# Spontaneous Total Thrombosis of Distal Superior Cerebellar Artery Aneurysm

## H. Ohta, N. Sakai, I. Nagata, H. Sakai, A. Shindo and H. Kikuchi

Departments of Neurosurgery, National Cardiovascular Center, Osaka, Japan

## Summary

We report the case of an aneurysm of the distal segment of the superior cerebellar artery (SCA) which showed complete spontaneous thrombosis. Initial angiography performed in another institution showed 3 non-ruptured aneurysms located on the right distal SCA, C3 segment of the right internal carotid artery (ICA) and left basilar artery (BA) – SCA bifurcation. The patient had two episodes of transient cerebellar ataxia of the right hand before admission to our hospital, but no neurological signs were noted on admission. Computed tomography (CT) and magnetic resonance image (MRI) showed a thrombosed mass on the right SCA from its origin. A follow up angiogram 9 month after endovascular surgery for other aneurysms showed no recanalization of SCA or the aneurysms. There are no previous reports of total spontaneously thrombosed non-giant aneurysms of the distal segment of the SCA.

*Keywords:* Distal superior cerebellar artery; spontaneous total thrombosis; aneurysm.

#### Introduction

Aneurysms of the distal segment of the superior cerebellar artery (SCA) are quite rare. About 30 cases of distal SCA aneurysms have been reported to our knowledge [4–7, 10, 11, 13–20, 22, 23, 25, 26, 29–32, 35]. On the other hand, there are many reports of spontaneous thrombosis of aneurysms in several intracranial areas [1–3, 8, 21, 27, 28, 33, 34], but they are usually giant aneurysms. We describe here a case of total spontaneous thrombosis of a non-giant aneurysm on the distal segment of the SCA.

## **Case Report**

A 47-year-old female experienced sudden transient double vision in June, 1999. She was found to have a right oculomotor nerve palsy by an ophthalmologist and went to neurosurgery clinic for further examination. CT scan showed an isodense round mass in the right crural cistern compressing the cerebellar peduncle (Fig. 1). On June 23, 1999, cerebral angiography showed multiple sacular aneurysms on the anterior pontine segment of the right SCA, at the left basilar artery (BA) – SCA bifurcation (Fig. 2a), and on right C3 segment of the internal carotid artery (ICA) (Fig. 2b). At that time, there was no intra-aneurysmal thrombosis of the distal SCA aneurysm visible on the angiogram. On July 24 and August 2, 1999, she experienced episodes of transient cerebellar ataxia of her right hand which continued for several hours, then improved spontaneously. Follow-up CT scan showed partial thrombosis of the aneurysm on August 4, 1999 (Fig. 3a). She was then referred to our hospital for treatment of all aneurysms by endovascular surgery. On August 21, 1999, she was admitted to our hospital.

On admission she had no neurological signs or abnormal haematological findings including coagulation time. CT scan demonstrated a moderately high density mass in the right crural cistern. There were no infarctions in the right SCA territory. On magnetic resonance



Fig. 1. Initial CT scan showing an isodense round mass on the right crural cistern. The cerebellar peduncle was compressed posteriorly by the mass

#### H. Ohta et al.



Fig. 2. (a) Vertebral angiogram showing sacular aneurysms on the anterior pontine segment of the right SCA and at the left BA - SCA bifurcation. (b) Right carotid angiogram showing a sacular aneurysm on the C3 segment



Fig. 3. (a) Follow-up CT scan showing a high density mass considered to be a total thrombosis of the aneurysm in the crural cistern. (b) MRI on T1 weighted images showing high intensity signal changes of the aneurysms

imaging (MRI), the aneurysm was seen as a high intensity mass on T1 and T2 weighted images, which indicates a subacute phase of thrombosis (Fig. 3b). Spontaneous total thrombosis of the aneurysm was suspected. Angiography was perfomed on August 25, 1999, and showed a filling defect of the right SCA at its origin (Fig. 4). Angiographic collateral flow from the right anterior inferior cerebellar artery (AICA) and from the posterior inferior cerebellar artery (PICA) was enough to supply the right SCA territory. The remaining two aneurysms did not show any thrombosis, and were treated with aneurysmal embolization with Guglielmi detachable coils (GDCs) on September 1, 1999. The post-operative course was uneventful and she was discharged without any neurological deficits. Follow-up angiography 9 months after the endovascular surgery showed no recanalization of the right SCA or other aneurysms.

## Discussion

Aneurysms arising in the distal portion of the SCA are very rare, accounting for less than 0.2% of all intracranial aneurysms [24, 35]. About 30 cases of distal SCA aneurysms have been reported [4–7, 10, 11, 13– 20, 22, 23, 25, 26, 29–32, 35]. The reported cases are summarized in Table 1. They are comprised of 18 males and 13 females ranging in age from 7 to 69 years (mean, 36.6 years). Most cases (24 cases) showed subarachnoid haemorrhage (SAH), and 11 patients had Spontaneous Total Thrombosis of Distal Superior Cerebellar Artery Aneurysm



Fig. 4. Follow-up vertebral angiogram showing no filling of the right SCA from its origin on wards

intracranial nerve palsies. According to Hardy's and Hoffmann's classification of the SCA segment [9, 12], 14 cases were located at the cortical segment, one at the quadrigeminal segment, 5 at the ambient segment, and 8 at the anterior pontine segment. The locations of the other three cases were not exactly specified (Case No. 3, 22, 23). Four cases had multiple cerebral aneurysms, 2 of which showed associated cerebral arterio-venous malformation (AVM).

Intra-aneurysmal thrombosis was observed in 8 of 31 (25.8%) cases (Table 2). One case was a traumatic false aneurysm, another case was a dissecting aneurysm associated with fibromuscular dysplasia, and the other 6 cases seemed to be true aneurysms. Seven of 8 cases showed partial thrombosis and only our case had total thrombosis of the aneurysm. All 8 patients had symptoms and signs, 4 of diplopia and 4 of SAH. Three cases were located on the cortical segment and 3 cases were on the ambient segment, and only our case was located on the anterior pontine segment. Neck clipping was done in only 2 patients, another 4 patients were treated with parent artery occlusion with or without STA-SCA bypass. Thus, it seems to be difficult to perform neck clipping for a thrombosed aneurysm.

Spontaneous intra-aneurysmal thrombosis is a well documented phenomenon that has been noted in approximately 50% of giant intracranial aneurysms [33]. Pozzati *et al.* reported that the incidence of total thrombosis in giant aneurysms is between 13% and 20% [27], but there were no reports of non-giant (large

or small) aneurysms. This high incidence of thrombus formation within giant intracranial aneurysms is related to the ratio between aneurysmal volume and aneurysmal neck size. In aneurysms with a relatively small neck, intra-arterial thrombosis may occur. Although other biophysiological and dynamic parameters contribute to the delicate balance between thrombogenesis and thrombolysis within the aneurysm (vide infra), the volume: orifice ratio would appear to be the major factor [1]. In our case, the dome size of the distal SCA aneurysm was about 12 mm and the neck size was about 3 mm on the initial angiogram, thus the volume: orifice ratio was larger than in other aneurysms (ICA and BA-SCA aneurysms). In addition, the right SCA had a narrow diameter and blood flow was too small to supply the distal aneurysm. The narrow neck of the aneurysm and poor blood supply from the parent artery may have caused the spontanous total thrombosis. A follow-up angiogram showed no recanalization of the SCA trunk or aneurysms, but a more long term follow-up might be necessary to see the spontaneous recanalization of the thrombosed aneurysm.

The surgical approaches for distal SCA aneurysms have been described in many reports [4-7, 10, 11, 22-26, 29-32, 35]. With the advances in microcatheter technology, endovascular surgery such as GDC embolization can be considered as an alternate treatment. Most distal SCA aneurysms were treated with neck clipping, but some aneurysms such as dissecting or fusiform aneurysms were treated by trapping or proximal occlusion of the parent artery with or without a bypass procedure. To prevent post-operative ischaemia in the SCA territory from sacrifice of the parent artery, a preoperative balloon occlusion test should be done by the endovascular technique. Tolerance of SCA occlusion when treating a fusiform or dissecting aneurysm can be better assessed with a proximal test balloon occlusion of the SCA while the patient is awake. Based on the findings of this endovascular testing, decisions should then be made as to whether the bypass is necessary. Surgical treatment carries risks of temporal lobe contusion, venous infarction and cranial nerve palsy, and such complications sometimes lead to negative outcomes. On the other hand, endovascular surgery is less invasive than direct surgery despite the possibility of recanalization due to coil compaction. Endvascular treatment will become a useful and mainstream treatment for distal SCA aneurysms.

Table 1	. Summary of Reported Cases of L	Distal SCA A	lneurysms					
Case no.	Author (year)	Age/sex	Clinical symptom	Site of aneurysms	Number of aneurysms	Intraaneurysmal thrombosis	Treatment	Complications
-	Cockrill <i>et al.</i> (1977) <sup>4</sup>	15/M	diplopia	Rt. ambient segment	1	partial	proximal occlusion	traumatic false aneurysm
7	Collins <i>et al.</i> $(1992)^5$	23/M	diplopia	Lt. ambient segment	1	partial	trapping	4th CN palsy
ŝ	Dimsdale <i>et al.</i> $(1959)^6$	56/F	SAH	Rt. antpont. segment	1	. 1	trapping	5th and 6th CN palsy
4	Gacs <i>et al.</i> $(1983)^7$	59/F	SAH	Lt. cortical segment	1	I	trapping	3rd CN palsy
S	F	53/F	SAH	Bil. cortical segment	2	Ι	occlusion	1
9	Ŧ	21/M	SAH	Lt. cortical segment	1	partial	occlusion	4th CN palsy
7	=	50/M	SAH	Lt. cortical segment	1	. 1	clipping	1
8	F	M/69	SAH	Rt. cortical segment	1	I	resection	AVM
6	Ŧ	10/M	SAH	Lt. cortical segment	1	I	resection	AVM
10	Hidaka <i>et al.</i> (1989) <sup>10</sup>	37/F	SAH	Lt. cortical segment	1	I	clipping	1
11	Hirose <i>et al.</i> $(1989)^{11}$	25/F	SAH	Rt. antpont. segment	1	I	proximal occlusion	6th CN palsy
12	Itoyama <i>et al.</i> $(1990)^{13}$	64/M	SAH	Rt. cortical segment	1	I	clipping	1
13	Kalyan-Raman et al. (1983) <sup>14</sup>	38/M	diplopia	unknown	1	partial		FMD
14	Kubota <i>et al.</i> $(1994)^{15}$	40/F	SAH	Rt. cortical segment	1	. 1	clipping	1
15	Logue $(1964)^{16}$	56/F	SAH	Rt. antpont. segment	1	I	trapping	5th and 6th CN palsy
16	Mabuchi et al. (1992) <sup>17</sup>	65/M	CH	Rt. cortical segment	2	I	resection	AVM
17	Matricali <i>et al.</i> (1986) <sup>18</sup>	45/F	SAH	Rt. cortical segment	1	partial	clipping	1
18	Murtagh <i>et al.</i> (1981) <sup>19</sup>	27/M	SAH	Lt. cortical segment	1	Ι	clipping	Ι
19	Nagasawa <i>et al.</i> (1995) <sup>20</sup>	21/M	SAH	Lt. ambient segment	1	partial	trapping	4th CN palsy
20	Orz <i>et al.</i> (1995) <sup>2 2</sup>	48/M	SAH	Lt. antpont. segment	1	I	clipping	1
21	Papo <i>et al.</i> (1977) <sup>23</sup>	23/F	SAH	Rt. ambient segment	1	Ι	clipping	4th CN palsy
22	Poppen $(1959)^{25}$	49/M	SAH	unknown	1	I	trapping	I
23	Ŧ	53/M	SAH	unknown	1	I	trapping	I
24	Pozzati <i>et al.</i> (1980) <sup>26</sup>	40/F	SAH	Lt. antpont. segment	1	Ι	clipping	3rd CN palsy
25	Sherman <i>et al.</i> $(1977)^{29}$	13/F	SAH	Lt. ambient segment	1	I	trapping	Rt. hemiplegia
26	Sugita (1985) <sup>30</sup>	47/M	SAH	Lt. antpont. segment	1	Ι	clipping	I
27	Uede <i>et al.</i> (1986) <sup>31</sup>	51/M	tinnitus	Rt. quad. segment	7	I	clipping	7th and 8th CN palsy
28	Vincent <i>et al.</i> $(1980)^{32}$	M/T	SAH	Lt. antpont. segment	1	I	clipping	3rd N palsy
29	Yasargil et al. (1984) <sup>35</sup>	62/F	SAH	Lt. cortical segment	1	I	clipping	AVM
30	z	51/M	SAH	Rt. cortical segment	1	partial	clipping	I
31	Present case	47/F	diplopia TIA	Rt. antpont. segment	Э	total	I	I
		,			.			

M Male, F female, SAH subarachnoid haemorrhage, CH cerebellar haemorrhage, Rt. right, Lt. left, ant.-pont. anterior-pontine, – nothing, CN cranial nerve, AVM arterio-venous malformation, TIA transient ischemic attack, FMD fibromuscular dysplasia.

H. Ohta et al.

840

Table 2	. Summary of Reported Cases of Di	istal SCA Anu	eurysms with Intra-Aneu	rysmal Thrombosis					
Case no.	Author (year)	Age/sex	Clinical symptom	Site	Number of aneurysms	Intra-An. thrombosis	Treatment	Complications (comments)	Outcome
1	Cockrill et al. (1977) <sup>4</sup>	15/M	diplopia	Rt. ambient segment	1	partial	proximal	diplopia (traumatic An )	good
7	Collins et al. (1992) <sup>5</sup>	23/M	diplopia	Lt. ambient segment	1	partial	trapping	4th CN palsy	fair
Э	Gacs <i>et al.</i> $(1983)^7$	21/M	SAH	Lt. cortical segment	1	partial	proximal occlusion	4th CN palsy	excellent
4	Kalyan-Raman <i>et al.</i> (1983) <sup>14</sup>	38/M	diplopia	unknown	1	partial	I	dissection (FMD)	D
5	Matricali <i>et al.</i> $(1986)^{18}$	45/F	SAH	Rt. cortical segment	1	partial	clipping	I	excellent
9	Nagasawa <i>et al.</i> (1995) <sup>20</sup>	21/M	SAH	Lt. ambient segment	1	partial	trapping	4th CN palsy	excellent
7	Yasargil <i>et al.</i> (1984) <sup>35</sup>	51/M	SAH	Rt. cortical segment	1	partial	clipping	I	excellent
8	Present case	47/F	diplopia TIA	Rt. antpont. segment	Э	total	I	I	excellent
			,						

Intra-An. Intra-aneurysmal, M male, F female, SAH subarachnoid haemorrhage, TIA transient ischaemic attack, Rt. right, Lt. left, ant.-pont. anterior-pontine, traumatic An. traumatic aneurysm, CN cranial nerve, FMD fibromuscular dysplasia, D died.

## References

- Black SPW, German WJ (1960) Observation on the relationship between volume and size of the orfice of experimental aneurysms. J Neurosurg 17: 984–990
- Cantore G, Santoro A, Pian RD (1994) Spontaneous occlusion of supraclinoid aneurysms after the creation of extraintracranial bypasses using long grafts: report of two cases. Neurosurgery 44(1): 216–220
- Carlson DH, Thomson D (1976) Spontaneous thrombosis of a giant cerebral aneurysm in five days: report of a case. Neurology 26: 334–336
- Cockrill HH Jr, JP Jimenez, JA Goree (1977) Traumatic false aneurysm of the superior cerebellar artery simulating posterior fossa tumor. Case report. J Neurosurg 46: 377–380
- Collins TE, Mehalic TF, White TK et al (1992) Trochlear nerve palsy as the sole initial sign of an aneurysm of the superior cerebellar artery. Neurosurgery 30: 258–261
- Dimsdale H, Logue V (1959) Ruptured posterior fossa aneurysms and their surgical treatment. J Neurol Neurosurg Psychiatry 22: 202–207
- Gacs G, Vinuela F, Fox AJ *et al* (1983) Peripheral aneurysms of the cerebellar arteries. J Neurosurg 58: 63–68
- Golding R, Peatfield RC, Shawdon HH *et al* (1980) Computer tomographic features of giant intracranial aneurysms. Clinical Radiolory 3: 41–48
- Hardy DG, Peace DA, Rhoton AL Jr (1980) Microsurgical anatomy of superior cerebellar artery. Neurosurgery 6: 10– 28
- Hidaka M, Shimoda M, Shibuya N *et al* (1989) Peripheral superior cerebellar artery aneurysm. Case report. Neurol Med Chir (Tokyo) 29: 533–537
- Hirose Y, Nakamura T, Takamiya Y et al (1990) Fusifoem superior cerellar artery aneurysm presenting with contralateral abducens nerve paresis. Case report. Neurol Med Chir (Tokyo) 30: 119–122
- Hoffmann HB, Margolis MT, Newton TH (1974) The superior cerebellar artery. In: Newton TH, Potts DG (eds) Radiology of the skull and brain, angiography, vol 2, book 2. St Louis, CV Mosby, pp 1809–1830
- Itoyama Y, Uemura S, Hamada J *et al* (1990) Aneurysm arising from the cortical branch of the superior cerebellar artery: case report. No Shinkei Geka 18: 867–870
- Kalyan-Raman UP, Kowalski RV, Lee RH *et al* (1983) Dissecting aneurysm of superior cerebellar artery. Arch Neurol 40: 120–122
- 15. Kubota S, Ohmori S, Tatara N et al (1994) A ruptured peripheral, superior cerebellar artery aneurysm: A case report and a review of the literature as to surgical approach. No Shinkei Geka 22: 279–283
- Logue V (1964) Posterior fossa aneurysm. Clin Neurosurg 11: 183–207
- Mabuchi S, Kamiyama H, Abe H (1992) Distal aneurysms of the superior cerebellar artery and posterior inferior cerebellar artery feeding an associated arteriovenous malformation: case report. Neusurgery 30: 284–287
- Matricali B, Seminara P (1986) Aneurysm arising from the medial branch of the superior cerebellar artery. Neurosurgery 18: 350–352
- Murtagh FR, Balis GA (1981) CT localization of posterior fossa bleeding sites in subarachnoid hemorrhage. Surg Neurol 16: 211–217
- Nagasawa S, Kobata H, Aoki J *et al* (1996) A large thrombosed superior cerebellar artery aneurysm: a case repoert. Surg Neurol 45: 36–38

- Oka H, Kurata A, Miyasaka Y *et al* (1994) Completely thrombosed large aneurysm of the distal middle cerebral artery: a case report. No sinkei geka 22(7): 677–680
- Orz Y, Kobayashi S, Ichinose Y et al (1996) Peripheral superior cerebellar artery aneurysm. Neurol Med Chir (Tokyo) 36: 106– 110
- Papo I, Caruselli G, Salvolini U (1977) Aneurysm of the superior cerebellar artery. Surg Neurol 7: 15–17
- Piepgras DG (1993) Posterior cerebral and superior cerebellar artery aneurysms. In: Apuzzo MLJ (ed) Brain surgery. Churchill Livingstone, New York, pp 1083–1111
- Poppen JL (1959) Vascular surgery of the posterior fossa. Clin Neurosurg 6: 198–210
- Pozzati E, Tognetti F, Padovani R *et al* (1980) Superior cerebellar artery aneurysms. J Neurosurg Sci 24: 85–88
- 27. Pozzati E, Nuzzo G, Gaist G (1982) Giant aneurysm of the pericallosal artery: case report, J Neurosurg 57: 566–569
- Schubiger O, Valavanis A, Hayek J (1980) Computed tomography in cerebral aneurysms with special emphasis on giant intracranial aneurysms. J Comput Assist Tomogr 4(1): 24–32
- Sherman DG, Salmon JH (1977) Ocular bobbing with superior cerebellar artery aneurysm. Case report. J Neurosurg 47: 596– 598
- Sugita K (1985) Microneurosurgical atlas. Berlin Heidelberg New York Tokyo, Springer, pp 92–93
- Uede T, Matsumura S, Ohtaki M *et al* (1986) Aneurysm of the anterior inferior cerebellar artery at the internal auditory meatus: report of two cases. No Shinkei Geka 14: 1263–1268
- Vicent FM, Zimmerman JE (1980) Superior cerebellar artery aneurysm presenting as an oculomotor nerve palsy in a child. Neurosurgery 6: 661–664
- Whittle IR, Dorsch NW, Besser M (1982) Spontaneous thrombosis in giant intracranial aneurysms. J Neurol Neurosurg Psychiatry 45: 1040–1047
- Whittle IR, Williams DB, Halmagyi GM, et al (1982) Spontaneous thrombosis of a giant intracranial aneurysm and ipsilateral internal carotid artery: case report. J Neurosurg 56: 287– 289
- Yasargil MG, Smith RD, Young PH et al (1984) Clinical consideration, surgery of the intracranial aneurysms and results. Microneurosurgery, vol 2. Thieme-Stratton, Stuttgart, pp 260– 280

# Comments

Ohta et al. present a case of spontaneous total thrombosis of distal superior cerebellar artery aneurysm with associated intra-arterial thrombosis of the proximal segment. The patient presented with two episodes of ataxia as an ischaemic sign before complete thrombosis was documented with angiography. Spontaneous thrombosis has been described for giant aneurysms, but intra-arterial thrombosis is apparently an uncommon phenomenon. In their case the authors treated with GCD two associated incidental aneurysms, but the symptomatic right distal SCA was left untreated due to its spontaneus thrombosis. The natural history of thrombosed aneurysms and eventual embolic complications is unknown. Some cases of recanalization and even rupture of thrombosed aneurysms have been reported (1, 2). Thus, failure to exclude the aneurysm from the circulation places the patient at risk not only of new embolic complications, but also of recanalization and even rupture. This morbimortality of a continuous follow up period with serial angiography is not negligible. Besides, the anti-agregation that may be indicated to

#### Spontaneous Total Thrombosis of Distal Superior Cerebellar Artery Aneurysm

prevent embolic events can accelerate the recanalization process. Finally, we do not agree with the authors conclusion that an endovascular procedure is a "safe and less invasive" approach to this lesion. The embolization with coils of a distal aneurysm of the SCA carries the risk of arterial dissection, arterial occlusion, distal emboli and the possibility of long term complications of coil compactation, wire protrusion and embolic events. In experienced hands, microsurgical techniques can minimize the eventual complications of parenchymal contusion, venous infarction or cranial nerve palsy.

Nevertheless the authors have done a good review of the literature and as a rare case it should be published in the Acta.

- Atkinson J, Lane J, Colbassani H, Llewellyn M (1993) Spontaneus thrombosis of posterior cerebral artery aneurysm with angiographic reappearence. J Neurosurg 79: 434–437
- Andrews B, Edwards M, Gannon P (1984) Acutely thrombosed aneurysm of the middle cerebral artery presenting as intracranial hemorrhage in a 3 year old child. J Neurosurg 60: 1303–1307 *J. Mura, H. Tedeschi and E. de Oliveira*

Correspondence: Hajime Ohta, M.D., Department of Neurosurgery, National Cardiovascular Center, 5-7-1 Fujishirodai, Suita, Osaka 565-8565, Japan.