

# Spontaneous Subarachnoid Hemorrhage Caused by Ruptured Aneurysm of Basilar Trunk Perforator

Tao Wu  
Yao Wu  
Ailin Chen  
Chungang Dai  
Qing Zhu (✉ [20185233075@stu.suda.edu.cn](mailto:20185233075@stu.suda.edu.cn))


---

## Case report

**Keywords:** Basilar trunk, Perforator artery, Intracranial Aneurysm, therapy

**Posted Date:** June 11th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-32783/v1>

**License:**  This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

---

# Abstract

**Background:** The morbidity of BAPA is very low. Up to now, the pathogenesis and treatment of BAPA are not uniform. Conventional endovascular embolization and craniotomy seem not to be a good choice. We report a case of spontaneous subarachnoid hemorrhage caused by rupture of perforator aneurysm of basal trunk and successfully discharged after conservative treatment, suggesting that conservative treatment may be superior to surgical intervention.

**Case presentation:** A 65-year-old male patient with sudden headache and dizziness for five days was admitted to our hospital for emergency treatment. Spontaneous subarachnoid hemorrhage was diagnosed by DSA. We finally found that hemorrhage Caused by ruptured aneurysm of basilar Trunk perforator.After conservative treatment for two months,DSA showed that the aneurysm disappeared completely.

**Conclusions:** Aneurysm located at perforator artery of basilar trunk was rare and difficult to treat.Conservative treatment for certain cases with periodic angiography follow-up was recommended in order to prevent from potential iatrogenic effects.

## Background

In 1986, van Gijn J et al first reported a group of SAH cases with negative results of DSA.The same feature is that the hemorrhage site on CT is mainly located in the brain cistern around the brain stem.It was speculated that the bleeding was from veins or capillaries,including occult arteriovenous malformations, telangiectasia or small segmental dissection of arteries and so on.Therefore they put forward The concept of "perimesencephalic nonaneurysmal subarachnoid hemorrhage (PNSH)"and This concept has been applied to today[27].The CT images of the cases we reported are also consistent with the characteristics of PNSH,however, we found BAPA through DSA examination,it is suggested that this is one of the causes of the so-called PNSH[6].The morbidity of BAPA is very low, Since the first case reported by Ghogawal Z et al in 1996, only 51 cases have been clearly reported so far(25 documents)[2].Because the lesions are mostly small and there is a thrombus in the aneurysm so that The exact diagnosis is not easy. as in our case, emergency CTA did not show signs of aneurysm, It was concluded that DSA should be an important means to diagnose BAPA, and even multiple DSA reviews are sometimes needed in a short period to confirm the diagnosis[7].

## Case Presentation

The patient was 65 years old. The history of "hypertension" and "diabetes" has been well controlled for many years. Because of "sudden headache, dizziness for five days" emergency admission, there is nausea and vomiting during the course of the disease. Physical examination at admission: conscious, meningeal stimulation positive, no signs of focal neurological deficits. Emergency head CT (computed tomography, CT) showed SAH around the brainstem. Emergency CTA(computed tomography angiography,CTA) showed no obvious aneurysm or vascular malformation. DSA(Digital subtraction angiography ,DSA) showed a small aneurysm of the dorsal perforating branch of the main trunk of the basilar artery, consistent with the site of bleeding. It was considered as a responsible lesion. The diameter of the aneurysm was less than 1.5 mm, and the perforating artery originated from the neck of the aneurysm. After communication with family members of patients, conservative treatment was carried out, and bleeding was absorbed after discharge two weeks later. On re-admission two

months later, the patient was generally in good condition, no more headache attacks, no neurological deficits; reexamination of DSA found that the aneurysm completely disappeared and the perforator remained intact (Fig. 1).

Using "basilar artery", "perforator artery" and "aneurysm" as key words to search Pubmed network database, 45 articles were found. A summary of 25 references to perforating aneurysms of the basilar artery was selected (Table 1).

Table 1  
Document retrieval

First author(Year)	Number of cases	Site*	Treatment	Methods	follow-up(moon)	Prognosis
Ghogawala Z (1996)[2]	1	distal	surgery	Clipping	6	good
Sanchez-Mejia RO (2007)[5]	3	distal	surgery	isolate + resection	Unknown	good
		middle	surgery		Unknown	good
		middle	surgery	isolate + resection	Unknown	good
				isolate + resection		
Mathieson CS (2010)[7]	1	distal	surgery	Clipping+ resection	5	Hydrocephalus Mild memory impairment
Chen L (2012)[9]	2	middle	interventional therapy	Coil embolization	24	hemiplegia
		middle	interventional therapy	Coil embolization	18	hemiplegia
Nyberg EM (2013)[12]	2	middle	interventional therapy	stent-in-stent	14	good
		middle	interventional therapy	stent-in-stent	4	good
Ding D (2013)[13]	3	middle	Conservative treatment	Onyx embolism	Unknown	Cerebral steminfarction
		distal			19	good
		distal	Conservative treatment		22	hemiplegia
			interventional therapy			
Chalouhi N (2014)[15]	1	middle	interventional therapy	flow diverter	6	good

Explanatory note\*: The main artery of the basilar artery is divided into three parts that Are called "the distal segment", "the middle segment", and "the proximal segment".

First author(Year)	Number of cases	Site*	Treatment	Methods	follow-up(moon)	Prognosis
Chavent A (2014)[16]	3	distal	Conservative treatment		6	good
		distal			12	good
		distal	6		good	
			Conservative treatment			
		Conservative treatment				
Forbrig R (2016)[20]	8	distal	Conservative treatment	Onyxembolism	6	Left hemiplegia Dysarthria
		distal	Conservative treatment	Coil embolization	6	good
		distal			60	
		distal	interventional therapy		5	good
		distal	Conservative treatment		23	Hydrocephalus Mild Cognition and gait disorders
		middle			11	Hydrocephalus Right hemiplegia
		middle			15	
		middle	Conservative treatment		78	Hydrocephalus left Hemiplegia
			Conservative treatment			Hydrocephalus Right Hemiplegia
	Conservative treatment			good		
Satti SR (2016)[21]	1	distal	interventional therapy	Overlapping three stents	7	good
Jiang Y (2016)[23]	1	proximal	Electrocoagulation		6	good

Explanatory note\*: The main artery of the basilar artery is divided into three parts that Are called "the distal segment", "the middle segment", and "the proximal segment".

## Discussion And Conclusion

Although the cases reported so far are all caused by SAH, there are no reports of unruptured cases, so the natural history of BAPA is not clear [26]. Because of the small size of the aneurysm, it is difficult to complete superselective artery embolization. Because of the small size of the aneurysm, On the other hand, The aneurysm is

located at the deep end, which makes it difficult to expose. Ischemic events caused by difficulties in perforating perforating branches are all problems to be considered when choosing a treatment plan. However, some cases were found to be self-healing during follow-up, so conservative observation under DSA follow-up was the preferred method in many reports [16]. Rehemorrhage occurred in 6 of the 21 conservative cases reported in the literature (28.57%), of which 2 received microsurgery and 2 received endovascular intervention. (1 case was treated with coil embolization, and 1 case was implanted with flow diverter). 2 cases remained conservative. Of the 4 patients receiving intervention, only 1 recovered well, and the other 3 had neurological dysfunction of varying degrees due to perforator ischemic events. 2 patients who received conservative treatment recovered well. This result proves that the effect of active intervention may not be better than conservative observation [5, 6, 11, 20, 24].

Traditional microsurgical clipping is not the first choice in BAPA. Sanchez-Mejia et al. believed that such lesions usually had no neck of aneurysm, or even a type of vesicular aneurysm, which should be isolated along with the perforating branch of the aneurysmal artery, and the operation of proximal basilar artery control is also very difficult [5]. We had planned to design a three-dimensional printing model before microsurgical clipping of aneurysms [30]. However, a more backward approach to the inferior temporal bone is needed for direct observation of aneurysms during simulated surgery, which increases the risk of injury to the Labbe vein. And the depth of entry is above 7 cm, The surrounding nervous and vascular structures cause narrow operation space. A longer conventional straight aneurysm clip is needed to ensure that the clip does not occlude the field of view, and therefore does not guarantee the exact clipping of the aneurysm and preservation of the perforating artery. (Fig. 2).

The difficulty of endovascular interventional therapy is that superselective microaneurysms with microcatheters are prone to rupture and bleeding, and the perforating arteries are too small to be effectively protected. Of the 3 cases reported in the literature with coils and 2 cases with Onyx embolization, only one had a good recovery from distal perforator aneurysms of the main basilar artery and the rest had hemiplegia of varying degrees caused by perforator ischemic events [9, 13, 20]. Therefore, although it has been reported that the perforator artery as the parent artery can be compensated [29], whether it can be safely occluded remains to be discussed. Another option to consider is stent placement in the basilar artery. The hemodynamic study of aneurysm model showed that the blood flow velocity, eddy current and wall shear stress in the aneurysm cavity were significantly changed after the stent was implanted into the aneurysm neck. And the denser the mesh, the greater the impact [30]. Accordingly, FD seems to be an ideal choice, but this is not the case. The incidence of perforating infarction after posterior circulation aneurysms treated with FD was 14% [31]. Only one of the five FD BAPAs (4 with Pipeline and 1 with SILK) in the literature had no ischemic events. It is suggested that excessive hemodynamic changes may be a risk factor for perforator occlusion [15, 19, 24]. To this end, more patients try to choose the conventional stent-in-stent technique (Enterprise, Neuroform, Leo) for treatment. Half of the 10 reported patients had no definite ischemic events (the other 5 had no definite prognosis), suggesting that this technique may be a better choice for BAPA intervention [12, 21, 26]. However, whether antiplatelet therapy will increase acute hemorrhagic complications remains to be seen in larger cases and longer-term follow-up.

Jiang Y et al. Reported a new method for the treatment of intracranial small aneurysms. When microcatheter is difficult to implant, Only conductive micro-wires (such as Traxcess14) were implanted into the aneurysm cavity, and then electrocoagulated to occlude the aneurysm. They reported a case of proximal basilar artery perforator aneurysm. The aneurysm was not only obscured by this method, but also retained the parent artery [23]. This

approach provides us with a new concept that seems promising to make BAPA's endovascular treatment process more convenient, safe, and cost-effective. However, there is no long-term follow-up study to determine whether the intraluminal thrombosis is stable enough.

## List Of Abbreviations

PNSH: perimesencephalic nonaneurysmal subarachnoid hemorrhage;

BAPA: basilar artery perforator aneurysm;

## Declarations

## Ethics approval and consent to participate

This manuscript was obtained through retrospective collection of data. The article did not expose any personal information related to patients that can be effectively identified. The ethics committee thought that the ethical approval could be exempted, but we did not obtain official documents.

## Consent for publication

A written informed consent has been taken from the patient during interictal period for presenting the clinical data and videos before sending this manuscript to the journal.

## Availability of data and material

All are available in the manuscript.

## Competing interests

The authors declare that they have no competing interests.

## Funding

National Key R&D Program (2016YFC1300700)

Construction Project of Key Medical Disciplines in Jiangsu Province (ZDXKB2016021)

The thirteenth batch of science and technology development plans in Suzhou (2016YFC1300701)

This project is funded by the above three research projects and This is not a competitive application and these funding bodies made no contribution to the study design, collection, analysis and interpretation of data, or in the writing of this manuscript.

# Authors' contributions

Tao Wu: Conception and acquisition of clinical and electronic data and drafting of manuscript. Ailin Chen and Yao Wu: Conception and acquisition of clinical and electronic data and drafting of manuscript. Chungang Dai: Analysis of clinical and electronic data, drafting of manuscript. Qing Zhu: Analysis of clinical and electronic data, drafting of manuscript. All the authors read and approved the manuscript before sending the manuscript to the journal for publication.

# Acknowledgements

Not applicable.

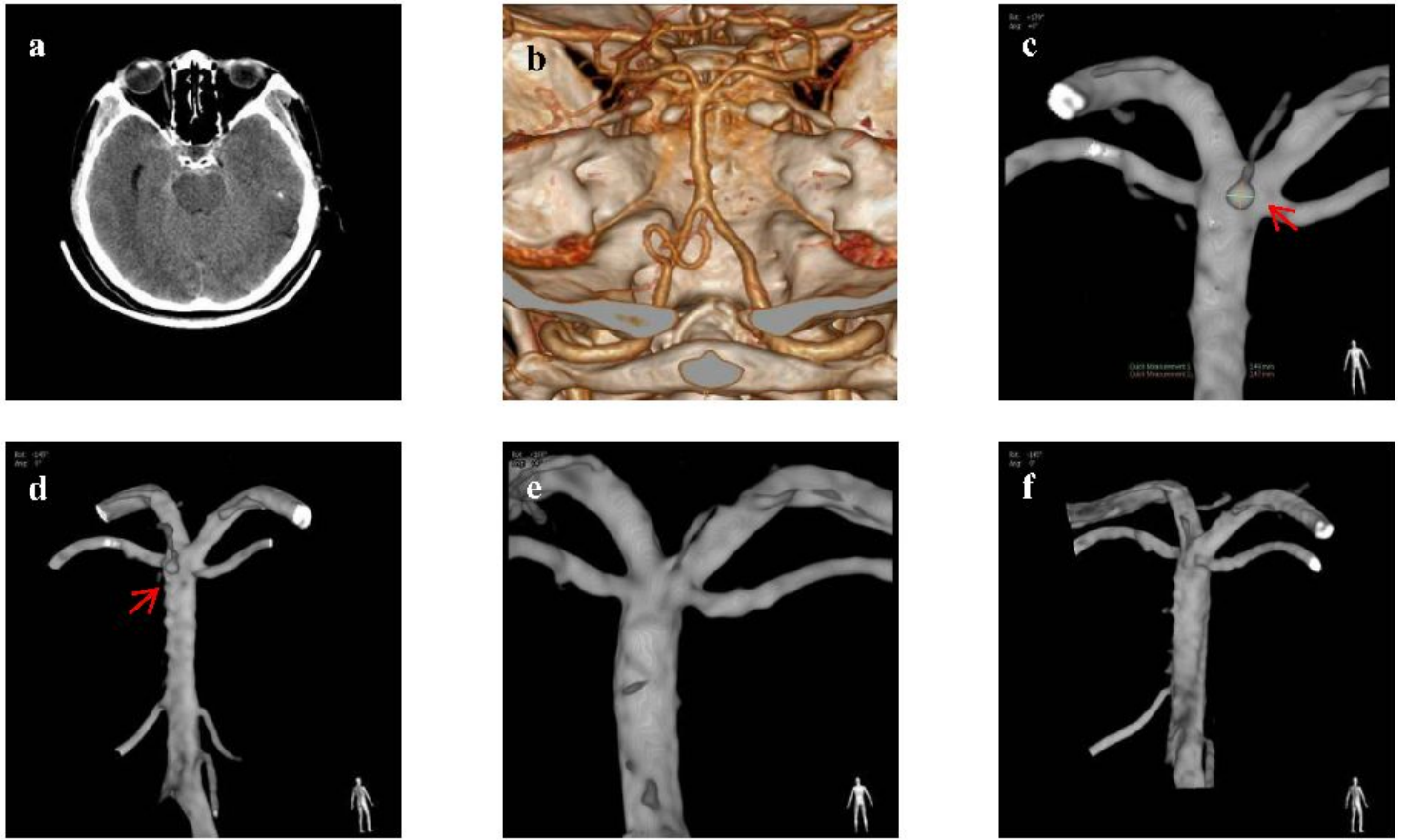
# References

1. Vargas J, Walsh K, Turner R, et al. Lenticulostriate aneurysms: a case series and review of the literature [J]. *J Neurointerv Surg*, 2015;7(3):194-201.
2. Ghogawala Z, Shumacher JM, Ogilvy CS. Distal basilar perforator artery aneurysm: case report [J]. *Neurosurgery*, 1996;39(2):393-396.
3. Hamel W, Grzyska U, Westphal M, et al. Surgical treatment of a basilar perforator aneurysm not accessible to endovascular treatment [J]. *Acta Neurochir (Wien)*, 2005;147(12):1283-1286.
4. Fiorella D, Albuquerque FC, Deshmukh VR, et al. Endovascular reconstruction with the Neuroform stent as monotherapy for the treatment of uncoilable intradural pseudoaneurysms [J]. *Neurosurgery*, 2006;59(2):291-300.
5. Sanchez-Mejia RO, Lawton MT. Distal aneurysms of basilar perforating and circumferential arteries. Report of three cases [J]. *J Neurosurg*, 2007;107(3):654-659.
6. Park SQ, Kwon OK, Kim SH, et al. Pre-mesencephalic subarachnoid hemorrhage: rupture of tiny aneurysms of the basilar artery perforator [J]. *Acta Neurochir (Wien)*, 2009;151(12):1639-1646.
7. Mathieson CS, Barlow P, Jenkins S, et al. An unusual case of spontaneous subarachnoid haemorrhage - a ruptured aneurysm of a basilar perforator artery [J]. *Br J Neurosurg*, 2010;24(3):291-293.
8. Deshaies EM, Jacobsen W, Krishnamurthy S. Enterprise stent-within-stent embolization of a basilar artery perforator aneurysm [J]. *World J Neurosci*, 2011;1(3):45-48.
9. Chen L, Chen E, Chotai S, et al. An endovascular approach to ruptured aneurysms of the circumferential branch of the basilar artery [J]. *J Clin Neurosci*, 2012;19(4):527-531.
10. Gross BA, Puri AS, Du R. Basilar trunk perforator artery aneurysms. Case report and literature review [J]. *Neurosurg Rev*, 2013;36(1):163-168.
11. Apok V, Tarnaris A, Brydon HL. An unusual aneurysm of a basilar perforating artery presenting with a subarachnoid haemorrhage [J]. *Br J Neurosurg*, 2013;27(1):105-107.
12. Nyberg EM, Chaudry MI, Turk AS, et al. Report of two cases of a rare cause of subarachnoid hemorrhage including unusual presentation and an emerging and effective treatment option [J]. *J Neurointerv Surg*, 2013;5(5):e30.



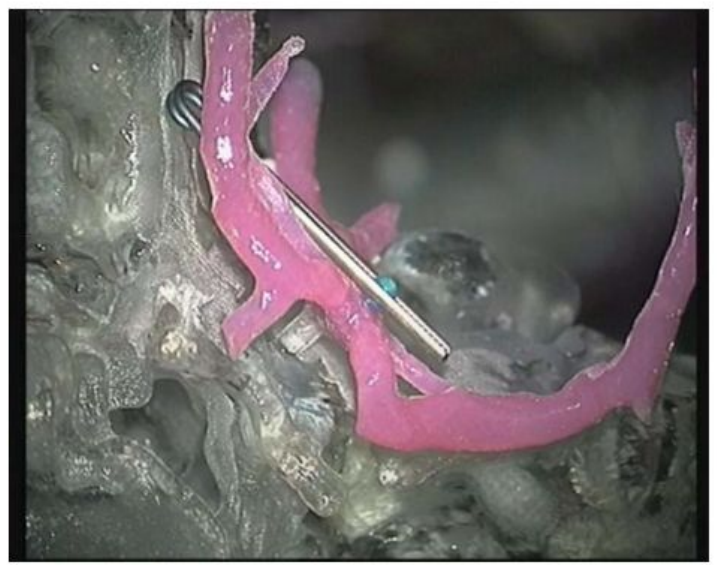
13. Ding D, Starke RM, Jensen ME, et al. Perforator aneurysms of the posterior circulation: case series and review of the literature [J]. *J Neurointerv Surg*, 2013;5(6):546-551.
14. Sivakanthan S, Carlson AP, van Loveren H, et al. Surgical clipping of a basilar perforator artery aneurysm: a case of avoiding perforator sacrifice [J]. *J Neurol Surg A Cent Eur Neurosurg*, 2015;76(1):79-82.
15. Chalouhi N, Jabbour P, Starke RM, et al. Treatment of a basilar trunk perforator aneurysm with the pipeline embolization device: case report [J]. *Neurosurgery*, 2014;74(6):E697-701.
16. Chavent A, Lefevre PH, Thouant P, et al. Spontaneous resolution of perforator aneurysms of the posterior circulation [J]. *J Neurosurg*, 2014;121(5):1107-1111.
17. Kim YJ, Ko JH. Sole stenting with large cell stents for very small ruptured intracranial aneurysms [J]. *Interv Neuroradiol*, 2014;20(1):45-53.
18. Daruwalla VJ, Syed FH, Elmokadem AH, et al. Large basilar perforator pseudoaneurysm: A case report [J]. *Interv Neuroradiol*, 2016;22(6):662-665.
19. Peschillo S, Caporlinqua A, Cannizzaro D, et al. Flow diverter stent treatment for ruptured basilar trunk perforator aneurysms [J]. *J Neurointerv Surg*, 2016;8(2):190-196.
20. Forbrig R, Eckert B, Ertl L, et al. Ruptured basilar artery perforator aneurysms—treatment regimen and long-term follow-up in eight cases [J]. *Neuroradiology*, 2016;58(3):285-291.
21. Satti SR, Vance AZ, Fowler D, et al. Basilar artery perforator aneurysms (BAPAs): review of the literature and classification [J]. *J Neurointerv Surg*, 2017;9(7):669-673.
22. Aboukais R, Zairi F, Estrade L, et al. A dissecting aneurysm of a basilar perforating artery [J]. *Neurochirurgie*, 2016;62(5):263-265.
23. Jiang Y, Luo J, Zheng J, et al. Endovascular pure electrocoagulation of intracranial perforator blister-like aneurysm not accessible to microcatheter—New approach to treat small vessel hemorrhage disease [J]. *Int J Stroke*, 2016;11(5):NP60-61.
24. Finitsis S, Derelle AL, Tonnelet R, et al. Basilar Perforator Aneurysms: Presentation of 4 Cases and Review of the Literature [J]. *World Neurosurg*, 2017;97:366-373.
25. Buell TJ, Ding D, Raper DMS, et al. Posterior circulation perforator aneurysms: a proposed management algorithm [J]. *J Neurointerv Surg*, 2018;10(1):55-59.
26. Chau Y, Sachet M, Sédat J. Should we treat aneurysms in perforator arteries from the basilar trunk? Review of 49 cases published in the literature and presentation of three personal cases [J]. *Interv Neuroradiol*, 2017 [Epub ahead of print].
27. van Gijn J, van Dongen KJ, Vermeulen M, et al. Perimesencephalic hemorrhage: a nonaneurysmal and benign form of subarachnoid hemorrhage [J]. *Neurology*, 1985;35(4):493-497.
28. Lan Q, Chen A, Zhang T, et al. Development of Three-Dimensional Printed Craniocerebral Models for Simulated Neurosurgery [J]. *World Neurosurg*, 2016;91:434-442.
29. Marinković SV, Gibo H. The surgical anatomy of the perforating branches of the basilar artery [J]. *Neurosurgery*, 1993;33(1):80-87.
30. Cantón G, Levy DI, Lasheras JC, Nelson PK. Flow changes caused by the sequential placement of stents across the neck of sidewall cerebral aneurysms [J]. *J Neurosurg*, 2005;103(5):891-902.
31. Phillips TJ, Wenderoth JD, Phatouros CC, et al. Safety of the pipeline embolization device in treatment of posterior circulation aneurysms [J]. *AJNR Am J Neuroradiol*, 2012;33(7):1225-1231.

## Figures



**Figure 1**

Image data of the case. a: SAH around brain stem was confirmed by head CT scan after onset. b: Emergent CTA did not demonstrate definite source of hemorrhage. c-d: 3DRA suggested a tiny aneurysm localized at posterior perforator artery of rostral basilar trunk. e-f: The lesion disappeared from DSA during 2 months follow-up with preservation of parent perforator artery.



**Figure 2**

Simulation procedure on printed three dimension model. a: Subtemporal keyhole approach of right side. The depth of aneurysm is 7 cm. b: The length of visible proximal basilar artery is only 5 mm between petrosal apex and aneurysmal neck from operative view. c: The aneurysm can be clipped by longer clip after retraction of ipsilateral superior cerebellar artery. d: Relationship of clip and surrounding vascular structures after aneurysmal clipping.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [checklist.pdf](#)