulting the spinal cord. Secondly, it is recommended that the degree of extension of the cervical spine in the supine position be minimized during the procedure in patients with cervical spinal stenosis or OPLL in order to promote an adequate blood supply to the spinal cord. Last but not least, more attention should be paid to the responses of patients during surgery, as these are helpful in determining whether each step is safe or not.

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References

1. Delank KS, Delank HW, König DP, *et al.* Iatrogenic paraplegia in spinal surgery. *Arch Orthop Trauma Surg*, 2005, 125: 33–41.
2. Bracken MB, Holford TR. Effects of timing of methylprednisolone or naloxone administration on recovery of segmental and long-tract neurological function in NASCIS 2. *J Neurosurg*, 1993, 79: 500–507.
3. Mizuno J, Nakagawa H. Ossified posterior longitudinal ligament: management strategies and outcomes. *Spine J*, 2006, 6 (6 Suppl.): S282–S288.
4. Min JH, Jang JS, Lee SH. Significance of the double-layer and single-layer signs in the ossification of the posterior longitudinal ligament of the cervical spine. *J Neurosurg Spine*, 2007, 6: 309–312.
5. Mizuno J, Nakagawa H. Outcome analysis of anterior decompressive surgery and fusion for cervical ossification of the posterior longitudinal ligament: report of 107 cases and review of the literature. *Neurosurg Focus*, 2001, 10: E6.
6. Yamazaki M, Okawa A, Koda M, *et al.* Transient paraparesis after laminectomy for thoracic myelopathy due to ossification of the posterior longitudinal ligament: a case report. *Spine*, 2005, 30: E343–E346.
7. Tribus CB. Transient paraparesis: a complication of the surgical management of Scheuermann's kyphosis secondary to thoracic stenosis. *Spine*, 2001, 26: 1086–1089.
8. Lee KS, Shim JJ, Doh JW, *et al.* Transient paraparesis after laminectomy in a patient with multi-level ossification of the spinal ligament. *J Korean Med Sci*, 2004, 19: 624–626.
9. Bacher T, Schiltenswolf M, Niethard FU, *et al.* The risk of paraplegia through medical treatment. *Spinal Cord*, 1999, 37: 172–182.
10. Hori T, Kawaguchi Y, Kimura T. How does the ossification area of the posterior longitudinal ligament thicken following cervical laminoplasty? *Spine*, 2007, 32: E551–E556.
11. Epstein NE. Evaluation and treatment of clinical instability associated with pseudoarthrosis after anterior cervical surgery for ossification of the posterior longitudinal ligament. *Surg Neurol*, 1998, 49: 246–252.
12. Mizuno J, Nakagawa H, Matsuo N, *et al.* Dural ossification associated with cervical ossification of the posterior longitudinal ligament: frequency of dural ossification and comparison of neuroimaging modalities in ability to identify the disease. *J Neurosurg Spine*, 2005, 2: 425–430.
13. Chang UK, Choe WJ, Chung CK, *et al.* Surgical treatment for thoracic spinal stenosis. *Spinal Cord*, 2001, 39: 362–369.
14. Hentschel SJ, Woolfenden AR, Fairholm DJ. Resolution of spontaneous spinal epidural hematoma without surgery: report of two cases. *Spine*, 2001, 26: E525–E527.
15. Yoo DS, Lee SB, Huh PW, *et al.* Spinal cord injury in cervical spinal stenosis by minor trauma. *World Neurosurg*, 2010, 73: 50–52.
16. Sharma S, Singh M, Wani IH, *et al.* Adult spinal cord injury without radiographic abnormalities (SCIWORA): clinical and radiological correlations. *J Clin Med Res*, 2009, 1: 165–172.
17. Kyriakides AE, Lalam RK, El Masry WS. Acute spontaneous spinal subdural hematoma presenting as paraplegia: a rare case. *Spine*, 2007, 32: E619–E622.