

症状性椎-基底动脉重度狭窄或闭塞致后循环缺血性卒中的血管重建治疗

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【摘要】 目的 探讨慢性椎-基底动脉重度狭窄或闭塞致后循环缺血性卒中血管重建治疗的有效性和安全性。方法 纳入 2018 年 1 月至 2021 年 1 月天津市环湖医院诊断与治疗的 11 例慢性椎-基底动脉重度狭窄或闭塞致后循环缺血性卒中患者,采用 MRI 定位梗死部位,CTA 确定血管狭窄或闭塞部位以及狭窄率,DSA 明确侧支代偿情况,分别行枕动脉-椎动脉(OA-VA)搭桥术、颈外动脉-桡动脉-椎动脉(ECA-RA-VA)搭桥术、枕动脉-小脑后下动脉/小脑前下动脉(OA-PICA/AICA)搭桥术、颞浅动脉-大脑后动脉/小脑上动脉(STA-PCA/SCA)搭桥术等后循环血管重建治疗,采用改良 Rankin 量表(mRS)评价预后。结果 11 例患者经 CTA 确定血管狭窄或闭塞部位,分别位于基底动脉占 2/11,双侧椎动脉 V4 段-基底动脉串联病变占 1/11,双侧椎动脉颅内段占 2/11、颅外段占 1/11,一侧椎动脉颅内段合并对侧颅外段占 4/11,一侧椎动脉起始部闭塞合并另一侧椎动脉纤细占 1/11。DSA 明确侧支代偿情况,代偿血管分别为后交通动脉占 7/11,小脑软膜吻合(包括小脑后下动脉、小脑前下动脉和小脑上动脉)占 5/11,颈升动脉占 4/11,大脑软膜吻合(大脑中动脉-大脑后动脉)占 3/11,脊髓前动脉占 1/11。11 例患者顺利完成血管搭桥术,影像学检查(吲哚菁绿荧光血管造影术、DSA 和 CTA)均提示桥血管通畅。2 例术后并发肺部感染,1 例可疑颅内感染,均经抗生素治疗后好转。11 例患者出院时 mRS 量表中心位评分为 1;术后平均随访 8 个月,9 例预后良好(mRS 评分为 0~1)、2 例预后中等(mRS 评分为 2~3)。结论 血管重建治疗慢性椎-基底动脉重度狭窄或闭塞致后循环缺血性卒中有效性和安全性均较好,具备临床可行性。

【关键词】 椎底动脉供血不足; 卒中; 脑缺血; 脑血管重建术; 脑血管造影术

Cerebral revascularization of symptomatic severe vertebro-basilar artery steno-occlusion with posterior circulation ischemic stroke

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【Abstract】 Objective To explore the efficacy and safety of cerebral revascularization treatment for the posterior circulation ischemic stroke with chronic vertebro-basilar artery steno-occlusion. **Methods** From January 2018 to January 2021, 11 patients with posterior circulation ischemic stroke by chronic vertebro-basilar artery steno-occlusion were diagnosed and treated in Tianjin Huanhu Hospital. We utilized MRI to locate the infarct, CTA to assess the steno-occlusive site and the stenosis rate, and DSA to evaluate the collateral compensation. These patients were treated by using occipital artery (OA)-vertebral artery (VA) bypass, external carotid artery (ECA)-VA bypass with radial artery (RA) graft, OA-posterior inferior cerebellar artery (PICA)/anterior inferior cerebellar artery (AICA) bypass and superficial temporal artery (STA)-posterior cerebral artery (PCA)/superior cerebellar artery (SCA) bypass. The prognosis was assessed

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through modified Rankin Scale (mRS). **Results** The steno-occlusive sites confirmed by CTA were located at basilar artery(BA, 2/11), bilateral vertebr-basilar artery as tander lesions (1/11), intracranial and extracranial segments of bilateral VA (2/11 and 11/11), unilateral intracranial segment of VA with contralateral extracranial segment of VA (4/11), initial segment of unilateral VA with tenderness of contralateral VA (1/11). Collateral patterns confirmed by DSA included posterior communicating artery (PCoA, 7/11), cerebellar pial collateral (5/11; among PICA, AICA and SCA), ascending cervical artery (AA, 4/11), cerebral pial collateral [middle cerebral artery (MCA)-PCA, 3/11] and anterior spinal artery (ASA, 1/11). All the 11 patients underwent bypass operation successfully. Imaging [indoleocyanine green angiography (ICGA), DSA and CTA] suggested bypass vascular patency. Two patients suffered lung infection postoperatively, one patient was suspected with intracranial infection, and all the patients got better after antibiotic treatment. The median mRS score was 1. The mean follow-up time was 8 months. Nine patients had good prognosis at discharge (mRS score 0-1), 2 cases had a medial prognosis (mRS score 2-3). **Conclusions** Cerebral revascularization treatment of chronic symptomatic severe vertebr-basilar artery steno-occlusive with posterior circulation ischemic stroke is effective, safe, and feasible.

【Key words】 Vertebrobasilar insufficiency; Stroke; Brain ischemia; Cerebral revascularization; Cerebral angiography

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后循环缺血性卒中约占全部缺血性卒中的 20%，具有较高的病残率和病死率^[1]。慢性椎-基底动脉狭窄致后循环缺血性卒中若不及时治疗，易出现灾难性小脑或脑干缺血性卒中，病死率 > 70%^[2]。慢性椎-基底动脉狭窄致后循环缺血性卒中仍是目前临床治疗的难点，本研究对近 3 年天津市环湖医院收治的 11 例慢性双侧椎-基底动脉重度狭窄或闭塞致后循环缺血性卒中患者实施血管重建治疗，评价该术式的可行性和安全性，以为临床治疗此类疾病提供参考。

资料与方法

一、临床资料

1. 纳入标准 (1) 参照华法林-阿司匹林治疗症状性颅内动脉狭窄研究(WASID)标准^[3]，经 CTA 证实椎-基底动脉重度狭窄(狭窄率 > 70%)或闭塞。(2) 发病时间 ≥ 2 周。(3) 经规范内科治疗后仍有后循环短暂性脑缺血发作(TIA)或缺血性卒中，如反复发作的头晕、视物模糊、行走不稳、构音障碍等，或者 MRI 证实后循环梗死。(4) 参照美国介入和治疗性神经放射学学会(ASITN)/美国介入放射学学会(SIR)标准^[4]，经 DSA 证实侧支循环分级 < 3 级。(5) 灌注成像(PWI)显示后循环供血区存在广泛低灌注。(6) 所有患者及其家属均对手术方案知情同意并签署知情同意书。

2. 排除标准 (1) 因血管炎、放射性因素等造成的非动脉粥样硬化性颅内动脉狭窄或闭塞。(2) 存

在阿司匹林等相关药物禁忌证。(3) 合并心脏病等其他严重疾病，一般状况较差，无法耐受全身麻醉手术。(4) 合并脑肿瘤、脑出血、非椎-基底动脉系统缺血性卒中。(5) 年龄 ≥ 80 岁。

3. 一般资料 选择 2018 年 1 月至 2021 年 1 月在天津市环湖医院神经外科采用血管搭桥术的慢性双侧椎-基底动脉重度狭窄或闭塞致后循环缺血性卒中患者共 11 例，男性 10 例，女性 1 例；年龄为 50~65 岁，中位年龄 57 岁；发病至手术时间 2~8 个月，中位时间 3 个月；临床主要表现为头晕占 8/11，肢体无力占 6/11，共济失调占 3/11，构音障碍占 2/11，饮水呛咳和肢体麻木各占 1/11；既往合并高血压占 10/11、糖尿病占 4/11、高脂血症占 3/11、冠心病占 2/11，以及吸烟史占 11/11、重度饮酒史占 2/11；入院时改良 Rankin 量表(mRS)评分 1~3，中位评分 2。MRI 证实存在椎-基底动脉分布区梗死，梗死部位分别位于小脑半球占 9/11，脑桥和桥臂各占 3/11，丘脑占 1/11。CTA 确定血管狭窄或闭塞部位，分别位于基底动脉(BA)占 2/11，双侧椎动脉(VA)V4 段-基底动脉串联病变占 1/11，双侧椎动脉颅内段占 2/11、颅外段占 1/11，一侧椎动脉颅内段合并对侧颅外段占 4/11，一侧椎动脉起始部闭塞合并另一侧椎动脉纤细占 1/11；狭窄率 85%~100%，平均(96.35 ± 5.11)%。DSA 明确侧支代偿情况，代偿血管分别为后交通动脉(PCoA)占 7/11，小脑软膜吻合[包括小脑后下动脉(PICA)、小脑前下动脉(AICA)和小脑上动脉(SCA)]占 5/11，颈升动脉(AA)占 4/11，大脑软膜吻

表 1 11例慢性双侧椎-基底动脉重度狭窄或闭塞致后循环缺血性卒中患者的临床资料

Table 1. Clinical data of 11 patients with chronic bilateral severe vertebro-basilar artery steno-occlusion with posterior circulation ischemic stroke

序号	性别	年龄(岁)	发病至手术时间(月)	既往史	临床表现	狭窄或闭塞部位	狭窄率(%)	梗死部位	侧支代偿	血管搭桥方式	mRS评分		
											入院时	出院时	随访
1	男性	52	2	高血压、糖尿病、吸烟史	头晕、肢体无力	BA下段	90	右侧桥臂	左PCoA、左PICA-AICA/SCA	STA-P2	3	1	1
2	男性	54	3	高血压、糖尿病、冠心病、高脂血症、吸烟史	肢体无力	BA下段	97	右侧桥臂、双侧小脑半球	双侧MCA-PCA、右PICA-AICA/SCA	STA-P2+STA-SCA	3	3	2
3	男性	62	8	高血压、吸烟史	头晕	椎-基底动脉交界处	89	右侧脑桥、右侧小脑半球	右PICA-SCA/AICA	STA-SCA	2	1	1
4	男性	63	2	高血压、糖尿病、高脂血症、吸烟史	构音障碍、共济失调、饮水呛咳	双侧VA颅内段	100/100	双侧小脑半球、脑桥	双侧PCoA、ASA	OA-AICA	2	2	2
5	男性	62	7	高血压、糖尿病、吸烟史、饮酒史	头晕、构音障碍、肢体无力	双侧VA颅外段	100/100	右侧桥臂	双侧MCA-PCA	OA-PICA	3	2	1
6	男性	50	3	高血压、吸烟史	头晕	右VA闭塞,左VA颅内段狭窄	90/100	双侧小脑半球、脑桥	左PCoA、右PICA-SCA/AICA	OA-PICA	1	1	1
7	男性	59	3	高血压、冠心病、高脂血症、吸烟史、饮酒史	头晕、肢体无力	右VA起始部闭塞,左VA纤细	92/100	双侧小脑半球	右AA,左PCoA,右PICA-AICA/SCA	OA-VA	3	1	1
8	男性	54	4	高血压、吸烟史	共济失调	左VA颅外段,右VA颅内段	100/100	左侧小脑半球、右侧丘脑	左PCoA、右AA	ECA-RA-VA	1	0	0
9	男性	65	3	吸烟史	头晕、共济失调	双侧VA颅内段	95/100	左侧小脑半球	双侧MCA-PCA	OA-PICA	2	2	1
10	女性	57	3	高血压、吸烟史	头晕、肢体无力	左VA颅内段,右VA颅外段	85/100	双侧小脑半球	右AA,右PCoA	OA-VA	3	1	0
11	男性	52	4	高血压、吸烟史	头晕、肢体无力、麻木	左VA颅外段闭塞,右VA颅内段闭塞、颅外段狭窄	100/100	双侧小脑半球	双侧PCoA、右AA	OA-VA	1	1	1

mRS, modified Rankin Scale, 改良 Rankin 量表; BA, basilar artery, 基底动脉; VA, vertebral artery, 椎动脉; PCoA, posterior communicating artery, 后交通动脉; PICA, posterior inferior cerebellar artery, 小脑后下动脉; AICA, anterior inferior cerebellar artery, 小脑前下动脉; SCA, superior cerebellar artery, 小脑上动脉; ASA, anterior spinal artery, 脊髓前动脉; MCA, middle cerebral artery, 大脑中动脉; PCA, posterior cerebral artery, 大脑后动脉; AA, ascending cervical artery, 颈升动脉; STA, superficial temporal artery, 颞浅动脉; OA, occipital artery, 枕动脉; ECA, external carotid artery, 颈外动脉; RA, radial artery, 桡动脉

合[大脑中动脉(MCA)-大脑后动脉(PCA)]占3/11, 脊髓前动脉(ASA)占1/11。11例慢性双侧椎-基底动脉重度狭窄或闭塞致后循环缺血性卒中患者的临床资料参见表1。

二、研究方法

1. 血管搭桥术 本组主要采取枕动脉(OA)-VA搭桥术、颈外动脉(ECA)-桡动脉(RA)-VA搭桥术、OA-PICA/AICA搭桥术、颞浅动脉(STA)-PCA/SCA搭桥术等后循环血管重建术。(1)OA-VA搭桥术:用于双侧椎动脉起始部或颅外段狭窄或闭塞,通过枕动脉向后循环代偿供血,采取经远外侧入路,患者侧俯卧位,手术切口呈倒“L”形,起自C₃横突水平向上至胸锁乳突肌后缘前方,转向内侧沿上项线至枕骨隆突表面;皮瓣翻向下内侧,胸锁乳突肌翻向乳突前方,切开头夹肌,乳突下方切断头最长肌,翻向下内侧,二腹肌后腹下方附近分离枕动脉并向远端游离,长度3~5cm,覆盖罂粟碱盐水棉条备用;自上项线处切断头半棘肌,翻向中线侧,显露枕下三角,

整体游离并移除上斜肌,下斜肌、头后大小直肌亦翻向中线侧,显露椎动脉,椎动脉大多被枕后静脉丛包绕,需将寰椎(C₁)椎板上、枕骨大孔和寰枕筋膜处覆盖的静脉丛切开,充分游离椎动脉,必要时磨除部分C₁骨质;枕动脉吻合端去除外膜,阻断椎动脉,切开三角形吻合口,将枕动脉与椎动脉吻合,血流朝向颅内(图1)。(2)ECA-RA-VA搭桥术:用于双侧椎动脉闭塞,通过颈外动脉向后循环代偿供血,首先切取桡动脉,患者平卧位,头偏向对侧,对侧上肢外展位,前臂纵行切开皮肤及皮下,肌间分离显露桡动脉,选取中段长约20cm为移植段,离断细小分支结扎,两端切断,将切取的桡动脉浸泡在罂粟碱溶液+低分子量肝素溶液中备用,前臂逐层缝合包扎并留置皮下引流管。切取桡动脉的同时患者仰卧位,头偏向对侧,标记同侧胸锁乳突肌前缘斜行手术切口,分离颈外侧肌群,向外侧牵拉胸锁乳突肌,显露颈动脉鞘,游离同侧颈总动脉、颈外动脉、颈内动脉、颈静脉,分离颈深部肌群包括颈长

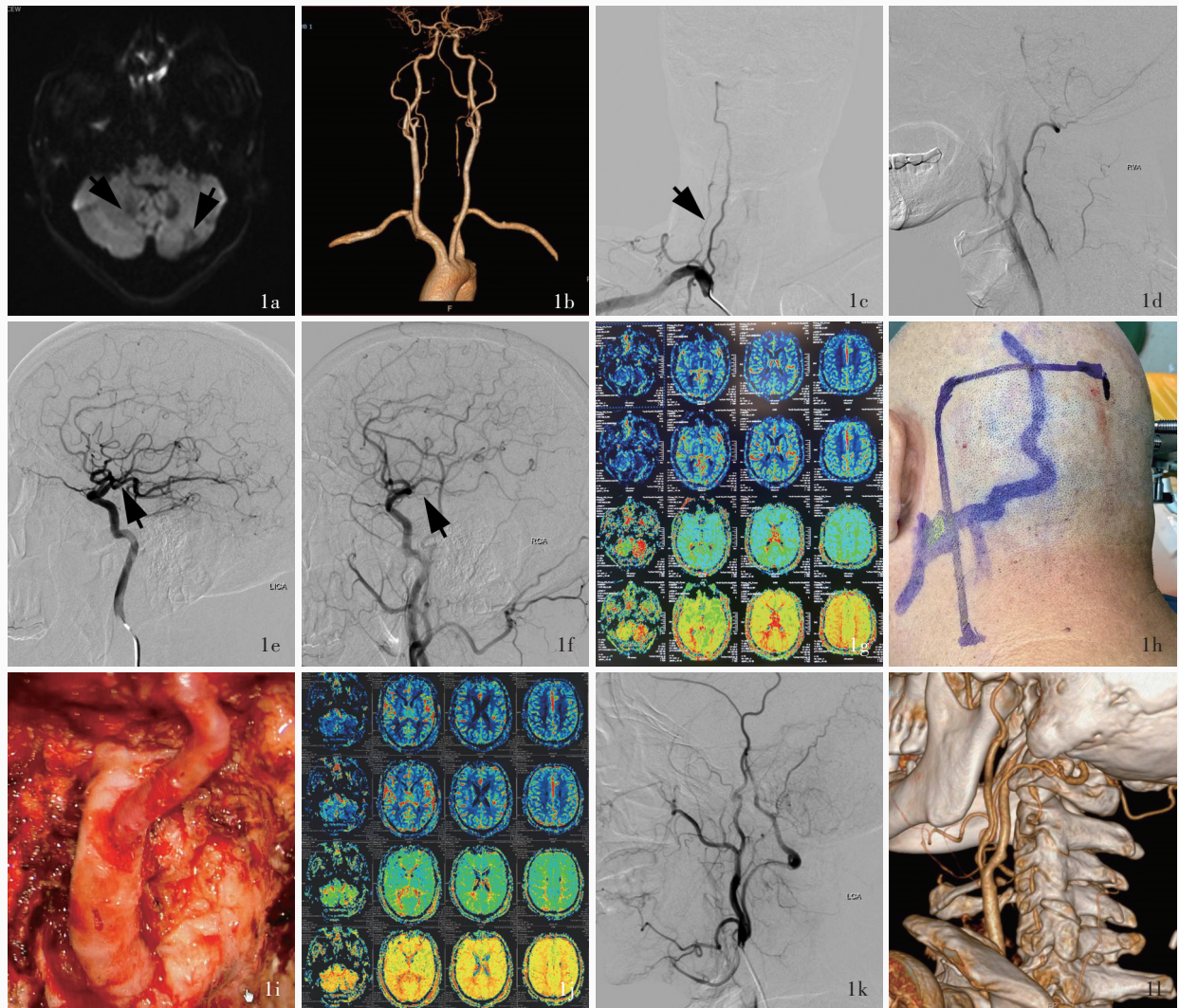


图1 男性患者(例11),52岁,临床诊断为左椎动脉颅外段闭塞,右椎动脉颅内段闭塞、颅外段狭窄,高血压,行左OA-VA搭桥术 1a 术前横断面DWI显示,双侧小脑半球软化灶(箭头所示) 1b 术前CTA显示左椎动脉颅外段闭塞,右椎动脉颅内段闭塞、颅外段狭窄 1c~1f 术前DSA显示双侧后交通动脉、颈升动脉部分代偿(箭头所示) 1g 术前PWI显示,双侧小脑半球及双侧枕叶低灌注,MTT、TTP延迟 1h 描记枕动脉走行,做倒“L”形远外侧入路切口 1i 术中枕动脉与椎动脉吻合 1j 术后7d复查PWI显示双侧小脑半球及枕叶灌注改善 1k 术后7d复查DSA可见椎-基底动脉显影 1l 术后6个月复查CTA显示桥血管通畅

Figure 1 A 52-year-old man with a diagnosis of extracranial occlusion of left VA, intracranial occlusion of right VA, extracranial stenosis of right VA and hypertension underwent left OA-VA anastomosis. Preoperative axial DWI showed focus of malacia in bilateral cerebellar hemispheres (arrows indicate, Panel 1a). Preoperative CTA showed stenosis and occlusion in the intra- and extracranial segments of bilateral VAs (Panel 1b). Preoperative DSA showed bilateral PCoA and AA provided partial compensation (arrows indicate, Panel 1c-1f). Preoperative PWI showed hypoperfusion in bilateral cerebellar hemispheres, the MTT and TTP were delayed (Panel 1g). The course of OA was traced and an inverted "L" shaped distal lateral approach incision was made (Panel 1h). Intraoperative OA-VA anastomosis (Panel 1i). Postoperative PWI 7 d after operation showed perfusion improved apparently in bilateral cerebellar hemispheres and occipital lobes (Panel 1j). Postoperative DSA 7 d after operation showed visualization of VA and BA (Panel 1k). CTA of 6 months after operation showed graft vessel patency (Panel 1l).

肌、头长肌、头前直肌、头外侧直肌等,显露C₃₋₅横突,磨除横突骨质,充分显露同侧椎动脉,临时阻断同侧椎动脉上下端,将移植的桡动脉远端与椎动脉端侧吻合、桡动脉近端与颈外动脉端侧吻合(图2)。(3)OA-PICA/AICA搭桥术:用于椎动脉颅内段闭塞、PWI显示小脑后下动脉供血区低灌注,采取远外

侧入路,枕动脉显露、椎动脉游离同前,所需枕动脉的长度依据小脑后下动脉位置,大多分离至上项线即可;再根据小脑后下动脉位置确定颅骨切开范围,位置较高者骨瓣上方可开至上项线,位置较低者骨瓣开至下项线即可,下方至枕骨大孔、内侧至接近中线、外侧至乙状窦后,以寰枕关节后方为中

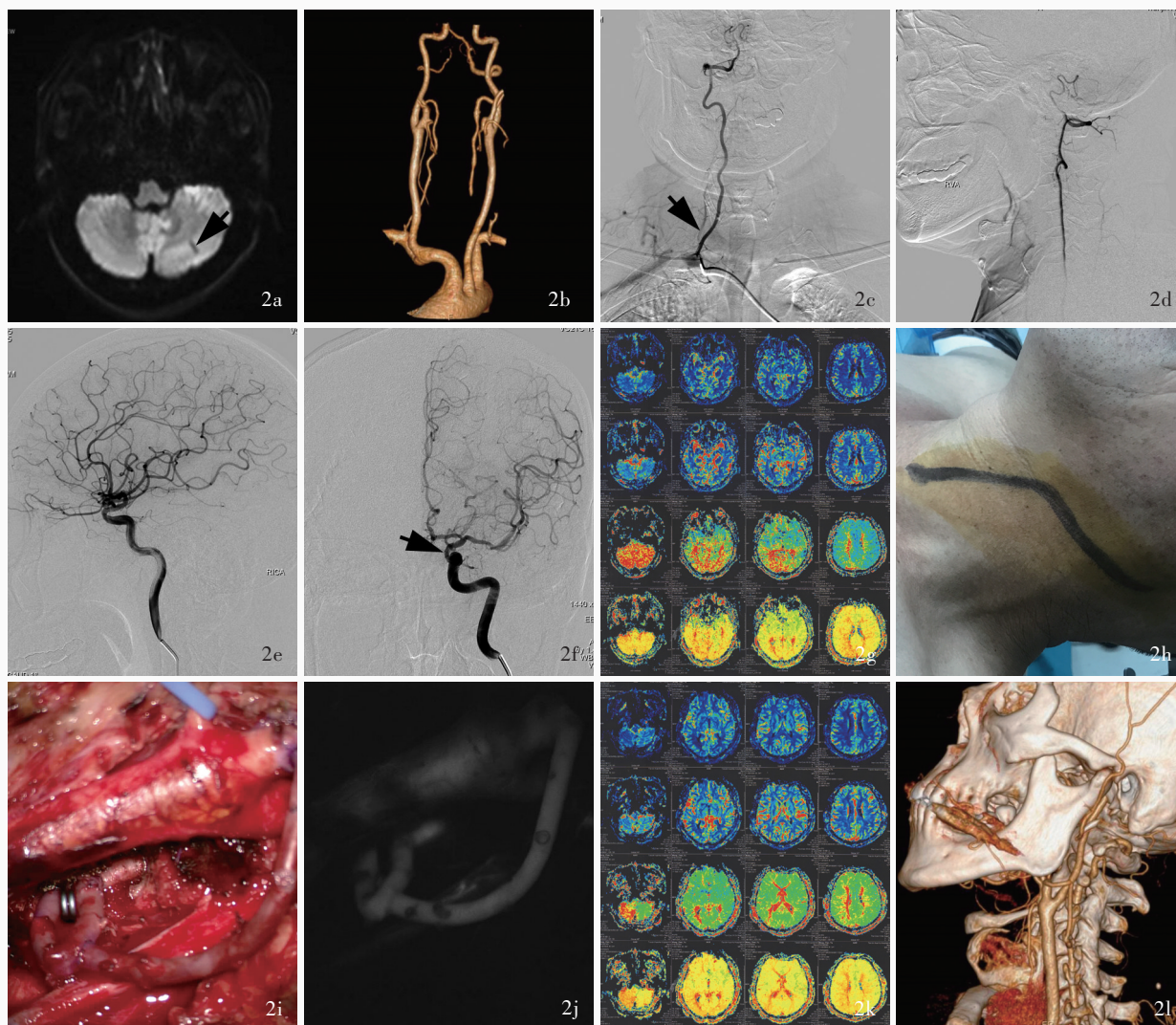


图2 男性患者(例8),54岁,临床诊断为左椎动脉近端闭塞,右椎动脉远端闭塞,高血压,行左ECA-RA-VA搭桥术 2a 术前DWI显示,左侧小脑半球软化灶(箭头所示) 2b 术前CTA显示,左椎动脉近端和右椎动脉远端闭塞 2c~2f 术前DSA显示左后交通动脉和右颈升动脉部分代偿(箭头所示) 2g 术前PWI显示,双侧小脑半球和枕叶低灌注,MTT、TTP延迟 2h 术中标记同侧胸锁乳突肌前缘斜行手术切口 2i 术中颈外动脉-桡动脉-椎动脉吻合 2j 术中ICGA显示桥血管吻合口通畅 2k 术后7d复查PWI显示左侧小脑半球及双侧枕叶灌注明显改善 2l 术后6个月复查CTA显示桥血管通畅

Figure 2 A 54-year-old man (Case 8) with a diagnosis of left proximal VA occlusion and right distal VA occlusion and hypertension underwent left ECA-RA-VA anastomosis. Preoperative axial DWI showed focus of malacia in left cerebellar hemispheres (arrow indicates, Panel 2a). Preoperative CTA showed occlusion in the proximal end of left VA and distal end of right VA (Panel 2b). Preoperative DSA showed left PCoA and right AA provided partial compensation (arrows indicate, Panel 2c-2f). Preoperative PWI showed hypoperfusion in bilateral cerebellar hemispheres and occipital lobes, the MTT and TTP were delayed (Panel 2g). Surgical incisions of anterior margin of sternocleidomastoid (Panel 2h). Intraoperative vascular anastomosis (Panel 2i). Intraoperative ICGA showed anastomosis patency (Panel 2j). Postoperative PWI 7 d after operation showed perfusion improved apparently in left cerebral hemisphere and bilateral occipital lobes (Panel 2k). CTA of 6 months after operation showed graft vessel patency (Panel 2l).

心“C”形切开颅后窝小脑硬膜,释放脑脊液,悬吊硬脑膜,翻向外侧,可见椎动脉入颅处;分离小脑后下动脉,尽可能靠近远端,由于小脑后下动脉起始部发出小分支给延髓背外侧供血,吻合部位尽量靠近起始部,与枕动脉等直径切口,二者间断缝合。若经影像学检查小脑后下动脉不显影或不适宜作受体血管,可同样采取此入路,显露小脑前下动脉,行

OA-AICA搭桥术(图3)。(4)STA-PCA/SCA搭桥术:用于基底动脉重度狭窄或闭塞,采取经颞前入路,患者仰卧位,头向对侧转约30°,颞弓上做弧形切口,长约20cm,分离颞浅动脉主干及额支,离断额支,阻断备用,筋膜间分离皮瓣,显露并离断颞弓,将颞肌连同颞弓一同翻下,骨瓣成形后,磨除蝶骨嵴,骨窗达前中颅底,充分分离外侧裂,将颞极牵向

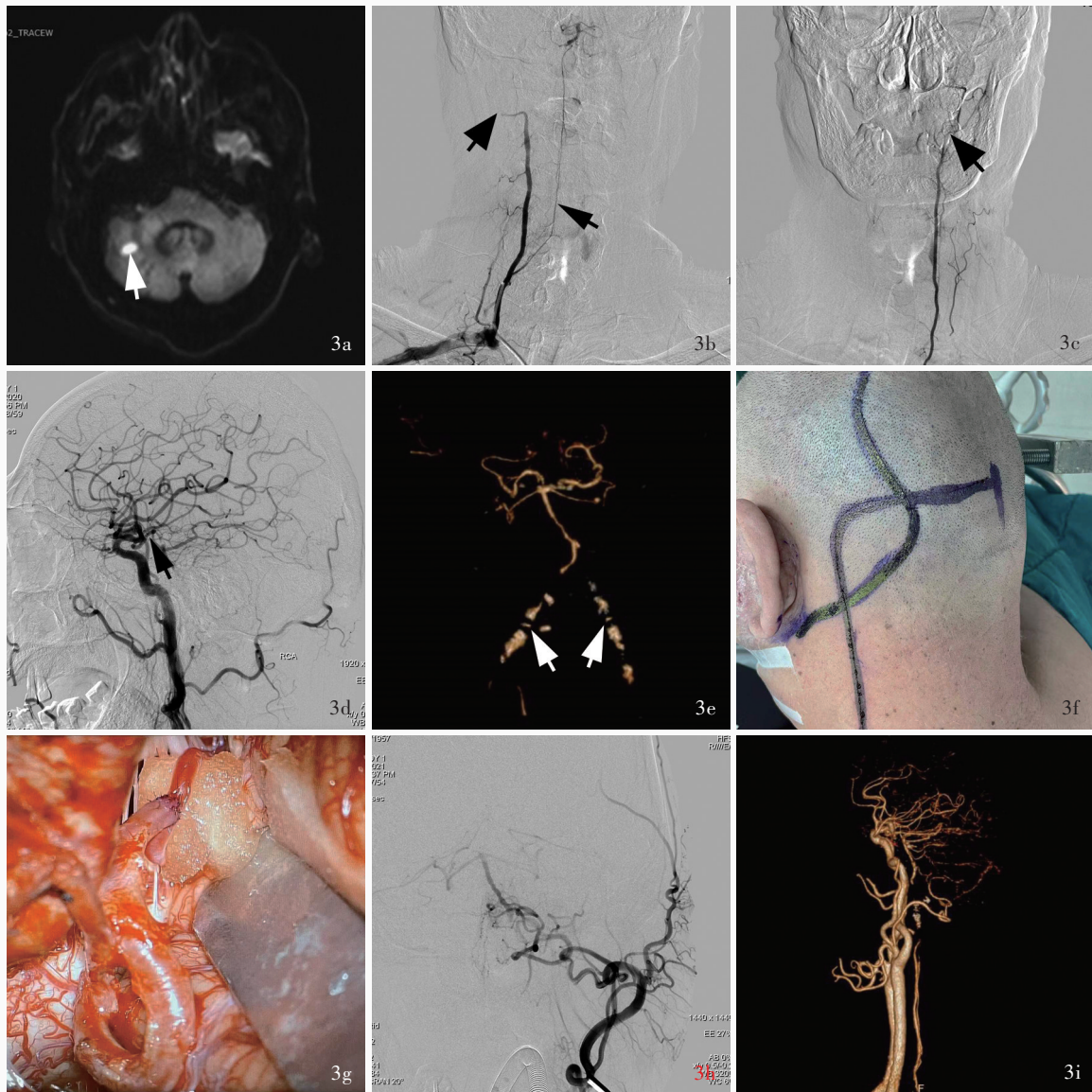


图3 男性患者(例4),63岁,临床诊断为双侧椎动脉V4段闭塞,行OA-AICA搭桥术 3a 术前横断面DWI显示,右侧小脑高信号(箭头所示),提示急性期梗死灶 3b~3d 术前DSA显示双侧椎动脉闭塞(粗箭头所示),侧支循环经后交通动脉、脊髓前动脉代偿(细箭头所示) 3e 术前CTA显示,双侧椎动脉颅内段断续显影,考虑不全闭塞(箭头所示) 3f 描记枕动脉走行,做倒“L”形远外侧入路切口 3g 术中行枕动脉与小脑前下动脉端侧吻合 3h 术后7 d复查DSA,显示桥血管正常,基底动脉显影良好 3i 术后6个月复查DSA三维重建,吻合效果良好

Figure 3 A 63-year-old man (Case 4) with severe stenosis at the V4 segments of bilateral VAs underwent the OA-AICA anastomosis. Preoperative axial DWI showed progressive infarction in the right cerebellum (arrow indicates, Panel 3a). Preoperative DSA showed bilateral VAs occlusion (thick arrows indicate) and collaterals compensated partial flow through PCoA and ASA (thin arrows indicate, Panel 3b-3d). Preoperative CTA showed intracranial segment of bilateral VAs were discontinuous, considering incomplete occlusion (arrows indicate, Panel 3e). Inverted "L" type surgical incision for far lateral approach (Panel 3f). OA-AICA anastomosis (Panel 3g). DSA of 7 d after operation showed graft vessel and BA was normal (Panel 3h). DSA of 6 months after operation showed effect of anastomosis was well (Panel 3i).

后上方,显露大脑后动脉、小脑上动脉、动眼神经。通常将颞浅动脉与大脑后动脉P2段吻合,若结合术前DSA及术中触及的血管弹性显示大脑后动脉粥样硬化斑块明显,也可将颞浅动脉与小脑上动脉吻合(图4)。术中吲哚菁绿荧光血管造影术(ICGA)以

及术后7 d复查DSA或CTA观察桥血管通畅情况。

2. 围手术期处理 术前予阿司匹林 100 mg/d 口服,连续超过 5 d。拟行桡动脉移植的患者术前经 DSA 和 Allen 试验确保桡动脉无明显斑块、狭窄,以及移植后不会造成肢端缺血、坏死。术前 1 d 血管

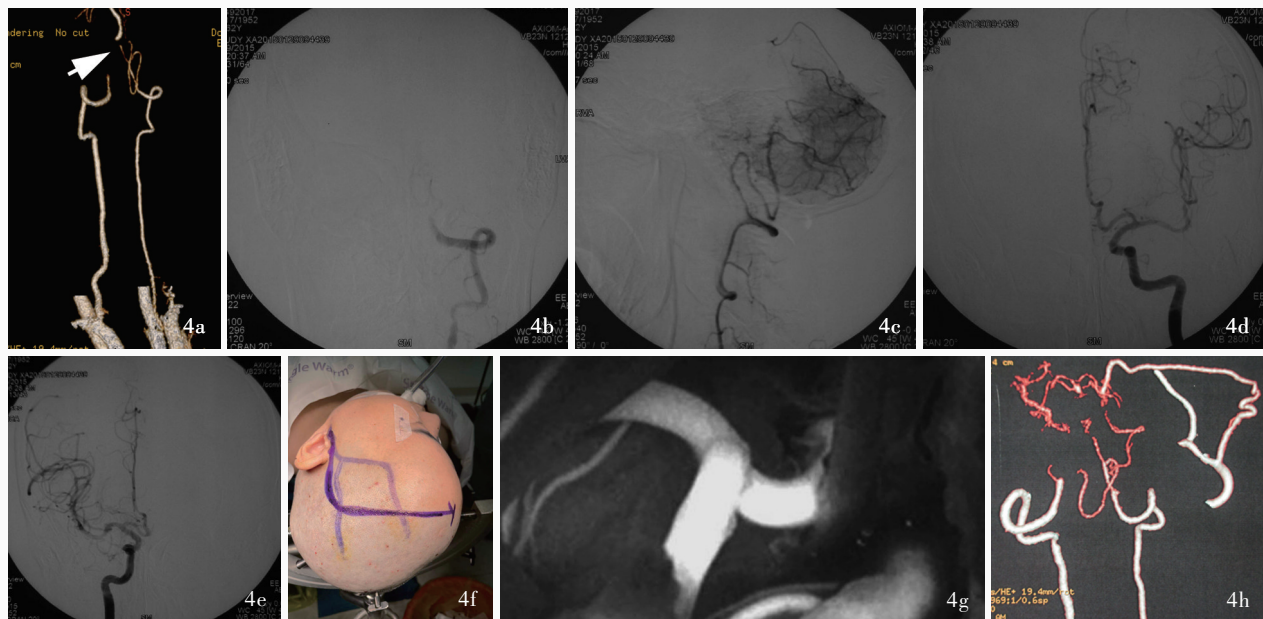


图4 男性患者(例3),62岁,临床诊断为椎-基底动脉交界处重度狭窄,高血压,行右STA-SCA搭桥术 4a 术前CTA显示椎-基底动脉交界处重度狭窄(箭头所示) 4b~4e 术前DSA显示右侧小脑软膜吻合提供少量代偿 4f 术中颧弓上做弧形切口 4g 术中ICGA显示桥血管通畅 4h 术后6个月复查CTA显示桥血管通畅

Figure 4 A 62-year-old man (Case 3) with a diagnosis of severe stenosis in the vertebro-basilar junction and hypertension underwent right STA-SCA anastomosis. Preoperative CTA showed severe stenosis at vertebro-basilar junction (arrow indicates, Panel 4a). Preoperative DSA showed right cerebellar pial collateral provided a small amount of compensation (Panel 4b-4e). An arc incision was made on the zygomatic arch (Panel 4f). Intraoperative ICGA showed anastomosis patency (Panel 4g). CTA of 6 months after operation showed vascular patency (Panel 4h).

超声描记颞浅动脉、枕动脉、桡动脉走行。术后严格控制血压(收缩压120~140 mm Hg, 1 mm Hg = 0.133 kPa),防治缺血-再灌注损伤。术后继续予阿司匹林100 mg/d口服,持续1年。

3. 预后评价 出院后采取门诊和电话随访,所有患者均于出院时和随访期间采用mRS量表评价预后,评分0~1为预后良好、2~3为预后中等、4~5为预后不良^[5]。术后6个月复查CTA观察桥血管长期通畅性。随访期间观察有无短暂性脑缺血发作或缺血性卒中复发。

结 果

本组11例患者顺利完成血管搭桥术,术中ICGA均显示桥血管通畅。3例术后即刻复查DSA,2例桥血管通畅;1例(例2)颞浅动脉分别吻合大脑后动脉和小脑上动脉,大脑后动脉吻合支闭塞,考虑血流动力学尚不稳定,3d后复查CTA显示2支桥血管均通畅。本研究有9例术后3~14d复查DSA、2例复查CTA,均显示桥血管通畅,向后循环供血良好。本组有9例术后2~6d行PWI检查、1例术后10d行CT灌注成像(CTP)检查,9例脑灌注较术前

明显改善,达到或接近未缺血部位的灌注水平、1例脑灌注较术前改善不明显,余1例因自身原因未检查脑灌注。

2例术后并发肺部感染,予痰培养阳性敏感的抗生素静脉滴注持续约1周后好转,其中1例症状较严重者同时行气管切开,病情好转;1例行腰椎穿刺脑脊液检查提示感染可能,但脑脊液细菌培养呈阴性,予间断腰椎穿刺并头孢曲松静脉滴注持续约1周,病情好转。

本组患者出院时mRS评分0~3,中位评分为1。术后随访3~18个月,平均8个月,9例预后良好(mRS评分为0~1)、2例预后中等(mRS评分为2~3),未再出现短暂性脑缺血发作或缺血性卒中。本组有7例患者行门诊影像学(CTA)随访,显示桥血管通畅,前循环向后循环供血良好。

讨 论

约1/4后循环缺血性卒中的病理生理学机制为椎-基底动脉狭窄或闭塞^[6]。动脉粥样硬化是椎-基底动脉狭窄或闭塞的重要病因。新英格兰医学中心后循环登记(NEMC-PCR)研究显示,后循环动脉

粥样硬化病变通常为多发病变,如串联病变、长节段病变及路径迂曲病变等,因此复发率高,血管内介入治疗困难^[7-9]。

侧支代偿作为疾病预后的影响因素,对神经外科医师把握手术指征具有重要意义。本研究结果显示,后交通动脉是最常见的侧支代偿,占 7/11,小脑软膜吻合(包括小脑后下动脉、小脑前下动脉和小脑上动脉)亦较常见,占 5/11,但此种方式并不可靠,难以单独充分发挥代偿作用;对于椎动脉闭塞患者,颈升动脉常发挥重要代偿作用,占 4/11,应引起神经外科医师的重视。

1946 年, Kubik 和 Adams^[10]发表了里程碑文献,首次报告 18 例基底动脉闭塞患者,使神经外科医师逐渐认识到椎-基底动脉闭塞常伴随灾难性后果。研究显示,慢性动脉粥样硬化性椎-基底动脉闭塞患者尽管予以药物治疗,2 年内缺血性卒中复发率仍达 10%~15%^[3,11-14]。Lindsberg 等^[15]进行为期 2.8 年的随访研究显示,经静脉溶栓治疗后,仅 30% 基底动脉闭塞患者预后较满意(mRS 评分 0~2)。众多学者就血管内介入治疗在慢性椎-基底动脉重度狭窄或闭塞中的应用进行了有益尝试,但也面临着诸如脑血管痉挛、支架内再狭窄、血管破裂出血、血栓脱落、高灌注综合征、血栓形成、穿支动脉闭塞等并发症以及手术风险高等弊端。例如, Dashti 等^[16]采用 Wingspan 支架治疗 9 例基底动脉闭塞患者,8 例患者血管成功再通;4 例出现围手术期并发症,包括动脉夹层 2 例、支架内血栓 1 例、穿孔 1 例;4 例死亡,其中 2 例死于围手术期并发症。

血管内支架植入术在椎动脉狭窄病变中得到广泛应用,但研究显示,椎动脉起始部粥样硬化性狭窄行支架植入术后再狭窄率为 10%~45%^[17-18]。Edgeell 等^[19]的多中心研究纳入 148 例椎动脉起始部支架植入术患者,术后平均随访 8.5 个月,再狭窄($\geq 50\%$)率为 15.5%(9/58);而且,与椎动脉颅外段狭窄相比,椎动脉颅内段狭窄患者围手术期缺血性卒中复发率和病死率更高。由此可见,血管内介入治疗在双侧或优势侧椎动脉重度狭窄或闭塞病变特别是后循环常见的串联病变、长节段病变和路径迂曲病变方面仍有其局限性。

本研究分别采取 OA-VA 搭桥术、ECA-RA-VA 搭桥术、OA-PICA/AICA 搭桥术、STA-PCA/SCA 搭桥术等后循环血管重建术治疗慢性椎-基底动脉重度狭窄或闭塞,为此类疾病的治疗提供了可行方案。

应注意的是:(1)术前和术后均需服用阿司匹林,避免桥血管血栓形成。1 例(例 2)术后即刻发生桥血管闭塞,术后 3 天复查 CTA 又显示桥血管通畅,考虑是由于血管搭桥术后短时间内血流动力学不稳定。(2)移植桡动脉前需行 DSA 和 Allen 试验,明确供体动脉条件且避免出现前臂缺血、坏死。(3)为避免出现血管痉挛,较少采用颌内动脉作为供体,移植桡动脉时,多采取打结离断主干小分支血管直至取下桡动脉,避免双极电凝,分离枕动脉时亦应尽可能避免损伤。(4)关于低流量或高流量搭桥的选择,同样是与椎动脉端侧吻合,既有低流量搭桥,亦有移植桡动脉的高流量搭桥,这主要根据术前血流储备能力和缺血严重程度进行综合判断,如果血管搭桥术目的仅是补充血流量,低流量搭桥即可满足,如果是替代优势侧椎动脉,则需高流量搭桥。(5)后循环搭桥术的难点在于手术入路的选择,供体和受体动脉无法充分显露,从而影响手术效果,本研究综合采用经远外侧、颞前入路等方式,这需要结合术前影像学资料、供体动脉与受体动脉之间距离综合判断。(6)术中血管吻合时需罂粟碱盐水反复冲洗管腔,避免桥血管血栓形成,血管吻合后即行 ICGA 造影,若出现显影不良或无法显影证实桥血管血栓形成(多位于吻合口位置),需即刻修整或重新吻合。

1976 年, Ausman 等^[20]完成首例 OA-PICA 搭桥术,之后陆续开展 STA-SCA 等多种搭桥术。尽管后循环血管重建术较前循环血管重建术难度略大,但若经过熟练培训,后循环血管重建术仍是治疗慢性症状性椎-基底动脉重度狭窄或闭塞的安全、可靠的方法。我们在临床实践中还面临诸如颅底肿瘤严重浸润压迫后循环、椎-基底动脉巨大夹层动脉瘤等诸多治疗上的棘手问题,后循环血管重建术具有广阔的应用前景,值得进一步研究。

综上所述,对于慢性双侧椎-基底动脉重度狭窄或闭塞,针对不同的病变部位采取相应的后循环血管重建术,安全、有效,但是本研究样本量较小,尚有待大样本的随机对照试验进一步验证。

利益冲突 无

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