

Original Article

Remote cerebellar hemorrhage after microsurgical clipping of intracranial aneurysms: diagnosis and treatment a review of 13 cases

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Abstract: Objective: Case reports and retrospective review of remote cerebellar hemorrhage after microsurgical clipping of intracranial aneurysms. Methods: The medical and pathologic records were reviewed of 13 patients with remote cerebellar hemorrhage occurred after microsurgical clipping of intracranial aneurysms procedure during 2013-2014. Clinical symptoms, pathological mechanisms, treatments, and prognosis were analyzed. Results: Of the 13 patients, 10 patients had frequent headaches, 3 patients had staring spells, 5 patients had omitting, 2 patients had decreased muscular strength in the unilateral limb, 3 patients had coma, and 2 patients had delayed recovery from general anesthesia. Of the 13 patients, bilateral cerebellar hemorrhage occurred in 6 patients and unilateral cerebellar hemorrhage in 7 patients. 3 patients had coma caused by heavy bleeding (> 10 ml) and underwent a second surgery for evacuating intracranial hematoma, removing partial skull to relieve pressure, and external ventricular drainage. All blood clots were absorbed in 10 patients who received conservative treatment. All 13 patients who received cerebrospinal fluid drainage treatment were successfully discharged after active treatment. Conclusion: Headache, omitting, delayed recovery from general anesthesia, decreased level of consciousness, and decreased limb muscle strength are common symptoms of remote cerebellar hemorrhage occurring after microsurgical clipping of intracranial aneurysms. Once remote cerebellar hemorrhage occurred, patients would benefit from timely treatment with reduced mortality and improved prognosis. Sudden changes of intracranial pressure in surgery may induce remote cerebellar hemorrhage after microsurgical clipping of intracranial aneurysms.

Keywords: Aneurysms, remote cerebellar hemorrhage, clinical symptom, pathological mechanism, treatment

Introduction

Remote cerebellar hemorrhage (RCH) is defined of cerebellar hemorrhage after supratentorial craniotomy or spinal surgery. RCH is rare, with a incidence less than 0.6% [1]. It normally occurred after aneurysm clipping and temporal lobe epilepsy surgeries [2]. In this study, we retrospectively collected the medical records of 13 patients with remote cerebellar hemorrhage occurred after microsurgical clipping of intracranial aneurysms and analyzed the clinical symptoms, pathological mechanisms, treatment and prognosis of this disease.

Materials and methods

Clinical data

The medical records were collected of 13 patients with remote cerebellar hemorrhage after microsurgical clipping of intracranial aneurysms in department of neurosurgery, Renmin Hospital, Wuhan University, China between September 2013 and December 2014. There were 6 males and 7 females, ranging in age from 42 to 67 years old (averaged 57 years old). The study protocol was approved by the Ethics Committee of Wuhan University, China. Written

informed consent was obtained from each patient or his/her guardians.

Preoperative preparation

Before surgery, all patients underwent CT, digital subtraction angiography, and/or CT angiography. Intracranial aneurysms were diagnosed by radiologists and experienced neurosurgeon. Intracranial hemorrhage was classified using the Fisher grade and the Hunt and Hess scale. Simultaneously digital subtraction angiography and/or CT angiography findings were analyzed. Coagulation profile, liver, and renal function tests were performed. The optimal surgical methods were determined according to patient's general conditions.

Microsurgery

All operations were performed by experienced physicians in microsurgical clipping of intracranial aneurysms. Microsurgical clipping was accomplished through the pterion approach. Combination of dehydration and cerebrospinal fluid drainage was used to relieve the intracranial pressure. Intraoperative blood pressure was controlled below 120/70 mmHg.

Postoperative management

After microsurgery, patient's blood pressure was controlled below 130/80 mmHg. Within the first 24 hours post microsurgery, patients were co-managed by anesthetists, neurosurgeons and intensivists. Routine skull CT scan was performed within the first 24 hours post microsurgery and in any case that patient conditions were unstable. When patient conditions were stable, one more skull CT scan was done 7 days post microsurgery. Intracranial hemorrhage was evaluated by at least one neurosurgeon and one radiologist by consensus. According to hemorrhage volume, dehydration (Mannitol 250 mL/q6h + Furosemide 20 mg/q6 + Glycerol + Fructose 250 mL/12 h) and symptomatic treatment were given. For patients with heavy intracranial bleeding, secondary surgery was performed including evacuating intracranial hematoma, removing partial skull to relieve pressure, and external ventricular drainage.

Results

Of the 13 patients had remote cerebellar hemorrhage post microsurgical clipping of intracra-

nial aneurysms, middle cerebral artery aneurysm was found in 5 patients, anterior communicating aneurysm in 5 patients, posterior communicating aneurysm in 2 patients, and ophthalmic artery aneurysm in 1 patient. The occurrence of intracranial hemorrhage was classified by the Fisher Grade into I (n = 2), II (n = 3), III (n = 7), and IV (n = 1), and its severity was classified by the Hunt-Hess scale into 0 (n = 1), I (n = 2), II (n = 2), III (n = 7), IV (n = 1) and V (n = 0). Through CT angiography and/or digital subtraction angiography, no abnormal cerebellar vessels, coagulation disorder or use of anticoagulant therapy was observed in 13 patients. Postoperative symptoms included headache (n = 10), staring spells (n = 3), omitting (n = 5), decreased muscular strength in unilateral limb (n = 2), coma (n = 3) and delayed recovery from general anesthesia (n = 2). Among the 13 patients, bilateral cerebellar hemorrhage occurred in 6 patients and unilateral cerebellar hemorrhage in the other 7 patients. 3 patients experienced coma caused by heavy bleeding (> 10 mL) and underwent a secondary surgery for evacuating intracranial hematoma, removing partial skull to relieve pressure, and external ventricular drainage. All blood clots were absorbed in 10 patients who received conservative treatment. All 13 patients were successfully discharged after active treatment.

Discussion

Remote cerebellar hemorrhage occurring post supratentorial craniotomy or spinal surgery is rare and approximately only 100 cases have been reported [2-4]. Moreover, there are few reports on remote cerebellar hemorrhage after microsurgical clipping of intracranial aneurysms in China. In this study, we reported 13 cases of cerebellar hemorrhage occurring after microsurgical clipping of intracranial aneurysms, aiming to more clearly understand this disease in China.

Clinical symptoms

The commonest clinical symptom of the included patients is headache (77.2%), followed by decreased level of consciousness. Zhang et al. [5] reported that decreased level of consciousness or coma is the commonest clinical symptom, followed by delayed recovery from general anesthesia. This discrepancy occurs possibly because meningioma patients were included in Zhang's study, while aneurysm patients were

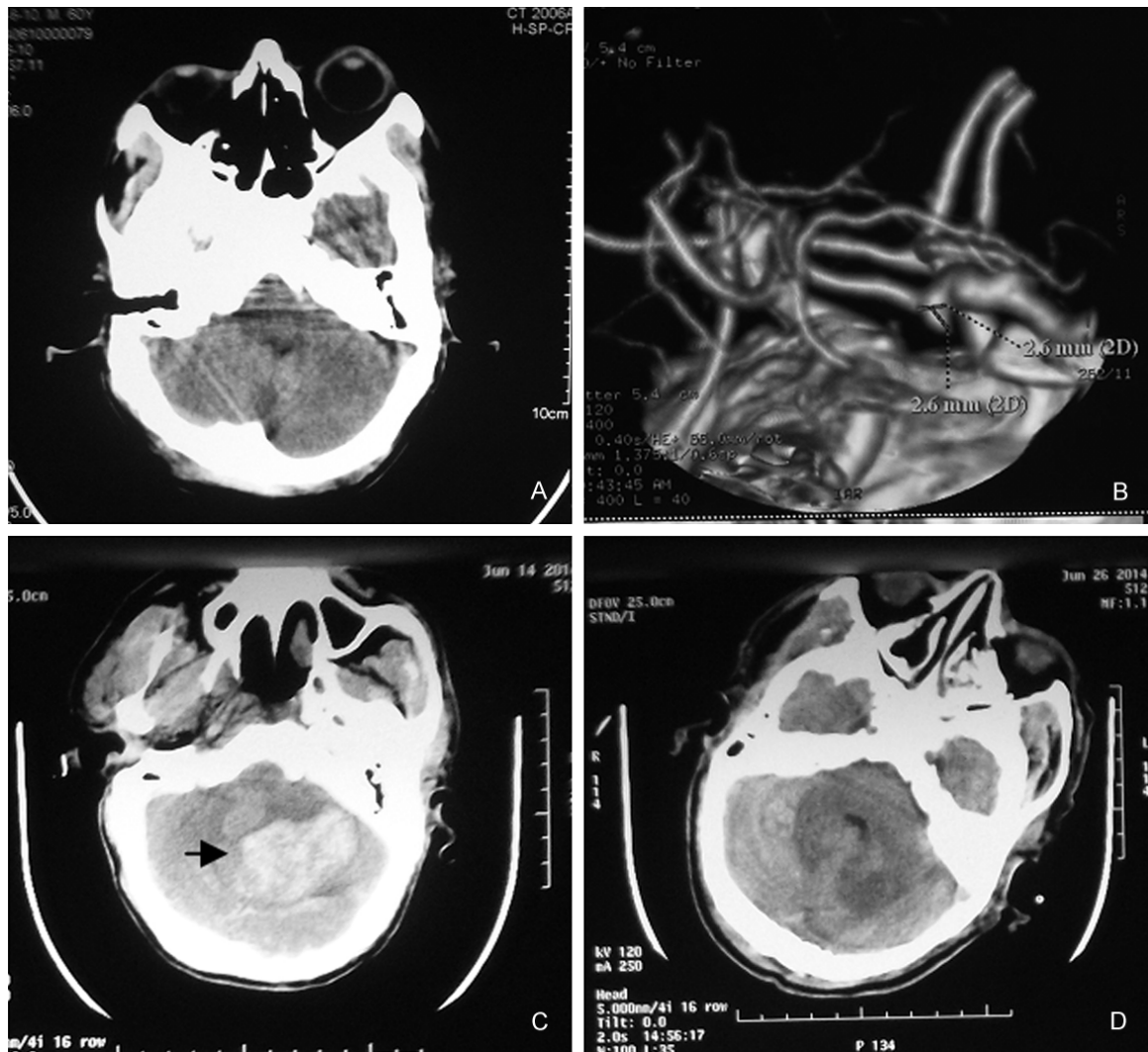


Figure 1. Patient 1. A. Before microsurgical clipping of intracranial aneurysms, no cerebellar hemorrhage was present on skull CT scan; B. CT angiography shows the presence of aneurysm of the middle cerebral artery; C. Cerebellar hemorrhage is present on postoperative skull CT scan; D. Hematoma was basically absorbed after treatment.

included in our study. In addition to headache and decreased level of consciousness, omitting and decreased muscle strength in unilateral limb should be paid more attention.

Imaging features

Remote cerebellar hemorrhage typically presents high-density shadow of cerebellar surface groove or cerebellar lobe fissure on CT scans, named “zebra stripe sign” [2, 3]. Bilateral intracranial hemorrhage accounts for 53.3% while unilateral intracranial hemorrhage for 46.5% [4, 6]. Same distribution is found in our study that bilateral intracranial hemorrhage was observed in 6 patients and unilateral intracra-

nial hemorrhage in 7 patients. Remote cerebellar hemorrhage often occurs on the upper surface of the cerebellum. Bleeding in the cerebellar parenchyma is often observed, but under most circumstances, superficial cerebellar parenchyma is involved. Heavy intracranial bleeding and hematoma can cause space-occupying lesion (**Figure 1C**), leading to compression of the fourth ventricle and finally causing obstructive hydrocephalus. There is evidence that cerebellar vermis hemorrhage accounts for 9% of all cerebellar hemorrhages, but hemorrhage of the subarachnoid cavity, cerebellar lobe or the mixed, in particular simple cerebellar vermis is very rare. Remote It's not hard to diagnose cerebellar hemorrhage: typical CT findings is high-

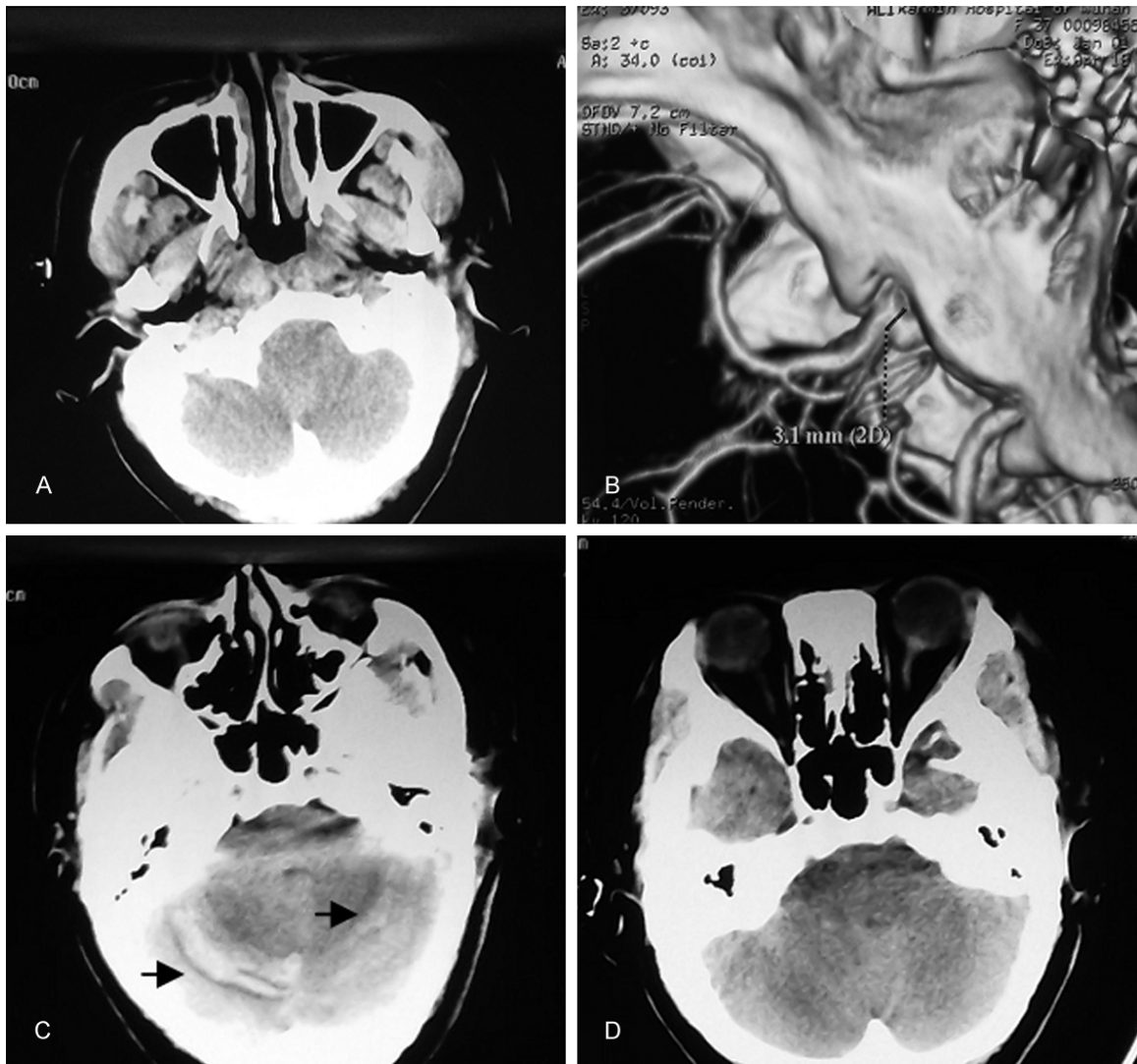


Figure 2. Patient 2. A. Before microsurgical clipping of intracranial aneurysms, no cerebellar hemorrhage was present on skull CT scan; B. CT angiography shows the presence of ophthalmic artery aneurysm; C. Bilateral cerebellar hemorrhage is present on postoperative skull CT scan; D. Hematoma was basically absorbed after treatment.

density shadows of unilateral or bilateral cerebellar surface groove or cerebellar lobe fissure, i.e., “zebra stripe sign” (**Figure 2C**), and disease history includes craniotomy. MRI imaging is required in case of difficultly diagnosed remote cerebellar hemorrhage.

Treatments

Headache, delayed recovery from general anesthesia, and decreased level of consciousness should be paid more attention to. CT examination should be performed when necessary. For patients presented with dyskinesia, ataxia, physical sign change or decreased level of consciousness with unknown reasons, post-

operative 6-12 hours is an appropriate time window for skull CT examination to monitor intracranial circumstance. For patients without any symptoms, skull CT examination on 1-2 days after surgery is better. Based on our experience, skull CT examination should be immediately performed once patients showed change of consciousness level, and within postoperative 24 hours followed by once every 7 days for patients without any symptoms. Remote cerebellar hemorrhage after microsurgical clipping of intracranial aneurysms should be paid more attention to. When coma or heavy bleeding (> 10 ml) occurs, active surgery is necessary, and simultaneous large drug does dehydration should be performed to decrease intracranial

pressure and to avoid brain hernia. Skull CT scan is performed at any time to prevent additional hemorrhage and hematoma-caused brain hernia.

Pathological mechanism

The pathological mechanism underlying remote cerebellar hemorrhage remains unclear. Some research show that brain tissue displacement may cause cerebral vessel drag and laceration, leading to cerebellar hemorrhage [7, 8]. Spinal fluid leaks lead to cerebellar ptosis, transient occlusion of the venous bridge on the surface of posterior cranial fossa and finally ischemic cerebellar infarction [9, 10]. Small vessels are easily lacerated during vascular reperfusion at low perfusion, which is also considered a cause of cerebellar hemorrhage [5]. Intracranial pressure change is generally considered as the pathological mechanism of remote cerebellar hemorrhage, which means a rapid decrease or increase of intracranial pressure causes brain tissue displacement and cerebral vessel dragging and laceration. In this study, cerebrospinal fluid release for decreasing intracranial pressure was performed during microsurgical clipping of intracranial aneurysms in all 13 included patients to provide operation space. Therefore, our results support the theory of intracranial pressure change, i.e., intraoperative and postoperative intracranial pressure change (intraoperative intracranial pressure decreases and postoperative intracranial pressure relatively increases) lead to transient occlusion of venous bridge on the surface of posterior cranial fossa, finally lead to high-density shadow of cerebellar surface groove or cerebellar lobe fissure on CT scans. Moreover, no obvious space-occupying effect was observed in 10 remote cerebellar hemorrhage patients after microsurgical clipping of intracranial aneurysms, and skull CT scan shows no changes in size and morphology of hemorrhagic focus. These imaging findings confirmed the venous hemorrhage.

Prognosis

The mortality of remote cerebellar hemorrhage is reported about 10-15%. All patients survived in this study. We think early detection and treatment of remote cerebellar hemorrhage contributed to this low mortality. We pay extreme attention to perioperative treatment. After

microsurgical clipping of intracranial aneurysms, patients are returned to VIP ward to closely monitor changes in consciousness level and pupils. Skull CT examination is performed when necessary. In this study, 3 patients had heavy bleeding with sudden loss of consciousness. Skull CT examination showed that the amount of cerebellar bleeding met surgical indications. After evacuation of intracranial hematoma, bone removal for decompression and external ventricular drainage, 2 patients fast recovered consciousness, and 1 patient recovered consciousness after 1 month.

In all, the typical clinical symptoms of remote cerebellar hemorrhage after microsurgical clipping of intracranial aneurysms include headache, omitting, delayed recovery from general anesthesia, decreased level of consciousness, and decreased limb muscle power. Typical CT findings of this disease are high-density shadow of (unilateral or bilateral) cerebellar surface groove or cerebellar lobe fissure, presenting "zebra stripe sign", which facilitates final diagnosis based on the history of craniotomy. Sudden intraoperative intracranial pressure changes are likely to be the mechanism of remote cerebellar hemorrhage. Early detection and treatment of remote cerebellar hemorrhage can decrease mortality and improve patient's prognosis.

Disclosure of conflict of interest

None.

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