Resolution of Severe Cervicogenic Headache after Cervical Open-Door Laminoplasty

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Abstract

The optimal treatment strategy for cervicogenic headache (CeH) remains controversial, possibly because the pathophysiology of this disease entity is unclear. The present study describes a case of alleviation of severe CeH that was alleviated after cervical open-door laminoplasty and reviews magnetic resonance imaging (MRI) data from a series of patients with CeH. In our case study, a 63-year-old male with severe headache underwent cervical open-door laminoplasty and his headache resolved postoperatively. In our MRI review, since preoperative MRI showed moderate, not severe, compression of the spinal cord by the surrounding tissues (bones, discs, and ligaments), the relationship between the degree of cervical spondylosis and headache was analyzed in patients with cervical spondylosis who were identified between November 2005 and December 2006 in the Department of Neurosurgery of our hospital. MRI data was compared between patients with and without headache. The number of cervical spinal levels in which there was either moderate or severe compression was significantly greater in the group without headache (at least 4 levels) than in the group with headache (at most 3 levels). All patients with pain who subsequently underwent open-door laminoplasty experienced alleviation of their symptoms. These data suggest that moderate cervical spondylosis may result in CeH and that cervical open-door laminectomy may be an effective therapeutic modality for treating this phenomenon.

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Key words
cervical spondylosis, cervicogenic headache, laminoplasty, pain

Introduction

The pathophysiology of and diagnostic criteria and optimal treatment strategy for cervicogenic headache (CeH) remain controversial. Various treatment modalities have been attempted for symptomatic relief of CeH, including drugs, anesthetic block, nerve stimulation, botulinum toxin injection, and surgery. Although more invasive than other treatment options, surgery has produced long-term and definite benefits for patients with CeH who are not responsive to any other physical or drug therapy. However, the indications for surgical management of CeH have not been defined. The present report describes a case of a patient with severe CeH and moderate cervical spondylosis, who experienced marked symptomatic relief following cervical open-door laminoplasty. Potential indications for the surgical management of CeH are then discussed using an analysis of magnetic resonance imaging (MRI) data from patients with cervical spondylosis.

Patients and results

[Patient 1]

A 63-year-old male experienced, the onset of occipital pulsatile headache. MRI demonstrated no brain lesions,
but was notable for moderate cervical spondylosis (Fig. 1 a). He was an avid trap shooter, and prior to this event, had practiced once a week. Three months later, the patient experienced onset of severe syncope and retroocular headache, which deteriorated further following dorsiflexion of the neck. Triptan therapy was able to produce only transient relief, and other drugs including antidepressant drug such as Paxil were not effective. X-ray examination did not show any instability of cervical bone. The patient did not want to use neck collar before and after surgery. Anesthetic blocks of 3 ml of 1% xylocaine with 2 mg of decadron for the left atlantoaxial joint was effective for only one or two hours. As a result of intense pain by neck movement, the patient was unable to walk and was essentially bed-bound. Thus, we diagnosed his headache as CеH\(^{110}\). Actually, MRI showed moderate cervical spondylosis. Despite the fact that he did not have peripheral symptoms, cervical open-door laminoplasty was elected at the strong preference of the patient. Following surgery, the patient experienced marked improvement in pain. In addition, he had no other episodes of syncope.

1 Cervical open-door laminoplasty

Data from preoperative computerized tomography (CT) scan of the C3 to C7 spine were transferred to a Stealth Station\(^{111}\) navigation system (Sofamor Danek Surgical Navigation Technologies Division, Osaka, Japan) using magneto-optical discs. The patient’s head was fixed at a neutral to a slightly flexed position. A midline skin incision was made from the spinous processes of C3 to C7, and dissection of the paravertebral muscles was performed from the lamina of C4 to C6. After the laminae of C3 to C6 were exposed at both sides, they were cut at the lateral boundary with a high-speed burr. The burr left a thin cortical layer of the right lamina, which functioned as a hinge, and the left lamina was excised completely under the guidance of a Stealth Station\(^{111}\) navigation system in order to open the lamina as widely and accurately as possible. To avoid injuring underlying structures during the excision of the lamina, a CUSA (cavitron ultrasonic surgical aspirator) for bone resection (M & M, Tokyo, Japan) was used for complete laminectomy just after the small complete excision of the left lamina. After an en bloc elevation of the lamina of C4 to C6 lamina, a dome-like resection of the inferior part of the C7 lamina, which was compressing the spinal cord, was performed using the CUSA for bone resection. The lamina was fixed at the open side using a titan plate with six holes (Rolentz, Medical U & A, Tokyo, Japan) from C4 to C6 (Fig. 1 b), and the muscle and skin were closed tightly. Postoperative MRI revealed the successful alleviation of the spinal cord compression caused by the surrounding tissues (bones, discs and ligaments) at the C4 to C7 levels (Fig. 1 c).
Table  Clinical data for cervical spondylosis patients with or without headache

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H/A: headache, +: severe headache that could not be relieved by drugs, +: moderate headache that could be relieved by drugs, Surgery +: cervical laminoplasty. Improvement of H/A: headache improved after surgery. C+: cervical cord was severely compressed and distorted by bones, discs, or ligaments at the neutral position, C+: cervical cord was in contact with bones, discs or ligaments at the neutral position and possibly compressed by them at the flexion or extension position. Sensory symptoms: hypesthesia, dysesthesia, paresthesia in upper or lower extremities. Motor symptoms: weakness of motor function in upper or lower extremities.

Fig. 2
a-c: MRI (sagittal view) displays relatively moderate spinal cord compression by the surrounding tissues (bones, discs, or ligaments) in patient 2 (a), patient 4 (b), and patient 5 (c) with cervical spondylosis and headache. d-f: MRI (sagittal view) displays severe spinal cord compression by the surrounding tissues in patient 10 (d), patient 12 (e) and patient 13 (f) with cervical spondylosis but without pain.
2 Relationship between the degree of cervical spondylosis and headache

Although patient 1 had only moderate compression of the spinal cord by surrounding tissues, the same patient had severe headache. The most likely etiology of this headache was the spondylosis, as his symptoms resolved immediately and completely after surgery. Therefore, the relationship between the degree of cervical spondylosis and headache was analyzed in a series of patients with cervical spondylosis as diagnosed by MRI from November 2005 to December 2006 in the Department of Neurosurgery of our hospital. MRI data were compared between two groups of patients: those with headache (patients 1 to 9) and those without any pain in the head, shoulders, or hands (patients 10 to 14) (Table, Fig. 2). Patients with shoulder or hand pain without headache were excluded from study. Surgical indication for patients with cervical spondylosis was that they complain of motor symptoms, or pain in their neck, head or extremities, which could not be controlled by medication. The number of cervical spinal levels in which there was either moderate or severe compression was significantly greater in the group without headache (at least 4 levels) than in those with headache (at most 3 levels) (Table, Fig. 2 a, b). All patients with pain who subsequently underwent open-door laminoplasty experienced alleviation of their symptoms (Table).

Discussion

The present study demonstrated that severe headache refractory to drug therapy and anesthetic block in a patient with cervical spondylosis was markedly relieved by cervical open-door laminoplasty. This was not due to neck fixation with a neck collar, because the patient refused to use a neck collar two days after surgery. CeH is a syndrome characterized by chronic hemicranial pain that is referred to the head from the neck, and anesthetic blockade is usually effective. In this case, anesthetic blockade for the left atlantoaxial joint was transiently effective at first, suggesting that this was possibly CeH, not tension headache, since tension headache is usually bilateral, and does not prohibit activities. In addition, the most important evidence for CeH in this case is the relief of headache after surgery. However, it would possibly be more convincing if we could obtain an MRI axial image to detect the lesion causing the pain, which would occur due to the compression of the spinal cord or nerves by either the flexion or extension movement of the neck. Moreover, it would be surprising that CeH has been diagnosed relatively frequently in our hospital. This might possibly be due to our diagnostic policy whereby almost all patients with headache undergo neck MRI. Since the fixation of neck by neck collar did not relieve his pain, the headache of patient 1’s headache was not possibly induced by instability of the atlantoaxial complex. These results suggest that the anesthetic blockade for the atlantoaxial joint was effective possibly due to the anesthetics infiltration to the C2 or major occipital nerve. Further study would be required to analyze the mechanism of pain in this case.

In the absence of motor or sensory symptoms and with only relatively moderate compression of the spinal cord (Fig. 1), most neurosurgeons are hesitant to recommend surgery. However, in the present case, the patient’s pain was debilitating, and the patient was eager to proceed with surgery despite the inherent risks. This case illustrates that indications for the surgical management of CeH may be different from those typically used for patients with cervical spondylosis. For example, the degree of cervical spondylosis in patients with CeH was less than that seen in patients without pain complications (Table, Fig. 2). Thus, debilitating pain that is not responsive to medical therapy may be an acceptable indication for surgical management of patients with cervical spondylosis and CeH. In this case, patient 1 was surprised by the good result he obtained after surgery, because we had told him that the possibility of a good result was not so high, and he therefore did not expect it before surgery. Thus, we believe that this was not a placebo effect. In addition, patient 2 and 3’s severe headaches were also relieved after surgery, although their indication for surgery was for sensory or motor symptoms. Therefore, prospective study would be required to prove this surgical indication for severe headache.

Prior groups have utilized ventral and dorsal decompressive surgery for the treatment of CeH10,11. Torbjorn et al. reported that half of the patients that underwent surgery reported long-term relief of symptoms11, while Jansen10 stated that 80% of surgically treated patients experienced favorable results. In the case of patient 1, we decided to perform a dorsal approach, since there was spi-
nal canal stenosis at three levels (C4 to C6), and the result of his surgery was good. Regardless, further research is needed to clarify whether the dorsal or ventral approach is the optimal strategy for surgical management as well as to determine which radiographic features on MRI suggest a good prognosis in relation to surgery. In addition, long-term postoperative follow-up showed that headache improved in around 70% of patients who underwent decompressive neck surgery including both dorsal and ventral approaches. We need to evaluate which approach shows better improvement of headache by long-term follow-up.

In the present study, CeH was associated with moderate but not severe spinal cord compression, and patients who underwent surgery experienced symptomatic relief (Table). Therefore, moderate cervical spondylosis and severe headache that is not relieved by other less invasive therapy may be a good indication for surgical management.

The pathophysiology underlying CeH remains unclear, and it seems difficult to explain a good plausible scientific basis for a good surgical outcome. However, some studies suggest that compression or irritation of nociceptively innervated tissues (e.g., disc, ligament, facet joint capsule, nerve root and dura) may trigger the pain of CeH. Then, why would moderate degenerative spondylosis produce headaches more so than severe forms of spondylosis? This would possibly be due to the mechanism whereby the irritation of nociceptively innervated tissues may be stronger when spinal cord compression is only moderate rather than severe, possibly because moderate spinal cord compression leads to large movement of nociceptively innervated tissues. Indeed, the ample space around the upper cervical and medulla in patient 1 could result in large movements of those tissues, thereby leading to irritation of the upper cervical nerve root (Fig. 1). Thus, the level of spinal cord compression would be lower than C4 in all of the cases in this study. Similarly, moderate spinal cord compression could result in abnormal movement of the cervical cord and secondary irritation of the surrounding tissues and CeH during neck movement. This might indicate that every patient who has severe spinal canal stenosis goes through a phase that produces headaches. Since headache improve or deteriorate repeatedly for a long period of time in some of the patients with headache, this might be true, but further study is needed to prove this hypothesis.

In conclusion, these data suggest that moderate cervical spondylosis may result in CeH and that cervical open-door laminectomy may be an effective therapeutic modality for treating this phenomenon.

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