Remote Cerebellar Hemorrhage After Foramen Magnum Decompression Surgery for Chiari I Malformation

—Case Report—

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Abstract

A 47-year-old woman underwent decompressive suboccipital craniectomy and C1 laminectomy with duroplasty in the prone position for Chiari malformation type I and syringomyelia. The arachnoid membrane was not injured. Intraoperative echography showed good enlargement of the subarachnoid space. No closed subcutaneous drain was used. The patient complained of repeated nausea and vomiting 3 hours after the operation, and computed tomography revealed remote cerebellar hemorrhage on postoperative day 1. The cerebellar hemorrhage was treated conservatively, and the symptoms continued only for 3 days after surgery. Dural opening with rapid loss of cerebrospinal fluid (CSF) has occurred in every reported case of remote cerebellar hemorrhage complicating intracranial and spinal procedures. Loss of CSF is the main pathogenesis of this condition. In our case, the most probable pathomechanism seems to involve stretching of the infratentorial cerebellar bridging veins due to cerebellar sagging because of dural opening in the prone position and drop in CSF pressure. Such a complication is rare but should be considered after foramen magnum decompression surgery if the patient shows unusual symptoms of repeated vomiting.

Key words: cerebellar hemorrhage, Chiari malformation, foramen magnum decompression, complication, cerebellar sagging

Introduction

Remote cerebellar hemorrhage occasionally occurs distant from the surgical site after cranial surgery and may be a life-threatening complication, as death occurs in 10–15% of cases. The incidence of remote cerebellar hemorrhage associated with craniotomy is 0.2–4.9%.2,7,8 Recently, spinal surgery has also been reported to cause remote cerebellar hemorrhage.2,4 The pathophysiological mechanism of remote cerebellar hemorrhage is unknown, but intraoperative or postoperative loss of cerebrospinal fluid (CSF) seems to be involved. We report a case of remote cerebellar hemorrhage following foramen magnum decompression (FMD) for Chiari type I malformation.

Case Report

A 47-year-old woman presented with occipital headache and numbness of the right hand persisting for 2 months. Cervical magnetic resonance (MR) imaging revealed tonsillar herniation and associated syringomyelia (Fig. 1). She underwent FMD in the prone position with the head in neutral position. After suboccipital craniectomy (approximately 3 × 3 cm), the dura was opened with a Y-shaped incision. The arachnoid membrane was intact and no CSF leakage was identified. Intraoperative echography showed enlargement of the subarachnoid space at the craniovertebral junction (Fig. 2). The dura was watertightly patched with expanded polytetrafluoroethylene. No closed subcutaneous suction drain was placed. Three hours after the
Remote cerebellar hemorrhage after surgery for Chiari malformation

Intraoperative photograph after dural opening showing the intact arachnoid membrane and downward displacement of the cerebellar tonsils (A). Intraoperative echogram after dural opening disclosing adequate enlargement of the subarachnoid space at the craniovertebral junction (B).

Postoperative computed tomography scans of the head and craniovertebral junction one day after foramen magnum decompression surgery revealing left cerebellar hemorrhage with a streaky curvilinear bleeding pattern (A), and hematoma in the cerebellar sulci facing the tentorium (B, arrow).

Brain MR imaging and MR angiography did not disclose any vascular lesions in the cerebellum.

Discussion

Remote cerebellar hemorrhage may occur after cranial surgeries with draining of larger volumes of CSF, such as aneurysm surgery or temporal lobectomy, and after spinal surgeries with opening of the dura. This phenomenon was first described in 1981, after a cervical laminectomy in which the dura was opened widely and the dentate ligaments were sectioned with the patient in a sitting position. Most recently, a patient developed cerebellar hemorrhage after removal of thoracic ossification of the yellow ligament with dural tear and persistent CSF leakage.

An important common feature of these previous reported cases is the intradural nature of the procedures, with consequent loss of CSF. There is a growing consensus that hemorrhagic venous infarction is the underlying cause of most cases of remote cerebellar hemorrhage. The most likely pathophysiological cause is cerebellar sag resulting from CSF hypovolemia. The most probable cause for development of the hemorrhage was drop in CSF pressure. Downward cerebellar displacement or sag resulting from intraoperative loss of CSF possibly causes transient stretch occlusion of the superior cerebellar veins draining cephalad into the deep venous system, causing intracerebellar hemorrhage in patients with insufficient collateral venous drainage.

In the present case, brain CT demonstrated a streaky bleeding pattern in the superior aspect of the cerebellum, or ‘zebra sign,’ indicating a characteristic pattern of remote cerebellar hemorrhage. The hemorrhage occurred distant from the craniectomy site. This pattern of cerebellar hemorrhage on postoperative CT strongly suggests similar mechanisms for the remote cerebellar hemorrhage in our patient. The absence of CSF leakage during the FMD surgery supports the hypothesis that development of remote cerebellar hemorrhage may be caused by a drop in CSF pressure due to dural opening and cerebellar sagging associated with the prone position. Variations in the venous drainage of the posterior fossa might influence the pathomechanism because the occipital sinus was cut during opening of the dura at the craniovertebral junction.

Remote cerebellar hemorrhage is extremely rare in FMD surgery for Chiari type I malformation, but should be considered if the patient complains of severe headache, repeated vomiting, or unexplained neurological deterioration such as decreased level of consciousness. Most patients with remote cerebellar hemorrhage can be managed conservatively, but large hematomas and acute hydrocephalus require surgical treatment. Early diagnosis is important for the management of remote cerebellar hemorrhage after cranial surgeries including FMD.

References

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