Bull Yamaguchi Med Sch 36(3-4) : 101—104, 1989

Traumatic Cerebral Aneurysm

— Surgical Management and Importance of Post-Traumatic Cerebral Angiography Before Delayed Rupture —

Naoto Adachi, Tetsuaki Iwamoto, Mitsuru Tsuha, Yukio Wakuta, Tsutomu Nagamitsu, Katsuhiro Yamashita**

Department of Neurosurgery, Yamaguchi Saiseikai General Hospital, Yamaguchi 753,* Department of Neurosurgery, Yamaguchi University School of Medicine, Ube, Yamaguchi 755, Japan
(Received June 28, revised November 1, 1989)

Abstract We report a rare case of traumatic cerebral aneurysm. A 36-year-old man fell and struck the right parietal region of his head. He lost consciousness for 10 min but had no neurological deficits on admission. CT scan revealed right acute subdural hematoma. On the eighth day, we anticipatively performed precautionary cerebral angiography, which showed a traumatic cerebral aneurysm on the peripheral branch of the right middle cerebral artery. This aneurysm was cured by microneurosurgery and the patient was discharged without deficits.

The most important aspect of the present case was that the aneurysm was discovered in advance by cerebral angiography and cured by microneurosurgery.

We review previous cases of traumatic cerebral aneurysm and discuss the importance of cerebral angiography after head injury and the surgical management of traumatic cerebral aneurysm.

Key Words : Cerebral angiography, False aneurysm, Head injury, Neurosurgery, Traumatic Cerebral aneurysm

Introduction

Traumatic cerebral aneurysm is the rarest complication occurring after head injury and the prognosis has been poor in cases of delayed rupture, all of which were diagnosed only after the rupture. Such delayed rupture is called "delayed traumatic apoplexy" or "delayed traumatic intracerebral hematoma". We report a case of asymptomatic traumatic aneurysm which it was possible to detect in advance and cure by neurosurgery before rupture. We also review the importance of angiography after head injury and the surgical management of traumatic aneurysm.

Case Report

A 36-year-old man fell accidentally to the floor from a height of about 2 m and struck his head in the right parietal region. He lost consciousness about for 10 min and was admitted to our hospital by ambulance. On admission, he complained of only mild headache. Physical examination revealed no laceration to the head and or other parts of the body. Neurologically, he was alert (Glasgow coma scale 15) without other neurological deficits. Plain craniography revealed no cranial bone fracture, but CT scan revealed a thin acute subdural hematoma in the right parietal region, causing right hemispheric swelling and compression (Fig.1).

This subdural hematoma was almost completely resolved on CT scan after four days. On the eighth day, we anticipatively performed precautionary cerebral angiography to search for the origin of the hemorrhage, suspecting cerebral vascular complications of the head injury. We found a saccular cerebral aneurysm in an unusual region, on the peripheral branch of the right middle cerebral artery in the same region as the subdural hematoma (Fig.2). Left carotid and vertebral angiography revealed no abnormal lesions. Traumatic cerebral aneurysm was most suspected in view of the history of trauma and angiographic findings on the unusual location and in the same region as that of the trauma. Neurosurgery was performed as soon as possible two weeks after the initial onset for prevention of delayed repture, because of the poor prognosis in such cases.

On general anesthesia, the patient was located in a supine position and a right parietal craniotomy was performed. This craniotomy was a single burr hole regional exposure craniotomy, which gives full play in confirming and searching for a small lesion on the cerebral surface [1] . After the old thin subdural hematoma clot had been aspirated, we found an aneurysm exactly on the middle cereral artery branch bifurcation. The apex of the aneurysm adhered to the dura on the arachnoid side with the surrounding hard clot. The neck of the aneurysm was located on the proximal portion of the bifurcation. We sacrificed the aneurysm, the apex of which projected toward the dural side, but were unable to identify the ruptured portion because of the old clot and granulation. After the parent artery and two branching arteries had been clipped temporarily together (Sugita temporal clip No.52) and the full contour of the aneurysm had been identified, the aneurysm was resected from the body portion and this resected portion was micro -sutured with 10-0 nylon. We confirmed absence of bleeding from the sutures and recanalization of the arteries after removing the temporal clip. The sutured region was then coated with Biobond-Oxycell.

Subsequent angiography revealed no aneurysmal shadow in the same region (Fig.3) and the patient was discharged without neurological deficits. Pathological examination showed features of false aneurysm, which revealed granulation tissues but no vascular structures.

Discussion

The incidence of traumatic aneurysm among all cases of cerebral aneurysm is reported to be below 0.5% (0.25% [2] , 0.09% [3]), and the total number of cases reported previously is about 260 up to now, all of which were diagnosed after rupture or only incidentally [2-9] . Traumatic cerebral aneurysm occurs mainly in young males (76% [4]), among whom about 70% are below forty years of age because of the increased chance of head injury among this age group (below 20 years old 27%, below 30 years old 50%, below 40 years old 69% [4]). The cause is mostly closed head injury without skull bone fracture (62% [5]) and complicating intracranial hemorrhage is present in about 60% of cases. The site

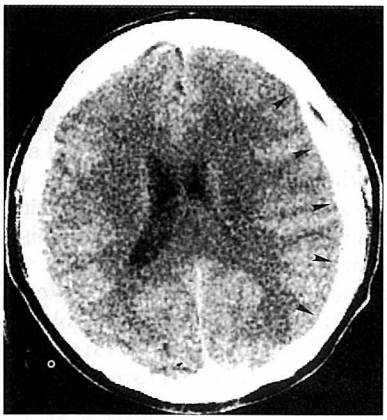

Fig. 1 Plain CT scan on admission reveals the right subdural hematoma and swelling of the right hemisphere (arrowheads show the contour of the subdural hematoma).

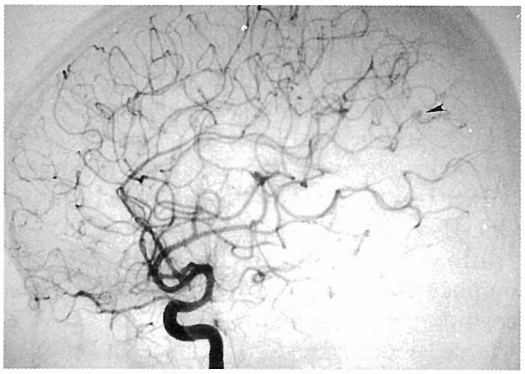

Fig. 2 Preoperative right carotid cerebral angiography reveals a saccular aneurysm (arrowhead) on the peripheral branch bifurcation of the middle cerebral artery.

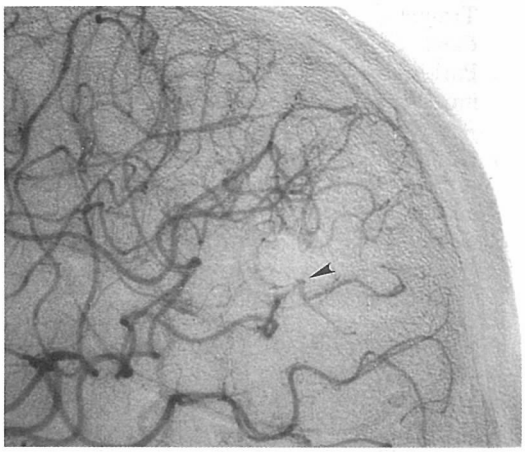

Fig. 3 Postoperative right carotid cerebral angiography reveals no aneurysm shadow, confirming complete resection of the aneurysm (arrowhead indicates the affected portion after resection and suture).

of the aneurysm is mostly the cavernous portion of the internal carotid artery (48%), the peripheral branch of the middle cerebral artery (26%) and the anterior cerebral artery (17%) [4] . Such aneurysms show a high incidence of delayed rupture (60%) between two and four weeks after trauma [4] . On the other hand, spontaneous resolution of such aneurysms is rare, only 3.5% of all cases [6] . The mortality reaches 75% in non-surgical cases but is 15% in surgical cases [6] . This suggests that surgical management is necessary as soon as possible after detection. Radical surgery is considered to be indicated for all cases in which traumatic aneurysm is found and is operable [6] . During surgery, since the wall of the traumatic aneurysm is fragile and ruptures easily, the parent artery and branch arteries must be confirmed and blood flow must be stopped temporarily before the aneurysm is identified.
At present, for radical surgery, clipping of the aneruysmal neck is usually performed, but other manipulations (ligation & bypass surgery and resection & suture) must be prepared in reserve in case of difficulty with neck-clipping because of the fragility of the aneurysm. The pathological features of these traumatic aneurysms are those of "false aneurysm", in which the wall is formed from the old clot and lacerated granular tissues (82% [5] , 100% [6]).

We diagnosed the present cerebral aneurysm as traumatic cerebral aneurysm on the following grounds ; 1) young age of patient 2) history of trauma 3) location same as that of the trauma and subdural hematoma, being rather unusual in comparison with congenital aneurysm 4) intraoperative findings 5) pathological findings. As for the pathogenesis of the ocurrence and development of the present aneurysm, it appeared that the peripheral branch of the middle cerebral artery had been injured between the brain and the dura by coup injury force at the time of trauma, and that the portion on the dural side had ruptured and bled through the arachnoid membrane into the subdural space. This created the acute subdural hematoma and the ruptured portion subsequently grew to form the false aneurysm.

The most important aspect of this case was that we were able to find the aneurysm in advance intensionally by precautionary angiography before it ruptured, allowing surgical cure.

It is our policy to perform cerebral angiography in all cases of severe head injury and all cases of traumatic intracranial hemorrhage, since occult traumatic vascular lesions may be caused by head injury. In fact, about half of all cases of traumatic intracranial hemorrhage for which we have performed post-traumatic angiography have been complicated by some type of traumatic vascular lesion, for example traumatic aneurysm as in the present case and, in the majority, traumatic vasospasm. Traumatic cerebral vascular disease (TCVD) occurs at high incidence in cases of head injury. We consider that the mortality and morbidity of head injury will improve further by diagnosis and treatment of these TCVDs.

Recently, because of the development of other types of imaging system, cerebral angiography after head trauma is often neglected. The present case emphasizes the need to consider the importance of cerebral angiography after head injury to rule out the presence of a traumatic vascular lesion.

References

1) Elisevich, K. V., Colohan, A. R. T., Brem, S. and Comair, Y. : A rapid and modifiable technique for regional exposure in cerebral surgery. *J. Neurosurg.*, **67** : 140-142, 1987
2) Benoit, B. G. and Wortzman,G ; Traumatic cerebral aneurysms. *J. Neurol. Neurosurg. Psychiatry,* **36** : 127-138, 1973
3) Ferry, D. J. and Kempe, L. G : False aneurysm secondary to penetration of the brain

through orbitofacial wounds. *J. Neurosurg.*, **36** : 503-506, 1972
4) Fox, J. L. : *Traumatic aneurysms-Intracranial Aneurysms*. Springer Verlag, New York, 1983
5) Asari, S., Nakamura, S. and Yamada, O. : Traumatic aneurysm of peripheral cerebral artery. *Brain Nerve.*, **28** : 793-805, 1976
6) Amagasa, M., Onuma, T. and Suzuki, J. : Surgical Treatment of Intracranial Traumatic Aneurysm. *Surg. Cereb. Stroke,* **15** : 205-208, 1987
7) Norikane, H., Doi, A. and Nakashima, H. : Traumatic Intracranial Aneurysm. *Surg. Cereb. Stroke,* **15** : 201-204, 1987
8) Parkinson, D. and West, M. : Traumatic intracranial aneurysms. *J. Neurosurg.*, **52** : 11-20, 1980
9) Hashimoto, L., Nakagawara, J., Suematsu, K., Matsuzaki, T., Takeda, R., Tanaka, Y. and Nakamura, J. : A case of a traumatic aneurysm of anterior choroidal artery with delayed traumatic apoplexy. (in Japanese) *The Hokkaido Journal of surgery,* 32 : 26-31, 1987