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Case Report Open Access

Altered Coiling with Stent Assistance for an Iatrogenic Traumatic Aneurysm of the Internal Carotid Artery

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Abstract

We report a rare case of a traumatic aneurysm which developed after clipping surgery with review of the relevant literature. Endovascular treatment using coiling and stent assistance taking into account technical considerations is described. Monitoring of the aneurysmal pressure showed marked decrease immediately after the stent emplacement, a point for discussion.

Case Report

A 57-year old woman suffering from subarachnoid hemorrhage from a large internal carotid artery (ICA) aneurysm with a broad neck defined by computed tomography (CT) followed by three dimensional CT angiography in the local hospital, who was emergency transferred to our institute. Neurological status on admission was grade I on the H&H scale. This patient had had a past history of subarachnoid hemorrhage 14 years previously, undergoing surgery for a basilar artery ruptured aneurysm arising from the superior cerebellar artery (BA-SCA aneurysm) in other hospital. During the clipping surgery, the right internal carotid artery was injured, but fortunately it was repaired by further clipping. She and her family were Jehovahs Witness, rejecting the blood transfusion during the operation on grounds of religion.

At our institute, endovascular surgery was selected for the large traumatic aneurysm. Two clips were made, one completely dislocated from the internal carotid artery and the other for BA-SCA aneurysm, which disturbed the therapeutic window (Figure 1A) but endovascular surgery could be successfully performed (Figure 1B) and the immediate clinical course was uneventful. Follow-up angiography one month after the treatment showed opening of the aneurysm by coil compaction (Figure 2A) so additional coil embolization was performed (Figure 2B). However, follow-up angiography 4 months thereafter again showed reopening of the aneurysm (Figure 3A). Therefore, endovascular surgery for adding coils with stent emplacement was advocated. A 7F sheath was inserted into the right femoral artery and thereafter a 7F catheter (Brite tip guiding catheter, Cordis, J & J, USA) preceded by a 5F catheter (Cathex, Japan) with a coaxial system was introduced into the right internal carotid artery. Initially, an attempt was made to advance a microcatheter (Prowler Select Plus, Codman, J & J, USA) was advanced into the middle cerebral artery (MCA) beyond the aneurysm but this failed and a soft microcatheter (Excelsior SL 10, Striker, Boston) was therefore introduced into

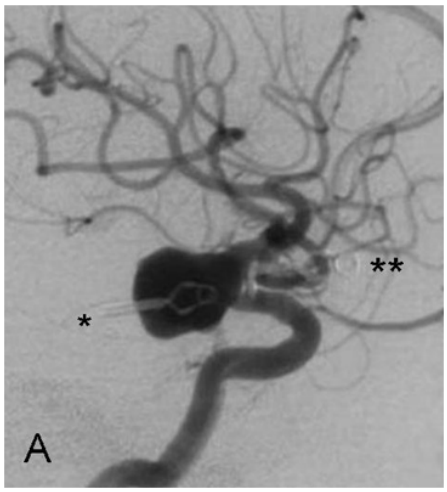

Figure 1 A: Right ICA angiogram demonstrated a large aneurysm and two clips (one asterisk: clip for a basilar artery aneurysm, two asterisks: dislocated clip for the internal carotid artery).

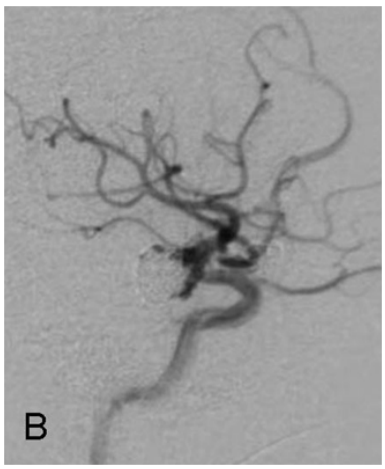

Figure1B: Right ICA angiogram after embolizatioin showing incomplete occlusion of the aneurysm.

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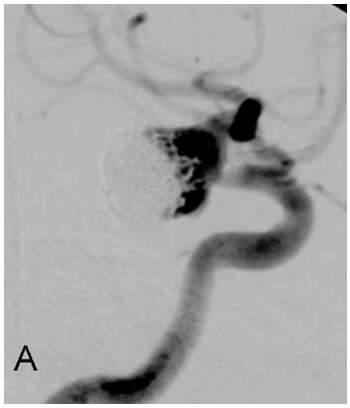

Figure 2A: Follow-up right ICA angiogram one month after the embolization showing coil compaction.

Figure 2B: Necessitating additional coil embolization.

Figure 3A: Right ICA angiogram 4 month after the embolization showing re-opening of the aneurysm.

the MCA. For the guide wire technique a 300cm long-guide wire (Accelerator, Covidien, USA) was applied. The microcatheter for the stent was successfully advanced into the MCA through this long guide wire (Figure 3B). Thereafter another microcatheter (Excelsior SL10, Stryker, USA) for coil embolization was introduced into the upper part of the residual lumen, which was inflow-zone. A self-expanding nitinol stent (Enterprise, Codman, J & J, USA) 37mm length was put in

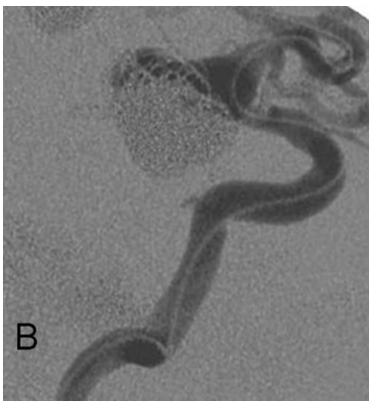

Figure 3B: A self expanding nitinol stent was therefore in place from the distal portion to the paraclinoid portion of the ICA, covering the normal arterial wall beyond the aneurysm.

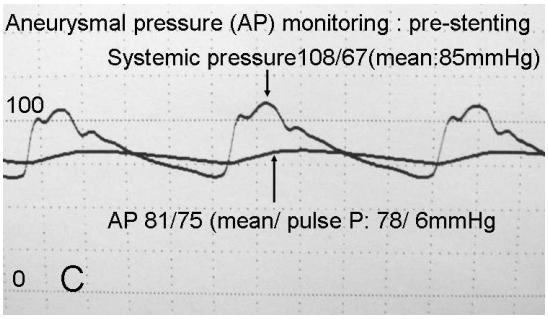

Figure 3C: The intra-aneurysmal pulse pressure before emplacement of the stent was 6mmHg.

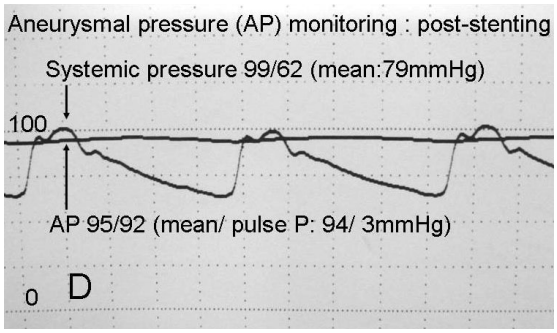

Figure 3D: Decreasing to 3 mmHg immediately after the stent emplacement.

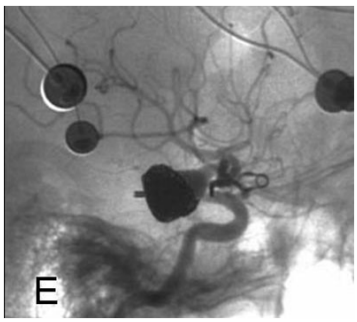

Figure 3E: Right ICA angiogram after coiling with stent assistance indicating disappearance of the aneurysm (arrow).

place from the M1 portion to a site distal to the carotid cavernous ICA to cover the broad neck of the aneurysm adequately. Thereafter coil embolization using jailing technique was successfully performed with monitoring of the aneurysmal internal pressure. After emplacement of the stent, the aneurysmal pressure showed marked decrease, pulse pressure in particular falling from 6 mmHg to 3mm Hg (Figure 3C & D). Final angiography showed no flow into the aneurysmal fundus (Figure 3E) and the clinical course was uneventful. Two days after the treatment, the patient was discharged without neurological deficit. Follow-up angiography 6 months after the final treatment showed persistent complete occlusion of the aneurysm.

Discussion

Traumatic intracranial aneurysms caused by iatrogenic injury are a very rare. Bank et al. [1] described a traumatic occlusion of the basilar artery, and their review of intracranial traumatic aneurysms summarized only 41 cases in the world literature. Although the iatrogenic source was not always clear, the aneurysm were usually associated with contiguous skull fractures or penetrating head injuries. Regarding iatrogenic intracranial aneurysms after aneurysmal surgery, to our knowledge there have only 10 cases in the literature, including present case (Table 1) [2-10].

Cerebral angiography is instrumental in the diagnosis of traumatic aneurysms. Certain features on angiography suggest a traumatic etiology [11] such as a poorly defined neck, unusual sites or projections of the aneurysm, irregularly shape and delayed filling and emptying. Our case was an irregularly shaped aneurysm with a poorly defined neck was seen in.

Traumatic aneurysms rarely regress and because the wall is often only an organized clot have a high incidence of rupture (as high as 67%) [12]. Six of the 10 reported iatrogenic aneurysms after aneurysmal surgery were ruptured, the time being after less than 1 month in all except present case. Yatsuzuka et al. [7] emphasized the importance of early diagnosis and treatment.

Thus, treatment should be instituted once a diagnosis is made and in traumatic cases an encircling clip is very useful. However, when the aneurysm cannot be obliterated by a clip, it may needed to be trapped with an accompanying vascular bypass. Since this patient and her family were Jehovahs Witness, and did not accept such an operation on the grounds of religion because they rejected the blood transfusion, endovascular surgery was selected. The problem is that endovascular procedures also carry a significant risk given friable aneurysms with poorly defined necks. In the case presented, stenting proved a useful technique to prevent the coil migration and disturbance of the aneurysmal inflow. The monitoring of the aneurysmal pressure during endovascular surgery showed marked decrease immediately after the emplacement of the stent, this resulting in disturbance of the water-hammer effect, influenced by diversion of the blood inflow through the stent mesh (the diameter is about 3mm). Tremmel et al. [13] reported flow diversion effect using Enterprise stents. Evaluation of stagnation time of contrast material is an experimental model after emplacement of stents, showed increasing time delay associated with their number with one the delay was 114-117% compared with control, with two it was 127-128% and with three was 141%. Flow-diversion therapy for aneurysms has become available in Europe, with the Silk device (Balt, Montmorency, France) and the Pipeline Embolic Device (ev3, Irvine, California) and Lylyk et al. [14] and Szikora et al.[15] reported flow-diversion treatment of 63 and 19 aneurysms, respectively, with no hemorrhages. Such flow-diversion therapy might be particularly recommended for high risk aneurysms that are amenable to coil therapy or surgical clipping but are likely to recur as with the present case.

Technical considerations for enterprise stenting

Initially, attempts to advance a microcather (Prowler Select Plus, Codman, J & J, USA) was advanced into the middle cerebral artery (MCA) beyond the aneurysm failed. Prowler Select Plus (2.3F/3.0F) is stiff and its poor trackability resulted in protrusion into the aneurysm lumen. Therefore a soft microcatheter (Excelsior SL 10, Striker, Boston) was introduced into the MCA. Application of a exchanging guide wire technique with a 300cm long-guide wire (Accelerator, Covidien, USA) and a microcatheter (Prowler Select Plus, Codman, J & J, USA) for stenting should be recommended.

References

1. Bank WO, Nelson PB, Drayer BP, Wilkins RH, Rosenbaum AE (1978) Traumatic aneurysm of the basilar artery. AJR Am J Roentgenol 130: 975-977.

2. Alexander E Jr, Adams JE, Davis Ch Jr (1963) complications in the use of temporary intracranial arterial clip. J Neurosurg 20: 810-811.

Case No.	Authors (year)	Age/Sex	Primary site	Cause	Secondary site	Clinical course	Treatment	Outcome
1	Alexander (1963)	56M	MCA	Temporary clipping	ICA	Incidental (4.5M)	Undetermined	-
2	Raimondi (1968)	59F	Acom	Injury at clipping	ACA	Rupture (23D)	Undetermined	-
3	Yamaura (1978)	29F	MCA	Injury at clipping	ICA	Rupture (11D)	None	Alive
4	Cosgrove (1983)	36F	Acom	Injury at clipping	Acom	Rupture (21D)	Clipping	Alive
5	Sekino (1985)	25M	BA	Clip head	ICA	Thrombi (8M)	None	Alive
6	Yatzuka (1995)	40F	BA	Injury at clipping	ICA	Rupture (8D)	Trapping	Dead
7	Hayashi (1996)	56M	ICA	Injury at clipping	ACA	Incidental (28D)	Clipping	Alive
8	Tokunaga (2001)	34M	Acom	Injury at clipping	MCA	Incidental (22D)	Coiling 8	Alive
9	Present case	57F	ICA	Injury at clipping	BA	Rupture (14Y)	Stent assisted coiling	Alive

MCA: middle cerebral artery, ICA: internal carotid artery, Acom: anterior communicating, ACA: anterior cerebral artery, BA: basilar artery, D: day, M: month, Y: year

Table 1: Iatrogenic intracranial aneurysm after aneurismal surgery.

3. Raimondi AJ, Yashon D, Reyes C, Yarzagaray L (1968) Intracranial false aneurysms. Neurochirurgia (Stuttg) 11: 219-233.

4. Yamaura A, Makino H, Hachisu H, Takemiya S (1978) Secondary aneurysm due to arterial injury during surgical procedures. Surg Neurol 10: 327-333.

5. Cosgrove GR, Villemure JG, Melançon D (1983) Traumatic intracranial aneurysm due to arterial injury at surgery. Case report. J Neurosurg 58: 291-294.

6. Sekino H, Katoh Y, Kanki T, Nakamura N (1985) [Iatrogenic traumatic intracranial aneurysm. Case report]. Neurol Med Chir (Tokyo) 25: 945-951.

7. Yatsuka H, Morooka S, Akiyama M, Sanada S (1995) A case of ruptured traumatic internal carotid artery aneurysm. Jpn J Neurosurg 4: 47-51.

8. Hayashi A, Oda M, Sekino T, Fujitsu K (1986) [Traumatic aneurysm occurring after surgical procedure of large cerebral aneurysm]. No Shinkei Geka 14: 881-885.

9. Tokunaga K, Kusaka N, Nakashima H, Date I, Ohmoto T (2001) Coil embolization of intradural pseudoaneurysms caused by arterial injury during surgery: report of two cases. AJNR Am J Neuroradiol 22: 35-39.

10. Cohen JE, Rajz G, Itshayek E, Shoshan Y, Umansky F, et al. (2005) Endovascular management of traumatic and iatrogenic aneurysms of the pericallosal artery. Report of two cases. J Neurosurg 102: 555-557.

11. Laun A (1979) Traumatic aneurysms. Cerebral aneurysms: Advances in Diagnosis and Therapy. Springer-Verlag, Berlin.

12. Buckingham MJ, Crone KR, Ball WS, Tomsick TA, Berger TS, et al. (1988) Traumatic intracranial aneurysms in childhood: two cases and a review of the literature. Neurosurgery 22: 398-408.

13. Tremmel M, Xiang J, Natarajan SK, Hopkins LN, Siddiqui AH, et al. (2010) Alteration of intra-aneurysmal hemodynamics for flow diversion using enterprise and vision stents. World Neurosurg 74: 306-315.

14. Lylyk P, Miranda C, Ceratto R, Ferrario A, Scrivano E, et al. (2009) Curative endovascular reconstruction of cerebral aneurysms with the pipeline embolization device: the Buenos Aires experience. Neurosurgery 64: 632-642.

15. Szikora I, Berentei Z, Kulcsar Z, Marosfoi M, Vajda ZS, et al. (2010) Treatment of intracranial aneurysms by functional reconstruction of the parent artery: the Budapest experience with the pipeline embolization device. AJNR Am J Neuroradiol 31: 1139-1147.