

An Aneurysm Developing on the Infundibulum of Posterior Communicating Artery : Case Report and Literature Review

Woo-Youl Jang, M.D., Sung-Pil Joo, M.D., Tae-Sun Kim, M.D., Jae-Hyoo Kim, M.D.

Department of Neurosurgery, Chonnam National University, Medical School, Gwangju, Korea

Infundibular dilatation is funnel-shaped symmetrical enlargement that occurs at the origin of cerebral arteries and which is apparent on 7 to 25% of normal angiograms^{3,4,7,10,12,13,15}. Infundibular dilatation is frequently considered a normal anatomic variation of no pathologic significance. The authors report a case in which an aneurysm developed on an infundibular dilatation of the posterior communicating artery (PCoA). A 72-year-old woman presented with severe headache, nausea, and vomiting. Digital subtraction angiography showed a saccular aneurysm arising from the origin of the left PCoA. Operative findings revealed the aneurysm and infundibular widening of the right PCoA. The aneurysm was successfully obliterated. Whether infundibular dilatation is a pre-aneurysmal state or a benign dilatation is controversial. However, we believe infundibular dilatation of the PCoA in this case may have served as a pre-aneurysmal lesion.

KEY WORDS : Aneurysm · Infundibular dilatation · Posterior communicating artery.

Introduction

Funnel-shaped dilatations most frequently affect the origins of the posterior communicating arteries (PCoA) at their junctions with the internal carotid artery. This type of PCoA dilatation is not a true aneurysm and has been referred to as an infundibular dilatation, a junctional dilatation, infundibular widening, or as infundibulum^{3,4,7,10,12,14}. It remains controversial whether this dilatation represents a preaneurysmal condition, and demonstrations of an aneurysm formed from it is rare^{3,4,7,10,12,14-16}. Only twelve such cases have been reported to the best of the author's knowledge (Table 1).

Case Report

A 72-year-old woman with hypertension and diabetes mellitus (DM) II was transferred to our department with a history of a sudden onset headache, nausea, and vomiting. She had no neurological symptoms or signs except nuchal rigidity. Computerized tomography (CT) showed a

thick layer of subarachnoid hemorrhage in the basal cistern and Sylvian fissure, which was more prominent on the right (Fig. 1). Three-dimensional computed angiography (CTA) and cerebral angiography revealed an aneurysm with an or-

Table 1. Reported Cases of Infundibula-to-Aneurysm Progression

Series	Age	Sex	Side	Time to	
				Aneurysm Formation (yr)	Hypertension
Bjokesten and Troupp, 1962	40	F	L*	11	No
Drake, 1966	34	F	L*	4	No
Drake, 1966	-	-	-	-	-
Young et al., 1971	29	F	L*	4	Yes
Yoshimoto and Suzuki, 1974	56	F	L	8	No
Stuntz et al., 1970	38	M	L*	9	No
Waga and Morikawa, 1979	36	F	L	9	No
Trasi et al., 1981	26	F	L	0.5	No
Itakura et al., 1983	26	F	{R & L}*	7	-
Patrick and Appleby, 1983	35	F	R	9	No
Laurence et al., 1998	49	F	L*	5	Yes
Redife PE, 2005	53	F	R	0.9	No
Present report	72	F	R	-	Yes

* : Bilateral infundibula, - : Unknown

• Received : September 9, 2005 • Accepted : March 22, 2006

• Address for reprints : Sung-Pil Joo, MD, Department of Neurosurgery, Chonnam National University, Medical School, 8 Hak-dong, Dong-gu, Gwangju, 501-757, Korea Tel : +82-62-220-6606, 6600, Fax : +82-62-224-9865, E-mail : nsjsp@hanmail.net



Fig. 1. Computed tomographic scan on admission. High density is present in the subarachnoid space bilaterally, and is slightly more prominent on the right.

igin at the right PComA (Fig. 2). The patient was operated on the day after admission using a right pterional approach. During the operation, we found a true aneurysm on the postero-lateral wall of the PComA infundibulum. Marked atherosclerotic change was observed in the infundibulum and lateral wall of the

internal carotid artery(ICA) (Fig. 3), and thus we clipped the aneurysm neck and wrapped the atherosclerotic infundibulum. Postoperative course was uneventful. The postoperative angiogram revealed obliteration of the aneurysm and a patent posterior communicating artery (Fig. 4).

Discussion

Most so-called 'true' PComA aneurysm is arising on the junction of the internal carotid artery and PComA unrelated with internal carotid artery or posterior cerebral artery⁸⁾. However aneurysm originating directly from the PComA itself do not appear to attract much attention. The incidence of this 'true' PComA aneurysm varies from 0 to 3.3%⁸⁾. The aneurysm developing on the infundibulum of the PComA is the verified case of 'true' PComA aneurysm.

Infundibular dilatation is defined as a funnel-shaped dilatation of the posterior communicating artery where the artery leaves the carotid siphon and the PComA emerges from the apex of the enlargement^{3-5,7,10,12,14,15)}. The reported incidence of PComA infundibular dilatation detected by angiography ranges 6% to 17%, and this increases with age¹⁾. The dilatation is roughly triangular and its

diameter is no greater than 3mm. Although infundibular dilatation is a well established angiographic diagnosis and is generally believed to be benign. It is sometimes difficult to differentiate angiographically an aneurysm from the PComA infundibulum^{1-3,5,7,16-18)}.

Ohkuma et al.¹⁰⁾, in their interesting angiographic study on infundibular dilatation of the PComA, pointed out that infundibular dilatations show a significant tendency to develop into aneurysms. They found that the incidence of infundibular dilatation was higher and the size of the infundibulum was larger in patients with PComA aneurysms. They also demonstrated that the incidence of a large infundibular dilatation was higher in young patients and in patients with a past history of hypertension.

There is still some controversy about the exact history and natural history of infundibular dilatation. Some histological studies that investigated the relationship between infundibular dilatation and aneurysms have furnished contradictory evidence. Hassler and Salzman looked at the histologies of 21 cases of infundibular dilatation and found that a significant

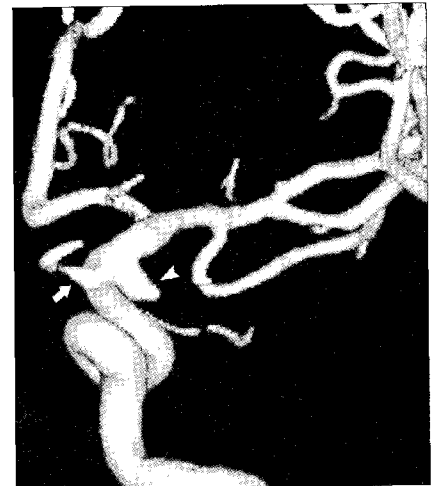


Fig. 2. Three-dimensional computed angiogram demonstrating an aneurysm (arrow head) arising from the dilated infundibular portion of the posterior communicating artery (arrow).

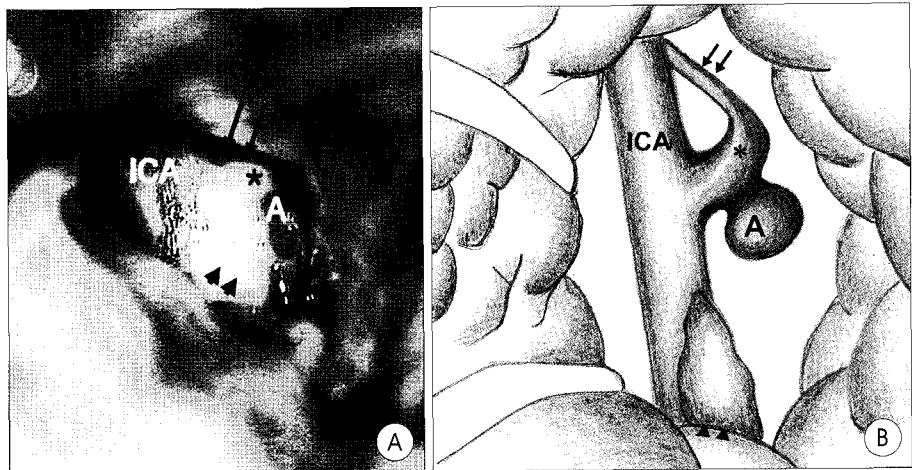


Fig. 3. Operative findings demonstrating a true aneurysm on the postero-lateral wall of the posterior communicating artery infundibulum (asterisk) with a reddish bulge at its origin (A). Marked atherosclerotic change is observed in the infundibulum and the lateral wall of the internal carotid artery (arrow) (arrow head : PComA).

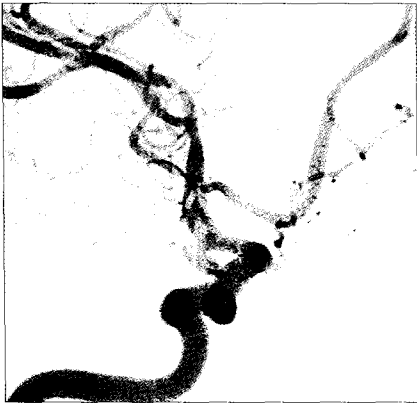


Fig. 4. Postoperative angiogram shows complete obliteration of the aneurysmal dilatation and patent posterior communicating artery. The images show a triangular infundibulum and the posterior communicating artery arising from the top of the dilatation.

proportion demonstrated typical aneurysmal defects in the internal elastic lamina and in the media⁶. However, similar studies by Ebstein et al disclosed no abnormality, and lead them to conclude that the condition is neither aneurysmal nor pre-aneurysmal³.

Patrick et al compared the site distribution of aneurysms in familial aneurysm cases in the general population. Family cases showed a 30% incidence of PCoMA aneurysm and a 20% incidence of infundibular dilatation of the PCoMA, and supporting the hypothesis that infundibulum is indeed pre-aneurysmal¹².

Based on intra-operative findings, Endo et al reported atypical bulging at infundibular dilatations, especially in regions of the lateral wall, strongly suggestive of early aneurysm progression. They reported that a well-developed PCoMA may be a factor that contributes to progression from an infundibulum to a true aneurysm. They explained that hemodynamic stress at the PCoMA may contribute to such progression⁴.

Several instances of aneurysms developing from infundibular dilatations have been reported, and the incidence of progression to aneurysm is greater in cases of multiple aneurysms, bilateral infundibular dilatations, and familial intracranial aneurysms^{3,4,7,10,12,14,15,17}.

Thus, it seems likely that infundibular dilatation is a pre-aneurysmal condition. There is a certain increased incidence of de novo aneurysm formation in patients with infundibular dilatations, i.e., in patients who have bilateral infundibula, large infundibula, multiple aneurysms, familial intracranial aneurysms, and who are young^{7,13}. Conceivably, hypertension, atherosclerosis at the infundibulum and an enlarged PCoMA would contribute to hemodynamic stress and repeated vessel wall distension, and could lead to aneurysm formation.

Conclusion

We present the case of a 72-year-old woman in whom an aneurysm developed at the site of an infundibular

dilatation of the left PCoMA. Although infundibular dilatation may be frequent findings, and its incidence may increase with age, the incidence of the transformation of a bulge into a true aneurysm is probably extremely low. We believe that infundibular widening may be enlarged, and that such widening reflects a pre-aneurysmal tendency in patients with risk factors; such as bilateral infundibula, large infundibula, history of multiple aneurysms, a familial history of intracranial aneurysms, young age, hypertension, atherosclerosis, and an enlarged PCoMA.

References

1. Allcock JM, Canham PB : angiographic study of the growth of intracranial aneurysms. *J Neurosurg* 45 : 617-621, 1976
2. Bjorksten G, Troupp H : Changes in the size of intracranial aneurysms. *J Neurosurg* 19 : 583-588, 1962
3. Ebstein F, Ransohoff J : The significance of junctional dilatation of the posterior communicating artery. *J Neurosurg* 33 : 529-531, 1970
4. Endo S, Furuichi S, Takaba M, Hirashima Y, Nishijima M, Takaku A : Clinical study of enlarged infundibular dilatation of the origin of the posterior communicating artery. *J Neurosurg* 83 : 421-425, 1995
5. Fox JL, Baiz TC, Jakoby RK : Differentiation of aneurysm from infundibulum of the posterior communicating artery. *J Neurosurg* 21 : 135-138, 1964
6. Hassler O, Salzmann GF : Angiographic and Histologic changes in infundibular widening of the Posterior Communicating Artery. *Acta Radiol Diagn (Stockh)* 1 : 321-327, 1963
7. Itakura T, Ozaki F, Nakai E, Fujii T, Hayashi S, Komai N : Bilateral aneurysm formation developing from junctional dilatation (infundibulum) of the posterior communicating artery : Case report. *J Neurosurg* 58 : 117-119, 1983
8. Kang SD : True posterior communicating artery aneurysm. *J Korean Neurosurg Soc* 26 : 1007-1010, 1997
9. Kawanishi M, Sakaguchi I, Miyake H : Occlusion of the posterior communicating artery mimicking cerebral aneurysms : Case report. *Neurolo Res* 25 : 543-545, 2003
10. Marshman LA, Ward PJ, Walter PH, Dossetor RS : The Progression of an Infundibulum to Aneurysm Formation and Rupture : Case Report and Literature Review. *Neurosurgery* 43 : 1445-1449, 1998
11. Ohkuma H, Ebina K, Iwabuchi : Angiographic Study on Infundibular Dilatation of the Posterior Communicating Artery. *Neurol Med Chir (Tokyo)* 25 : 907-914, 1985
12. Patrick D, Appleby A : Infundibular widening of the posterior communicating artery progressing to true aneurysm. *British Journal of Radiology* 56 : 59-60, 1983
13. Patrick D, Appleby A : Familial intracranial aneurysm and infundibular widening. *Neuroradiology* 25 : 329-334, 1983
14. Stuntz JT, Ojemann GA, Alvord EC : Radiographic and histological demonstration of an aneurysm developing on the infundibulum of the posterior communicating artery. *J Neurosurg* 33 : 591-595, 1970
15. Waga S, Morikawa A : Aneurysm Developing on the Infundibular Widening of the Posterior Communicating Artery. *Surg Neurol* 11 : 125-127, 1979
16. Yoshida M, Aneagawa S, Moritaka K : Significance of Infundibular Dilatation in Unexplained Subarachnoid Hemorrhage. *Neurosurgery* 9 : 718-721, 1981
17. Yoshimoto T, Suzuki J : Surgical treatment of an aneurysm on the funnel-shaped bulge of the posterior communicating artery. *J Neurosurg* 41 : 377-379, 1974
18. Young B, Meacham F, Allen JH : Documented enlargement and rupture of a small arterial sacculature : Case report. *J Neurosurg* 34 : 814-817, 1971