·神经介入治疗临床研究·

破裂小脑前下动脉动脉瘤的外科治疗

高恺明 佟小光

【摘要】 **研究背景** 小脑前下动脉动脉瘤临床罕见，破裂出血后果严重。本文回顾分析12例小脑前下动脉动脉瘤患者（共13个动脉瘤）的临床诊断与治疗经过，分析总结其临床特点、影像学表现、手术方法及预后，以为临床提供参考。**方法** 回顾分析2004年6月–2012年6月治疗的小脑前下动脉动脉瘤患者的临床资料。**结果** 12例共13个动脉瘤，约占同期颅内动脉瘤总病例数的0.19%（12/6467），平均年龄54岁。动脉瘤形态以囊状居多（10个），梭形少见（3个）；分别位于小脑前下动脉起始部即小脑前下动脉-基底动脉交界处（3个）、内听道前段（3个，均位于小脑前下动脉第一分叉部）、内听道段（3个）和内听道后段（4个）；动脉瘤直径平均为3.90 mm。其中3例（4个动脉瘤）行外科手术治疗［动脉瘤夹闭术（2例）、孤立术（1例）］，其余9例均行血管内治疗（动脉瘤栓塞术2例、支架辅助动脉瘤栓塞术3例、动脉瘤和载瘤动脉闭塞术4例）。术后并发症包括面瘫（1例）、吞咽困难伴饮水呛咳（1例）和双眼对侧视野缺损（1例）；平均随访36.41个月，Glasgow预后分级3分1例、4分2例、5分9例，均达良好标准。**结论** 小脑前下动脉动脉瘤临床罕见，外科手术治疗者需综合评价手术夹闭与血管内治疗适应证，从而选择最佳治疗方法。

【关键词】 蛛网膜下腔出血； 颅内动脉瘤； 小脑； 显微外科手术； 栓塞，治疗性

Surgical treatment for ruptured anterior inferior cerebellar artery aneurysms

GAO Kai-ming[1], TONG Xiao-guang[2]

[1]*Grade 2010, Graduate School, Tianjin Medical University, Tianjin 300070, China*

[2]*Department of Neurosurgery, Tianjin Huanhu Hospital, Tianjin 300060, China*

Corresponding author: TONG Xiao-guang (Email: tongxg@gmail.com)

【**Abstract**】 **Background** Anterior inferior cerebellar artery (AICA) aneurysm is an extremely rare tumor, which can cause severe results after ruptured. This article retrospectively analyzed the clinical symptoms, imaging manifestations, surgical approaches, endovascular therapy and postoperative outcomes of 12 cases with AICA aneurysms, so as to provide reference for clinical practice. **Methods** Clinical data of patients with AICA aneurysms, who were treated in our hospital between June 2004 and June 2012, were carefully collected and studied. Glasgow Outcome Scale (GOS) scores were used to evaluate the patients' living status. **Results** There were 12 patients (the average age was 54 years old) with 13 ruptured aneurysms, accounting for 0.19% of all aneurysms (6467 cases) treated in the same period. CT showed simple subarachnoid hemorrhage (SAH) in 6 patients, simple ventricular hemorrhage in 1 patient and SAH complicated with ventricular hemorrhage in 5 patients. According to Hunt-Hess Grade, 2 patients were classified as Grade Ⅰ; 7 were Grade Ⅱ; 3 were Grade Ⅲ. Digital subtraction angiography (DSA) showed there were 10 saccular aneurysms and 3 fusiform aneurysms. Three aneurysms were located in the proximal segment of AICA (the junction of AICA and basilar artery), 3 premeatal segment (first bifurcation of AICA), 3 meatal and 4 postmeatal. The mean diameter was 3.90 mm. Three patients with 4 aneurysms were treated with microsurgery, of which clipping was carried out in 2 patients with 3 aneurysms and trapping in 1 case. Other 9 patients were treated with endovascular therapy, of which 2 cases underwent coil embolization, 3 stent-assisted coil, and 4 parent artery occlusion (PAO). Postoperative complications included facial paralysis (1 case), dysphagia and coughing when drinking (1 case) and contralateral hemianopia in both eyes (1 case). Follow-up was available in all of these cases for a mean of 36.41 months, with GOS scores 3 in 1 case, 4 in 2 cases and 5 in 9 cases. All the patients recovered well. **Conclusion** AICA aneurysms are rare. The treatment includes microsurgery and endovascular therapy. For proximal, premeatal and meatal aneurysms, the retrosigmoidal approach is recommended; for the distal ones, the

doi:10.3969/j.issn.1672-6731.2013.03.009

作者单位：300070 天津医科大学研究生院2010级（高恺明）；300060 天津市环湖医院神经外科（佟小光）

通讯作者：佟小光（Email：tongxg@gmail.com）

suboccipital approach with a center incision reverse to the ipsilateral (inverted 7 shaped) would be better for its minimal disturbance to cranial nerves. The endovascular therapy is recommended for all. For premeatal aneurysms, coiling or stent-assisted coiling would be good, even the aneurysms with wide neck are treated well; for distal ones, PAO is effective but the decision should be made very carefully for its potential risk of neurological deficits.

【Key words】 Subarachnoid hemorrhage; Intracranial aneurysm; Cerebellum; Microsurgery; Embolization, therapeutic

小脑前下动脉(AICA)动脉瘤临床十分罕见,其发生率<1%。自Schwartz[1]在1948年首次报告小脑前下动脉动脉瘤以来,截至1989年,全世界仅报道约100例。随着神经影像学诊断技术的发展,尤其是数字减影血管造影术(DSA)的进步和在脑血管疾病的应用,小脑前下动脉动脉瘤的诊断更加容易,因此其患病率亦呈逐年增加之趋势。大多数小脑前下动脉动脉瘤可通过神经外科手术夹闭、孤立术或包裹术治愈,仅极少数患者需行血管重建手术。目前,随着神经介入技术的发展,经血管内行保留载瘤动脉的动脉瘤栓塞术或载瘤动脉闭塞术而不带来任何神经功能障碍已成为可能。天津市环湖医院神经外科近10余年来共诊断和治疗12例小脑前下动脉动脉瘤患者,笔者拟对其发病特点、影像学表现、神经外科手术或血管内治疗方法,以及患者预后等临床资料进行回顾性总结,以期为临床治疗此类疾病提供更好的帮助。

资料与方法

一、一般资料

所有病例均为2004年6月–2012年6月在天津市环湖医院神经外科住院治疗的小脑前下动脉动脉瘤患者,共12例(13个动脉瘤),占同期颅内动脉瘤总病例数的0.19%(12/6467),男性4例,女性8例(9个动脉瘤),其中1例为同侧2个动脉瘤;年龄为45~69岁,平均54岁。所有患者均因动脉瘤破裂出血急诊入院,CT检查显示蛛网膜下隙出血6例、第四脑室出血1例、蛛网膜下隙出血伴脑室出血5例;Hunt-Hess分级Ⅰ级2例、Ⅱ级7例、Ⅲ级3例。入院后经全脑血管造影证实均为小脑前下动脉动脉瘤,其中左侧6个、右侧6个,另一个右侧小脑前下动脉动脉瘤于术中发现;其中囊状动脉瘤10个、梭形动脉瘤3个;分别位于小脑前下动脉起始部(小脑前下动脉-基底动脉交界处,3个)、内听道前段(均位于小脑前下动脉第一分叉部,3个)、内听道段(3个)和内听道后段(4个);动脉瘤直径2.50~9.00 mm,平均3.90 mm,均为中等大小动脉瘤(表1)。手术前Glasgow预后分级(GOS)2例3分、10例4分。12例患者中2例因脑积水于术前行侧脑室穿刺外引流术、1例因术后脑积水于术后行腰大池引流术。手术方式包括动脉瘤夹闭术2例(3个动脉瘤),孤立术1例,以及血管内栓塞治疗9例(单纯动脉瘤栓塞2例、支架辅助动脉瘤栓塞术3例、动脉瘤和载瘤动脉闭塞术4例)。

二、治疗方法

1. 动脉瘤夹闭或孤立术 12例中3例(4个动脉瘤)患者由于椎动脉迂曲、动脉瘤过小或经济原因无法施行经椎动脉小脑前下动脉动脉瘤血管内栓塞治疗,而采取动脉瘤夹闭术或孤立术(表2)。手术方式有:(1)经乙状窦后入路动脉瘤夹闭术1例(内听道段囊状动脉瘤)。经由乙状窦后入路开颅,牵开小脑,保护第Ⅲ、Ⅷ对脑神经(动眼神经、前庭蜗神经),显露小脑前下动脉全程,便于临时阻断并夹闭动脉瘤。(2)经乙状窦后入路动脉瘤孤立术1例(内听道段梭形动脉瘤)。经乙状窦后入路开颅,牵开小脑,显露脑桥小脑角区脑神经及小脑前下动脉内听道段,见小脑前下动脉梭形动脉瘤,瘤壁薄,无明显瘤颈,无法行动脉瘤夹闭术,故行动脉瘤孤立术。(3)经枕下正中右侧倒"7"形切口入路行动脉瘤夹闭术1例(2个动脉瘤)。经枕下正中右侧倒"7"形切口入路,显露小脑前下动脉内听道后段,夹闭动脉瘤,术中发现右侧小脑前下动脉远端2个动脉瘤,均呈动脉壁局部薄弱凸起。术中通过吲哚菁绿荧光血管造影(ICGA)及B超评价动脉瘤夹闭情况及载瘤动脉血流通畅情况。

2. 血管内治疗 本组9例(9个动脉瘤)患者施行血管内治疗(表2),其中2例采用Microplex-10微弹簧圈(美国Microvention公司)行保留载瘤动脉单纯动脉瘤栓塞术;3例分别采用Enterprise(美国Codman公司)或Solitaire AB(美国EV3公司)支架辅

表1 12例小脑前下动脉动脉瘤患者临床资料

Table 1. The clinical features of 12 cases with AICA aneurysms

No.	Sex	Age (year)	Intraventricular hemorrhage	Hunt-Hess Grade	Location	Diameter (mm)
1	Female	64	None	Grade Ⅱ	Origin of AICA	4.00
2	Female	57	None	Grade Ⅱ	Postmeatal segment of AICA	2.50
3	Female	51	None	Grade Ⅱ	Postmeatal segment of AICA	3.00
4	Female	46	Intraventricular hemorrhage	Grade Ⅱ	Meatal segment of AICA	3.50
5	Male	45	Intraventricular hemorrhage	Grade Ⅲ	Origin of AICA	9.00
6	Female	45	None	Grade Ⅱ	Postmeatal segment of AICA	3.00
7	Male	67	None	Grade Ⅰ	Premeatal segment of AICA	2.50
8	Female	46	Intraventricular hemorrhage	Grade Ⅲ	Postmeatal segment of AICA	2.50
9	Male	59	None	Grade Ⅱ	Origin of AICA	3.50
10	Male	58	Intraventricular hemorrhage	Grade Ⅱ	Meatal segment of AICA	4.00
11	Female	51	Intraventricular hemorrhage	Grade Ⅲ	Premeatal segment of AICA	6.00
12	Female	59	Intraventricular hemorrhage	Grade Ⅰ	Premeatal segment of AICA	4.00

AICA, anterior inferior cerebellar artery, 小脑前下动脉

表2 12例小脑前下动脉动脉瘤患者治疗方式及预后

Table 2. The surgical methods and prognosis of 12 cases with AICA aneurysms

No.	Surgical method	Postoperative complication	GOS		Follow-up (month)
			Preoperative	Postoperative	
1	Coil, stent	None	4	5	93
2	Coil, PAO	None	4	5	91
3	Coil, PAO	None	4	5	86
4	Retrosigmoid approach, clipping	None	4	5	70
5	Coil, stent	None	3	5	33
6	Onyx, PAO	Ipsilateral facial paralysis	4	3	25
7	Coil	None	4	5	20
8	Suboccipital approach with a center incision reverse to the ipsilateral (inverted 7 shaped), clipping	None	3	5	8
9	Coil, stent	Ipsilateral occipital lobe infarction	4	4	5
10	Retrosigmoid approach, trapping	dysphagia, coughing when drinking water	4	4	4
11	Coil	None	4	5	1
12	Coil, PAO	None	4	5	1

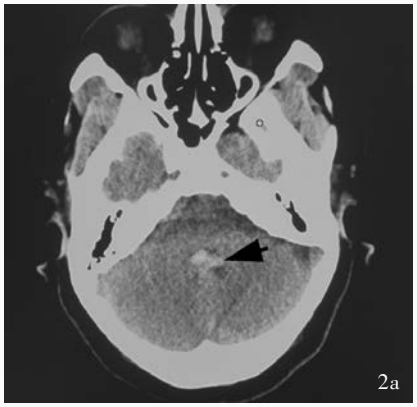
PAO, parent artery occlusion, 载瘤动脉闭塞术; GOS, Glasgow Outcome Scale, Glasgow预后分级

助Microplex-10微弹簧圈行保留载瘤动脉支架辅助栓塞术，先植入支架覆盖动脉瘤段的基底动脉，然后再行微弹簧圈栓塞术；3例应用Microplex-10微弹簧圈行动脉瘤和载瘤动脉闭塞术（2例动脉瘤位于小脑前下动脉内听道后段、1例位于小脑前下动脉内听道前段）；1例小脑前下动脉内听道后段动脉瘤患者，采用Onyx-18（美国EV3公司）完全闭塞动脉瘤和载瘤动脉。本组3例行保留载瘤动脉支架辅助栓塞术的患者，术前一次性口服氯吡格雷300 mg，术后口服阿司匹林100 mg/d和氯吡格雷75 mg/d，连续治疗6个月。

结　果

一、术后影像学检查

本组行动脉瘤夹闭或孤立术治疗的3例患者，术后1周CT血管造影（CTA）检查动脉瘤均未显影，其中行动脉瘤孤立术的患者载瘤动脉近端可见，而远端几乎不显影（图1）；行动脉瘤夹闭术的患者载瘤动脉血流通畅（图2）。经血管内栓塞治疗的9例患者分别于术后即刻、术后5 min和术后20 min时



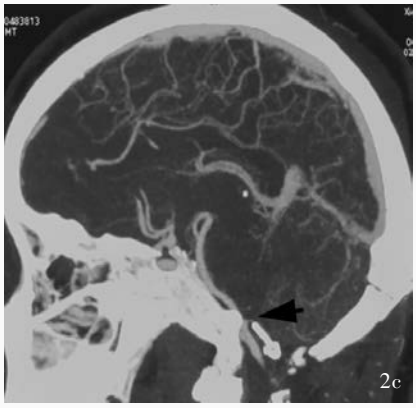


图1　男性患者，58岁。主因剧烈头痛伴恶心、呕吐，于2012年2月5日入院。CT检查显示蛛网膜下隙及第四脑室出血。术前脑血管造影检查显示，动脉瘤位于右侧小脑前下动脉内听道段。选择经右侧乙状窦后入路行动脉瘤孤立术，术后1周CTA可见载瘤动脉近端显示清晰，动脉瘤及小脑前下动脉远端几乎不显影（箭头所示）　**图2**　女性患者，46岁。主因突发性剧烈头痛伴恶心、呕吐10 h，于2011年10月24日入院。临床拟诊：蛛网膜下隙出血。经枕下正中倒"7"形切口入路施行动脉瘤夹闭术　2a　术前头部CT检查显示，蛛网膜下隙及第四脑室出血（箭头所示）　2b　术前选择性右侧椎动脉造影显示动脉瘤位于右侧小脑前下动脉内听道后段（箭头所示）　2c　术后1周CTA显示动脉瘤完全夹闭，载瘤动脉血流通畅（箭头所示）

Figure 1　A 58-year-old male patient was admitted for a sudden onset of headache accompanied by nausea and vomit in February 5, 2012. CT showed SAH and hemorrhage in the fourth ventricle. Preoperative DSA showed an aneurysm in meatal segment of right AICA. A trans-right-retrosigmoid approach surgery was carried on and the aneurysm was trapped. CT angiography (CTA) 1 week after microsurgery showed AICA aneurysm and distal segment of AICA disappeared with clear displaying of the proximal segment of AICA (arrow indicates). **Figure 2**　A 46-year-old female patient was admitted for a sudden onset of headache accompanied by nausea and vomit for 10 h in October 24, 2011 and was diagnosed as SAH. A surgery through trans-suboccipital approach with a center incision reverse to the ipsilateral (inverted 7 shaped) was carried on, and the aneurysm was clipped. Preopetative CT showed SAH and hemorrhage in the fourth ventricle (arrow indicates, Panel 2a). Preoperative DSA showed an aneurysm in postmeatal segment of right AICA (arrow indicates, Panel 2b). CTA 1 week after microsurgery showed the aneurysm was clipped completely and blood flow was fluent in parent artery (arrow indicates, Panel 2c).

行选择性椎动脉造影检查，动脉瘤均未显影（图3）。其中5例行微弹簧圈栓塞或支架辅助动脉瘤栓塞治疗的患者，载瘤动脉血流通畅（图3）；而4例行载瘤动脉闭塞术者，术中椎动脉造影均显示小脑前下动脉闭塞完全，动脉瘤未显影，2例未见周围皮质血管代偿、1例同侧小脑上动脉（SCA）和对侧小脑前下动脉经皮质支代偿供血（图4）、1例载瘤动脉闭塞术后1周MRI检查未发现小脑梗死征像。

二、术后并发症

本组有1例行Onyx-18载瘤动脉闭塞术的患者，术后出现患侧面瘫，考虑为面神经受累，术后2周出院时仍未恢复；1例行动脉瘤孤立术的患者于术后24 h出现吞咽困难伴饮水呛咳，考虑为第Ⅸ对脑神经（滑车神经）受累，经对症、支持治疗症状有所改善，出院时可经口进食，偶有饮水呛咳，1例采取支架辅助动脉瘤栓塞术的患者，术后出现同侧枕叶梗死，双眼对侧偏盲。其余9例患者术后无一例发生手术相关性并发症。有3例患者围手术期因脑积水施行脑室外引流或腰大池引流，1周后拔除引流管，无后遗症。

三、临床转归

回顾分析患者影像学资料及临床表现、治疗方案、术后并发症，并以电话或门诊复查方式进行随访，采用GOS评分评价患者生活质量及神经功能。

12例（13个动脉瘤）患者均采取电话或门诊复查随访，随访1～93个月，平均36.41个月。仅1例血管内栓塞治疗患者术后10个月时脑血管造影检查显示，基底动脉-小脑前下动脉起始部动脉瘤复发。3例发生术后并发症的患者（1例患侧面瘫、1例吞咽困难伴饮水呛咳和1例因存在同侧枕叶脑梗死而表现为双眼对侧偏盲），仅吞咽困难伴饮水呛咳者恢复尚可，另2例症状无明显改善；其余9例均恢复良好（随访过程中有1例复发）。所有患者术后均可正常生活与工作，根据GOS分级，12例患者术后

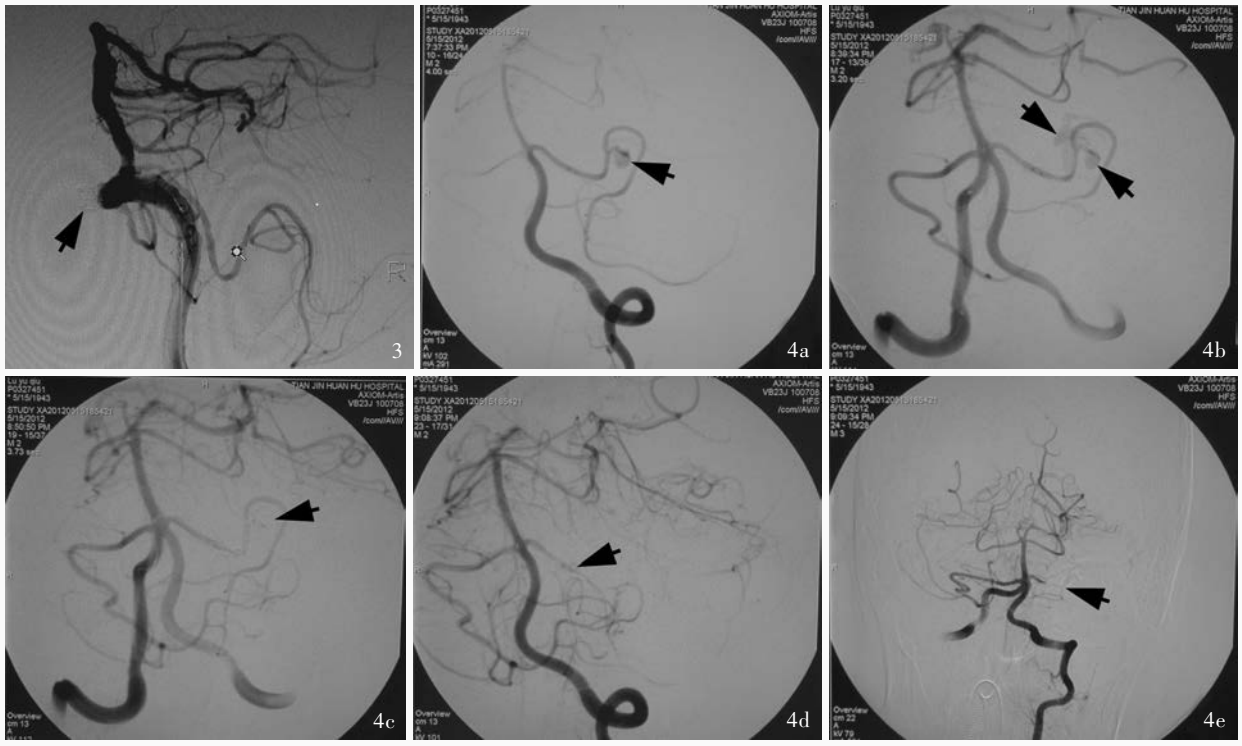


图3 小脑前下动脉动脉瘤支架辅助栓塞术后即刻椎动脉造影显示，支架覆盖动脉瘤瘤颈，基底动脉血流通畅，动脉瘤栓塞满意（箭头所示） **图4** 女性患者，59岁。主因突发头痛伴恶心、呕吐6 h，于2012年5月6日入院。临床拟诊：蛛网膜下隙出血。全脑血管造影后行动脉瘤和载瘤动脉闭塞术 4a 术前左侧椎动脉造影显示动脉瘤位于小脑前下动脉第一分叉部，瘤颈狭窄，由小脑前下动脉头侧干及尾侧干共同供血（箭头所示） 4b 术中植入第1枚Microplex-10型微弹簧圈后动脉瘤破裂，遂继续植入微弹簧圈直至动脉瘤和载瘤动脉闭塞（箭头所示） 4c 动脉瘤和载瘤动脉闭塞术后即刻行左侧椎动脉造影，动脉早期相动脉瘤未显影，小脑前下动脉显影浅淡（箭头所示） 4d 动脉瘤和载瘤动脉闭塞术后即刻左侧椎动脉造影，动脉晚期相动脉瘤未显影，小脑前下动脉远端未显影，左侧小脑上动脉及右侧小脑后下动脉代偿供应原小脑前下动脉供血区（箭头所示） 4e 动脉瘤和载瘤动脉闭塞术后10 min即刻行左侧椎动脉造影，动脉早期相显示左侧小脑前下动脉完全闭塞，左侧小脑前下动脉动脉瘤未显影（箭头所示）

Figure 3 The instant vertebral arteriography after stent-assisted coil showed the stent covered the neck of the aneurysm with good blood flow in basilar artery and satisfactory embolization of aneurysm (arrow indicates). **Figure 4** A 59-year-old female patient was admitted to our hospital for a sudden onset of headache accompanied by nausea and vomit for 6 h in May 6, 2012 and was diagnosed as SAH. The patient underwent DSA and PAO. Preoperative left vertebral arteriography showed an aneurysm located at the first bifurcation of AICA with a narrow neck and supplied by the two branches of AICA (arrow indicates, Panel 4a). The aneurysm ruptured after the first Microplex-10 coil was implanted. Then coiling was continued until the aneurysm and parent artery were completely occluded (arrows indicate, Panel 4b). The vertebral arteriography immediately after coiling and PAO (early time) showed the aneurysm was not developed and AICA was slightly developed (arrow indicates, Panel 4c). The vertebral arteriography immediately after coiling and PAO (late time) showed both the aneurysm and the distal segment of AICA were not developed. The left superior cerebellar artery and right posterior inferior cerebellar artery supplied the area where AICA supplied before (arrow indicates, Panel 4d). The vertebral arteriography 10 minutes after coiling and PAO (early time) showed the left AICA was occluded and the aneurysm was not developed (arrow indicates, Panel 4e).

生活质量分别达GOS评分3分1例（术前2例）、4分2例（术前10例）、5分9例。术后随访结果显示，所有患者生活质量均较术前改善。

讨 论

小脑前下动脉动脉瘤为临床较为少见的颅内动脉瘤，主要发生于小脑前下动脉起始部（小脑前下动脉-基底动脉交界处）和小脑前下动脉远端。1996年，Drake等[2]报告一组41例小脑前下动脉动脉瘤病例（包括小脑前下动脉-基底动脉交界处动脉瘤），均行动脉瘤夹闭术；2004年，Gonzalez等[3]报告1986–2002年诊断与治疗的34例小脑前下动脉动脉瘤病例，约占同期颅内动脉瘤总病例数的1.30%；2012年，Li等[4]报告6例小脑前下动脉动脉瘤，包括1例合并颅内动-静脉畸形（AVMs）的动脉瘤患者，仅占同期颅内动脉瘤总病例数的0.30%，后循环动脉瘤的6%。本组12例（13个动脉瘤）患者约占天津市环湖医院同期诊断与治疗的颅内动脉瘤总病例数的0.19%，包括位于基底动脉上由小脑前下动脉发出、位于小脑前下动脉起始部的动脉瘤，以及

表3 国内文献报道的小脑前下动脉动脉瘤病例一般资料(2005–2012)

Table 3. Cases of AICA aneurysms reported in China from 2005 to 2012

Publication (year)	Author	N	Location of aneurysms	Diameter of aneurysms (mm)	Surgical method	Surgical approach	Prognosis
2005	Sun, et al [8]	1	Inner meatus	3.00	Clipping	Suboccipital retromastoid approach	Ipsilateral deafness and slight facial paralysis
2005	He and You [9]	1	Distal segment of AICA	Unknown	Clipping	Retrosigmoid approach	Ipsilateral facial paralysis and hearing loss (recovered in 3 weeks)
2005	Wang, et al [10]	2	Unknown	Unknown	Clipping	Unknown	Unknown
2006	Li, et al [11]	2	Meatal segment of AICA	3.00	Clipping	Retrosigmoid approach	None
			Distal segment of AICA	20.00	Clipping	Retrosigmoid approach	Ipsilateral facial paralysis and facial numbness
2006	Wu, et al [12]	5	Proximal segment of AICA (2 cases)	3.06	Coil		
				3.67	Coil		
			Opening of meatus (2 cases)	16.00	Clipping	Retrosigmoid approach	Ipsilateral deafness and facial paralysis
				2.78	Clipping	Retrosigmoid approach	None
			Distal segment of AICA (1 case)	4.22	Clipping	Retrosigmoid approach	None
2007	Chen, et al [13]	4	Distal segment of AICA	Unknown	Coil + PAO		None
2008	Ding, et al [14]	2	Unknown	Unknown	Clipping	Suboccipital midline approach	None
2009	Li, et al [15]	2	Unknown	Unknown	Coil		None
2010	Zhou, et al [16]	1	Distal segment of AICA	Unknown	Clipping	Retrosigmoid approach	None
2010	Meng, et al [17]	1	Meatal segment of AICA	10.00	Clipping	Retrosigmoid approach	Ipsilateral facial paralysis and hearing loss
2010	Zhao, et al [18]	1	Inner meatus	Unknown	Clipping	Suboccipital retrosigmoid approach	None
2012	Li, et al [4]	6	Postmeatal segment of AICA	10.00	Clipping	Retrosigmoid approach	Vomit and nystagmus occasionally
			Inner meatus	10.00	Clipping	Retrosigmoid approach	Paralysis of abducent nerve (Ⅵ) & facial nerve (Ⅶ) (recovered in 4 months) and deafness
			Inner meatus	15.00	Clipping	Retrosigmoid approach	Paralysis of facial nerve (Ⅶ) (recovered in 4 months), deafness and tinnitus
			Postmeatal segment of AICA	12.00	Clipping	Retrosigmoid approach	Paralysis of facial nerve (Ⅶ) (recovered in 3 months) and facial hypesthesia
			Premeatal segment of AICA	10.00	Clipping	Far-lateral approach	Slight ataxia (recovered in 6 months)
			Opening of meatus	35.00	Clipping	Retrosigmoid approach	Paralysis of facial nerve (Ⅶ) (recovered in 2 months) and deafness
2012	Shi, et al [19]	1	Unknown	Unknown	Clipping	Unknown	None

PAO, parent artery occlusion, 载瘤动脉闭塞术; AICA, anterior inferior cerebellar artery, 小脑前下动脉

小脑前下动脉行程中的动脉瘤。小脑前下动脉动脉瘤以破裂动脉瘤多见,也有因压迫症状而就诊的较大动脉瘤和伴有血管畸形或硬脑膜动-静脉瘘(DAVF)的未破裂动脉瘤[5-7]。自2005–2012年国内共报道29例小脑前下动脉动脉瘤(表3),其中多为个案,鲜有系统性总结[4,8-19]。

小脑前下动脉多起始于基底动脉中下1/3,较少起于椎动脉,以单干起源多见。小脑前下动脉自基底动脉发出后,于邻近第Ⅶ、Ⅷ对脑神经围绕脑桥走行,近内听道神经和第四脑室外侧孔脉络丛时发

出分支，继而绕小脑中脚表面绒球，供应小脑脑桥裂的上下唇和小脑岩面。通常于近面听神经处分为头侧干和尾侧干，头侧干较尾侧干细小，绕小脑中脚到达水平裂，至小脑中脑裂上唇及其邻近小脑岩面；尾侧干供应小脑岩面下部，以及绒球、脉络丛的一部分，达小脑岩面下部后供应小脑后下动脉（PICA）之供血区[20-21]。一般认为，小脑前下动脉、小脑后下动脉、小脑上动脉之间存在吻合支，小脑前下动脉头支与小脑上动脉分支形成吻合，尾支与小脑后下动脉分支形成吻合支，这些吻合支在正常脑血管造影或相关血管造影检查时显影不明显，但却是小脑前下动脉闭塞后的血供，可否行小脑前下动脉闭塞术及其闭塞后的临床症状均与此相关。当同侧小脑后下动脉或小脑上动脉不发达较为纤细，而以小脑前下动脉作为主干时，小脑前下动脉则可供应原后下动脉和小脑上动脉供血的脑组织区域；同样，当同侧的小脑上动脉和小脑后下动脉呈优势时，闭塞小脑前下动脉后，其供血区域将由上述血管代偿供应，小脑前下动脉供血区发生脑梗死的范围与小脑后下动脉和小脑上动脉的管腔直径成反比[20]。亦有临床研究显示，颈内动脉系统经颞骨可向迷路及耳蜗供血，而吻合支在脑血管造影和手术中极难发现[22]。

表4 小脑前下动脉动脉瘤不同手术入路特点的比较

Table 4. Comparison of different surgical approaches for AICA aneurysms

Surgical approach	Indication	Technical point	Risk of surgery
Subtemporal-middle fossa approach (Kawase approach)	High origin of AICA aneurysm	Cut the tentorium and drill part of the petrosal bone	Drag the temporal lobe and injure the fourth cranial nerve
Retrosigmoid approach	Generally used and good show to the surgery field	Drill part of the petrosal bone and ligature the sigmoid sinus if necessary	Injure the vertebral artery and PICA
Suboccipital approach with a center incision reverse to the ipsilateral (inverted 7 shaped)	Generally used, especially for distal aneurysms in which revasculization is needed	Protect the facial nerve (Ⅶ) and vestibulocochlear nerve (Ⅷ)	Injure the facial nerve (Ⅶ) and vestibulocochlear nerve (Ⅷ)
Transpetrosal approach (transcochlea approach and translabyrinth approach)	Generally used, especially for giant aneurysms with extremely tortuous basilar artery	Drill the cochlea and the labyrinth	High disability rate, deafness and leakage of CSF
Far-lateral approach or combined with retrosigmoid approach	Low origin of AICA aneurysm	Retract the cerebellum	Injure the vertebral artery and PICA
Presigmoid approach	Generally used	Drill part of the cochlea, the labyrinth and the semicircular canal	Injure the lower cranial nerves and PICA

AICA，anterior inferior cerebeller artery，小脑前下动脉；CSF，cerebrospinal fluid，脑脊液；PICA，posterior inferior cerebellar artery，小脑后下动脉

小脑前下动脉根据其不同阶段与内听道之间的关系，可分为内听道前段、内听道段和内听道后段[23]。内听道前段系指自小脑前下动脉起始部至第Ⅶ、Ⅷ对脑神经（面神经、前庭蜗神经）复合体，此段常有发至脑干的穿支动脉发出；内听道段指小脑前下动脉与内听道相关的一段，此段常发出神经相关动脉，如内听动脉（迷路动脉）、回返穿通动脉和弓状下动脉；内听道后段则指内听道以远的小脑前下动脉。小脑前下动脉动脉瘤按其位置不同，分为起始部动脉瘤（小脑前下动脉-基底动脉交界处）、内听道前段动脉瘤、内听道段动脉瘤和内听道后段动脉瘤。对于起始部动脉瘤的治疗与基底动脉中下段动脉瘤相似，内听道前段和内听道段动脉瘤主要采取夹闭术或包裹术，亦可采用血管内栓塞治疗；内听道后段动脉瘤多施以外科手术治疗，亦可通过闭塞载瘤动脉的方法治愈[13,21,24]。小脑前下动脉动脉瘤临床主要表现为蛛网膜下隙出血，其次为动脉瘤压迫所产生的临床症状与体征[7]；CT检查可见蛛网膜下隙和第四脑室出血[25]，小脑前下动脉动脉瘤常伴高血流量病变，例如动-静脉畸形或硬脑膜动-静脉瘘[5,26]。

一、小脑前下动脉动脉瘤手术治疗

小脑前下动脉动脉瘤好发于起始部和小脑脑桥裂外侧面，依据小脑前下动脉起始位置和动脉瘤在动脉走行中的位置，选择适宜的手术入路（表4）。（1）高位起始的起始部动脉瘤：采用眶颧入路经颞下剪开小脑幕，磨除部分岩骨，可满意显露起始部和内听道段，但也存在牵拉颞叶、损伤第Ⅳ对脑神经的风险[2]。（2）正常或低位起始或小脑前下动脉全程动脉瘤：经乙状窦后入路为常用的手术入路，能够简单而直接显露起始部及其全程，术中可见内听道前段位于第Ⅶ、Ⅷ对脑神经之间，但需注意预防损伤外展神经。同时经乙状窦后入路尚可结合经远外侧入路，显露位于椎-基底动脉交界处的低位小脑前下动脉动脉瘤[27]。本组有2例患者采取经乙

状窦后入路施行动脉瘤夹闭术或孤立术，术野显露满意，手术效果良好。(3)内听道后段(远端)动脉瘤：取枕下正中倒"7"字形切口可以满意显露患侧小脑枕面及岩面，以及第Ⅶ、Ⅷ对脑神经复合体和内听道后段小脑前下动脉，并能提供充足的手术视野，方便进行动脉瘤夹闭，甚至可施行小脑前下动脉-小脑后下动脉或枕动脉-小脑前下动脉血管吻合术。本组1例患者即经此入路行动脉瘤夹闭术，共夹闭2个动脉瘤，手术效果良好。(4)动脉瘤体积巨大且基底动脉极度迂曲：经岩骨入路、经耳蜗入路或经迷路入路可提供到达脑干前方的最直接的手术入路，而经迷路入路则能够沿着岩骨从小脑前下动脉起始部至内听道段远端。经乙状窦前幕上下联合入路适用于绝大多数小脑前下动脉动脉瘤，但术中需适度磨除耳蜗、半规管、迷路等解剖结构，要求较高的手术技巧，而且术后并发症较多，如耳聋、面瘫、脑脊液漏等[27]。(5)经前方入路：经口入路、经面部入路等亦是一种显露小脑前下动脉动脉瘤的方法，但鲜见文献报道。

二、小脑前下动脉动脉瘤的血管内治疗

随着神经介入技术及材料的进步，血管内治疗业已成为治疗小脑前下动脉动脉瘤的重要选择。成功的动脉瘤栓塞术取决于动脉瘤瘤腔与瘤颈的比例，以及术中微导管是否能够到达动脉瘤瘤腔，随着电解脱支架和球囊材料的应用，宽颈动脉瘤亦能得到满意的栓塞效果。许多学者认为，已存在脑干受压的大型动脉瘤不宜施行动脉瘤栓塞治疗，但对于夹闭术后瘤颈较窄的复发或残余动脉瘤，或伴动-静脉畸形者，亦可首选动脉瘤栓塞术[28-32]。电解脱微弹簧圈栓塞治疗是目前较为常用的保留载瘤动脉的动脉瘤栓塞方法，而对于瘤颈较宽的动脉瘤则需球囊或支架辅助微弹簧圈栓塞，对于一些巨大型动脉瘤，采用血流导向装置改变血流方向，使动脉瘤自行形成血栓亦是一种可行的血管内治疗方法，但这种方法可能导致载瘤动脉，甚至椎-基底动脉闭塞而引发严重后果。由于上述栓塞方法均存在导致脑组织严重缺血的风险，因此建议术前必须进行球囊闭塞试验(BOT)以明确患者是否能够耐受动脉闭塞所带来的后果，必要时可采用颅内-外血管吻合术提供远端血流[33-35]。此外，尚可采用液体栓塞剂Onyx-18行动脉瘤和载瘤动脉闭塞术[36-37]。本组有1例小脑前下动脉内听道后段动脉瘤患者即以Onyx-18施行动脉瘤和载瘤动脉闭塞术完全闭塞动脉瘤及载瘤动脉，但术后出现患侧面瘫。因此建议谨慎使用Onyx-18液体栓塞剂，因其良好的弥散能力及栓塞彻底可能会完全闭塞脑神经相关动脉及其与其他动脉的吻合支，导致患侧相关神经、内耳、脑组织缺血而造成不良后果。

三、载瘤动脉闭塞术

在严格掌握适应证的情况下，动脉瘤和载瘤动脉闭塞术通常可达到满意效果，对于全身状况较差而无法施行动脉瘤夹闭术且不宜直接行动脉瘤瘤腔栓塞的患者，闭塞载瘤动脉为最佳选择，但是对于位于小脑前下动脉的囊状动脉瘤，则不主张以此法作为首选治疗方案。夹层动脉瘤或梭形动脉瘤，由于小脑前下动脉血管壁较薄，且夹层使动脉瘤更易破裂，因此彻底闭塞载瘤动脉为治疗此类动脉瘤的最佳方案[35]。尽管小脑前下动脉直径较细，无法获得较为满意的球囊闭塞试验结果，但仍建议于术前行球囊闭塞试验以明确小脑前下动脉供血区的代偿供血动脉。一般认为，内听道后段的小脑前下动脉不存在发至脑干的穿支血管，且其远端有较好的吻合丛可以代偿闭塞后段的局部供血。因此对位于内听道段远端的小脑前下动脉动脉瘤，建议施行载瘤动脉闭塞术。

四、血管重建术

累及小脑前下动脉起始部的巨大型基底动脉干动脉瘤或小脑前下动脉远端的梭形动脉瘤，直接行保留载瘤动脉的夹闭术十分困难，当闭塞载瘤动脉存在极高风险时，动脉瘤孤立术辅助载瘤动脉血管重建术不失为合理的选择[38]。一般选择经乙状窦后入路或枕下入路，亦可联合远外侧入路等施行枕动脉-小脑前下动脉端侧吻合术或同侧小脑前下动脉-小脑后下动脉侧侧吻合术，其中以枕动脉-小脑前下动脉端侧吻合术最为常用，因为枕动脉位置表浅且血流量充足[39-40]，而小脑前下动脉-小脑后下动脉侧侧血管吻合术则存在损伤小脑后下动脉的风险。一般建议在术前行多普勒超声检查定位枕动脉走行，术中完成血管吻合后须对动脉瘤进行彻底孤立，以消除因血流动力学改变而带来的动脉瘤破裂的风险[35-36]。此外，术中即刻吲哚菁绿荧光血管造影、超声扫描、神经电生理监测和术中即刻脑血管造影检查等技术，均可使血管重建术获得更为满意的效果和最小的神经损伤。

结 论

由于小脑前下动脉解剖结构的特殊性，小脑前下动脉动脉瘤患者的临床表现也依据动脉瘤在小脑前下动脉走行过程中的位置而异，治疗方法与原则亦有所不同。神经外科手术是治疗小脑前下动脉动脉瘤的常用方法，经乙状窦后入路为经典手术入路。随着血管内治疗技术的不断进步，血管内治疗更多地替代了外科手术治疗，本组病例血管内栓塞术为治疗小脑前下动脉动脉瘤的首选方法(9/12)，仅3例(4个动脉瘤)由于小脑前下动脉迂曲、微导管无法到达理想位置而选择外科手术治疗。对于位于小脑前下动脉内听道后段的小脑前下动脉动脉瘤，通常选择动脉瘤和载瘤动脉闭塞术，但术前应详细评价小脑前下动脉和小脑后下动脉的吻合情况。

参 考 文 献

[1] Schwartz HG. Arterial aneurysm of the posterior fossa. J Neurosurg, 1948, 5:312-316.

[2] Drake CG, Peerless SG, Hernesniemi JA. Surgery of vertebrobasilar anerysms. London, Ontario experience on 1767 patients. New York: Springer, 1996: 329.

[3] Gonzalez LF, Alexander MJ, McDougall CG, Spetzler RF. Anteroinferior cerebellar artery aneurysms: surgical approaches and outcomes-a review of 34 cases. Neurosurgery, 2004, 5:1025-1035.

[4] Li X, Zhang D, Zhao J. Anterior inferior cerebellar artery aneurysms: six cases and a review of the literature. Neurosurg Rev, 2012, 35:111-119.

[5] Lee SH, Koh JS, Bang JS, Kim GK. A case of ruptured peripheral aneurysm of the anterior inferior cerebellar artery associated with an arteriovenous malformation: a less invasive image - guided transcortical approach. J Korean Neurosurg Soc, 2009, 46:577-580.

[6] Figueiredo EG, Gomes MQ, Brito-Neto RV, Paiva WS, Teixeira MJ. A giant partially thrombosed AICA aneurysm. Arq Neuropsiquiatr, 2008, 66(3A):566-568.

[7] Zager EL. Isolated trigeminal sensory loss secondary to a distal anterior inferior cerebellar artery aneurysm: case report. Neurosurgery, 1991, 28:288-291.

[8] Sun ZH, Xu BN, Jiang JL, Qiao GY. A case of distal anterior inferior cerebellar artery aneurysm (intrameatal). Zhonghua Shen Jing Wai Ke Za Zhi, 2005, 21:273.[孙正辉, 许百男, 姜金利, 乔广宇. 小脑前下动脉远端(内听道内)动脉瘤一例. 中华神经外科杂志, 2005, 21:273.]

[9] He M, You C. A case of anterior inferior cerebellar artery aneurysm. Hua Xi Yi Xue, 2005, 20:150.[贺民, 游潮. 小脑前下动脉动脉瘤1例. 华西医学, 2005, 20:150.]

[10] Wang YB, Zhang JW, Ou SW, Liu YH, Wang YJ. The diagnosis and treatment of intracranial posterior circulation aneurysms (with 19 cases report). Zhonghua Shen Jing Wai Ke Za Zhi, 2005, 21:656-658.[王义宝, 张久伟, 欧绍武, 刘云会, 王运杰. 颅内后循环动脉瘤的诊断与治疗(附19例报告). 中华神经外科杂志, 2005, 21:656-658.]

[11] Li ZM, Guo CJ, Geng FY, Zhu JX, Wang YH. Two cases of anterior inferior cerebellar artery aneurysms. Zhongguo Zong He Lin Chuang, 2006, 22:1148.[李忠民, 郭传军, 耿风阳, 朱建新, 王运华. 小脑前下动脉瘤2例报告. 中国综合临床, 2006, 22:1148.]

[12] Wu HX, Sun JD, Qu YM, Xu GM, Li GX, Wang XD. Anterior inferior cerebellar artery aneurysms: report of five cases. Zhonghua Shen Jing Wai Ke Za Zhi, 2006, 22:479-481.[吴洪喜, 孙基栋, 曲元明, 徐广明, 李国新, 王晓东. 小脑前下动脉瘤五例报告. 中华神经外科杂志, 2006, 22:479-481.]

[13] Chen ZQ, Zhang GY, Gu BX, Deng DF, Pan QG, Hai J. Interventional therapy for distal aneurysms of intracranial arteries in the posterior circulation. Zhonghua Shen Jing Wai Ke Za Zhi, 2007, 23:837-839.[陈左权, 张桂运, 顾斌贤, 邓东风, 潘庆刚, 海舰. 颅内后循环远端动脉瘤的介入治疗. 中华神经外科杂志, 2007, 23:837-839.]

[14] Ding JJ, Gao YZ, Chen BD, Deng ZG, He Y, Wu JM, Fu YZ. Microsurgery for intracranial aneurysms in posterior circulation. Zhongguo Lin Chuang Shen Jing Wai Ke Za Zhi, 2008, 13:664-665.[丁建军, 高永中, 陈保东, 邓志刚, 何毅, 伍建民, 付友增. 颅内后循环动脉瘤的显微手术治疗. 中国临床神经外科杂志, 2008, 13:664-665.]

[15] Li ZQ, Liang GB, Tang XH, Lin J, Gao X, Xue HL. Endovascular therapy of posterior circulation aneurysms. Zhonghua Shen Jing Wai Ke Za Zhi, 2009, 25:198-200.[李志清, 梁国标, 唐新华, 林军, 高旭, 薛洪利. 后循环动脉瘤的血管内治疗. 中华神经外科杂志, 2009, 25:198-200.]

[16] Zhou Q, Xiao SW, Tan YF, Zhang CY, Luo Y. Clipping of a aneurysm of anterior cerebellar artery. Zhongguo Shen Jing Jing Shen Ji Bing Za Zhi, 2010, 36:267.[周全, 肖绍文, 谭源福, 张超元, 罗昱. 小脑前下动脉动脉瘤手术夹闭1例. 中国神经精神疾病杂志, 2010, 36:267.]

[17] Meng L, Chen ZB, Ge PL, Ye YH. A case of anterior inferior cerebellar artery aneurysm accompanied by arteriovenous malformation in cerebellopontine angle. Zhonghua Shen Jing Wai Ke Za Zhi, 2010, 26:27.[孟亮, 陈治标, 葛培林, 叶应湖. 小脑前下动脉瘤合并小脑脑桥角区动静脉畸形一例. 中华神经外科杂志, 2010, 26:27.]

[18] Zhao XM, Liang JT, Wan DH, Kuai D, Tong HB, Fan YM, Hao JH. Intracranial posterior circulation aneurysms: clinical characteristics and surgical treatment. Zhonghua Shen Jing Wai Ke Za Zhi, 2010, 26:109-111.[赵学明, 梁建涛, 万大海, 腩东, 仝海波, 范益民, 郝解贺. 颅内后循环动脉瘤的临床特征及显微外科治疗. 中华神经外科杂志, 2010, 26:109-111.]

[19] Shi XE, Zhang YL, Wu B, Zhou ZQ, Sun YM, Liu FJ, Qian H, Fan T, Li ZQ. Microsurgical management of posterior circulation aneurysms. Zhongguo Xian Dai Shen Jing Ji Bing Za Zhi, 2012, 12:48-54.[石祥恩, 张永力, 吴斌, 周忠清, 孙玉明, 刘方军, 钱海, 范涛, 李志强. 后循环动脉瘤显微外科手术治疗. 中国现代神经疾病杂志, 2012, 12:48-54.]

[20] Rhoton AL. The posterior cranial fossa: microsurgical anatomy and surgical approaches. Neurosurgery, 2000, 47(Suppl):29-68.

[21] Peluso JP, Rooij WJ, Sluzewski M, Beute GN. Distal aneurysms of cerebellar arteries: incidence, clinical presentation, and outcome of endovascular parent vessel occlusion. AJNR Am J Neuroradiol, 2007, 28:1573-1578.

[22] Baskaya MK, Coscarella E, Jea A, Morcos JJ. Aneurysm of the anterior inferior cerebellar artery-posterior inferior cerebellar artery variant: case report with anatomical description in the cadaver. Neurosurgery, 2006, 58:E388.

[23] Yamakawa H, Hattori T, Tanigawara T, Sahashi Y, Ohkuma A. Intracanalicular aneurysm at the meatal loop of the distal anterior inferior cerebellar artery: a case report and review of the literature. Surg Neurol, 2004, 61:82-88.

[24] Li J, Liu L, Li MQ. Clinical evaluation of therapeutic measures

forintracranial aneurysms. Zhongguo Xian Dai Shen Jing Ji Bing Za Zhi, 2012, 12:5-10.[李娟, 刘凌, 李梦秋. 颅内动脉瘤治理措施的临床证据评价. 中国现代神经疾病杂志, 2012, 12:5-10.]

[25] Andrade G, Faquini I, Azevedo-Filho H, Laércio J, Câmara D, Mendes JA, Abath C. Dissecting anterior inferior cerebellar artery aneurysm treated by endovascular route: report of three cases and review. Arq Neuropsiquiatr, 2010, 68:645-647.

[26] Menovsky T, André Grotenhuis J, Bartels RH. Aneurysm of the anterior inferior cerebellar artery (AICA) associated with high-flow lesion: report of two cases and review of literature. J Clin Neurosci, 2002, 9:207-211.

[27] BamBakidis NC, Manjila S, Dashti S, Tarr R, Megerian CA. Management of anterior inferior cerebellar artery aneurysms: an illustrative case and review of literature. Neurosurg Focus, 2009, 26:E6.

[28] Saito A, Ezura M, Takahashi A, Yoshimoto T. An arterial dissection of the distal anterior inferior cerebellar artery treated by endovascular therapy. No Shinkei Geka, 2000, 28:269-274.

[29] Suzuki K, Meguro K, Wada M, Fujita K, Nose T. Embolization of a ruptured aneurysm of the distal anterior inferior cerebellar artery: case report and review of the literature. Surg Neurol, 1999, 51:509-512.

[30] Suh SH, Kim DJ, Kim DI. Management of anterior inferior cerebellar artery aneurysms: endovascular treatment and clinical outcome. AJNR Am J Neuroradiol, 2011, 32:159-164.

[31] Santillan A, Gobin YP, Patsalides A, Riina HA, Rosengart A, Stieg PE. Endovascular management of distal anterior inferior cerebellar artery aneurysms: report of two cases and review of the literature. Surg Neurol Int, 2011, 2:95.

[32] Ishii D, Takechi A, Shinagawa K. Endovascular treatment for ruptured distal anterior inferior cerebellar artery aneurusm. Neurol Med Chir (Tokyo), 2011, 50:396-399.

[33] Pisapia JM, Walcott BP, Nahed BV, Kahle KT, Ogilvy CS. Cerebral revascularization for the treatment of complex intracranial aneurysms of the posterior circulation: microsurgical anatomy, techniques and outcomes. J Neurointerv Surg, 2011, 3:249-254.

[34] Ausman JI, Pearce JE, Vacca DF, Diaz FG, Shrontz CE, Patel S. Tandem bypass: occipital artery to posterior inferior cerebellar artery side-to-side anastomosis and occipital artery to anterior inferior cerebellar artery end-to-side anastomosis: a case report. Neurosurgery, 1988, 22:919-922.

[35] Fukushima S, Hirohata M, Okamoto Y, Yamashita S, Ishida S, Shigemori M. Anterior inferior cerebellar artery dissecting aneurysm in a juvenile: case report. Neurol Med Chir (Tokyo), 2009, 49:81-84.

[36] Nishi S, Taki W, Nakahara I, Yamashita K, Sadatoh A, Kikuchi H, Hondo H, Matsumoto K, Iwata H, Shimada Y. Embolization of cerebral aneurysms with a liquid embolus, EVAL mixture: report of three cases. Acta Neurochir (Wien), 1996, 138:294-300.

[37] Gao X, Liang G, Li Z, Wang X, Wei X, Zhang H, Feng S, Lin J. Intra-aneurysmal Onyx embolization for distal aneurysms of the cerebellar arteries. Neurol Res, 2012, 34:211-216.

[38] Xu BN, Wu C. Application of vessel bypass in the treatment of complex intracranial aneurysms. Zhongguo Xian Dai Shen Jing Ji Bing Za Zhi, 2012, 12:3-4.[许百男, 武琛. 血管搭桥技术在颅内复杂动脉瘤治疗中的应用. 中国现代神经疾病杂志, 2012, 12:3-4.]

[39] Ates O, Ahmed AS, Niemann D, Baskaya MK. The occipital artery for posterior circulation bypass: microsurgical anatomy. Neurosurg Focus, 2008, 24:E9.

[40] Tong XG. Therapeutic effectiveness of bypass and trapping treatment for complex intracranial aneurysms. Zhongguo Xian Dai Shen Jing Ji Bing Za Zhi, 2012, 12:26-31.[佟小光, 颅内复杂动脉瘤孤立搭桥术疗效观察. 中国现代神经疾病杂志, 2012, 12:26-31.]

（收稿日期：2012-12-31）

2013年天坛·国际神经外科麻醉论坛征文通知

由首都医科大学附属北京天坛医院、首都医科大学麻醉学系和北京麻醉学会共同主办的“2013年天坛·国际神经外科麻醉论坛（TINAS2013）”拟定于2013年5月17-19日在北京召开。论坛将以“探索、合作、进步”为主题，以更新的视角、更丰富的内容、更高品质的研究成果和创新的组织形式，全面展示神经外科麻醉及神经功能保护领域的前沿理念、技术及方法。届时将围绕颅脑创伤与麻醉、脑血管病与麻醉、脑肿瘤与麻醉、功能神经外科与麻醉、术中神经功能监测与麻醉、唤醒麻醉技术、神经外科麻醉恢复期管理，以及神经科学基础与临床研究等专题进行学术交流与探讨。大会议题包括：神经电生理监测与麻醉；颅脑创伤麻醉管理新进展；脑血管病麻醉管理新进展；介入神经放射学麻醉新进展；脑肿瘤麻醉新进展；癫痫手术术中管理；清醒脑肿瘤切除术；神经外科重症监护；神经科学研究新进展；头面部疼痛治疗；神经外科麻醉相关基础研究。与会者将授予国家级继续医学教育Ⅰ类学分6分。

1. 征文要求　尚未在全国性学术会议或公开发行刊物上发表的论文全文1份，具有科学性、实用性，论点明确、资料可靠，必要时应作统计学处理。采用Word文档或PDF格式进行上传，文稿顺序为题目、单位、作者姓名、电子信箱、正文。凡报送参加论坛交流的论文，请提交1份800字以内的论文摘要，按照目的、方法、结果、结论格式书写，并标注3～5个关键词。

2. 投稿方式　仅接受网上投稿（Email地址：tinasbeijing@gmail.com），请在投稿邮件中注明论文类别。

3. 截稿日期　2013年5月1日。

详情请登录会议网站：www.t-nas.com。