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• 短篇论著 •

## LVIS 支架辅助栓塞宽颈脉络膜前动脉动脉瘤疗效分析

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**〔摘要〕** **目的** 分析低剖面可视化腔内支撑装置(LVIS)辅助栓塞脉络膜前动脉动脉瘤的安全性及治疗效果。**方法** 回顾性分析南昌大学第二附属医院2015年1月至2019年1月行LVIS支架辅助栓塞治疗的31例宽颈脉络膜前动脉动脉瘤患者的临床资料及随访结果。采用颅脑数字减影血管造影(DSA)和Raymond分级评价栓塞效果,以改良Rankin量表(mRS)评分评价预后。**结果** 31例宽颈脉络膜前动脉动脉瘤患者中,破裂动脉瘤22例,未破裂动脉瘤9例,LVIS支架辅助栓塞术均获得成功。栓塞术后即刻颅脑DSA结果显示,Raymond分级I级25例(完全栓塞),II级(次全栓塞)4例,III级(部分栓塞)2例,载瘤动脉均通畅;术后发生缺血并发症4例。术后6~9个月复查颅脑DSA,Raymond分级I级27例,II级3例,III级1例;1例患者脉络膜前动脉轻度狭窄,余脉络膜前动脉均无明显狭窄或闭塞。29例预后良好(mRS评分 $\leq 2$ 分),2例患者预后不良(mRS评分均为3分)。破裂组与未破组患者术后缺血并发症发生率、术后6~9个月完全闭塞率及预后良好率差异均无统计学意义( $P > 0.05$ )。所有患者术后及随访期间均未发生再出血,均未进行再治疗。**结论** LVIS支架辅助栓塞宽颈脉络膜前动脉动脉瘤安全、有效,破裂组与未破裂组疗效无明显差异,但仍需更大样本、多中心研究及长期随访进一步验证。

**〔关键词〕** 脉络膜前动脉动脉瘤;宽颈动脉瘤;LVIS支架;治疗性栓塞**〔中图分类号〕** R 743 **〔文献标志码〕** A **〔文章编号〕** 2097-1338(2022)02-0224-05

## LVIS stent-assisted embolization of wide-necked anterior choroidal artery aneurysms: an analysis of efficacy

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**〔Abstract〕** **Objective** To analyze the safety and efficacy of low-profile visualized intraluminal support (LVIS) stent-assisted embolization for the anterior choroidal artery aneurysms. **Methods** The clinical and follow-up data of 31 patients with wide-necked anterior choroidal artery aneurysms who received LVIS stent-assisted embolization therapy in The Second Affiliated Hospital of Nanchang University from Jan. 2015 to Jan. 2019 were retrospectively analyzed. Cerebral digital subtraction angiography (DSA) and Raymond classification were used to evaluate the embolization effect, and modified Rankin scale (mRS) score was used to evaluate the prognosis. **Results** All the 31 patients with wide-necked anterior choroidal artery aneurysms (including 22 cases of ruptured aneurysms and 9 cases of non-ruptured aneurysms) were successfully treated with LVIS stent-assisted embolization. The results of DSA immediately after embolization showed that 25 aneurysms were presented with Raymond grade I (complete occlusion), 4 with grade II (subtotal occlusion) and 2 with grade III (partial occlusion), parent arteries were unobstructed, and ischemic complications occurred in 4 cases. The results of DSA 6-9 months after embolization showed that 27 aneurysms were Raymond grade I, 3 grade II and 1 grade III, 1 case had a mild stenosis of anterior choroidal artery, and no significant stenosis or occlusion was found in the remaining parent arteries. Twenty-nine patients had a good prognosis (mRS score  $\leq 2$ ), and 2 patients had a poor prognosis (mRS score was 3). There was no significant difference in postoperative ischemic complication incidence, complete occlusion rate or good prognosis rate 6-9 months after embolization between ruptured and non-ruptured groups (all  $P > 0.05$ ). No rebleeding or retreatment occurred during follow-up. **Conclusion** LVIS stent-assisted embolization of wide-necked anterior choroidal artery aneurysms is safe and effective, showing no significant difference between ruptured and non-ruptured groups,

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however, it still needs to be further verified by multicenter trials with large samples and long-term follow-up.

[Key words] anterior choroidal artery aneurysms; wide-necked aneurysms; LVIS stent; therapeutic embolization

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脉络膜前动脉动脉瘤来自脉络膜前动脉起始部(包括脉络膜前动脉)到颈内动脉分叉处,在颅内动脉瘤中约占2%~5%<sup>[1]</sup>。对于宽颈脉络膜前动脉动脉瘤,治疗上主要有支架辅助栓塞和开颅夹闭2种方法,但由于脉络膜前动脉供血区域的重要性及缺乏其他分支代偿,介入栓塞及开颅夹闭均可能造成严重并发症。低剖面可视化腔内支撑装置(low-profile visualized intraluminal support, LVIS)是新一代自膨式编制支架,具有较高金属覆盖率和通过性,广泛应用于颅内宽颈及夹层动脉瘤的治疗<sup>[2-3]</sup>,但在脉络膜前动脉动脉瘤中的应用少有报道。本研究回顾性分析了31例使用LVIS支架辅助栓塞的宽颈脉络膜前动脉动脉瘤患者的临床及随访资料,评价其安全性和有效性。

## 1 资料和方法

1.1 研究对象 回顾性分析南昌大学第二附属医院2015年1月至2019年1月行LVIS支架辅助栓塞治疗的宽颈脉络膜前动脉动脉瘤患者资料。纳入标准:(1)经颅脑数字减影血管造影(digital subtraction angiography, DSA)确诊为脉络膜前动脉动脉瘤;(2)宽颈动脉瘤(瘤颈>4 mm或瘤颈/瘤体>1/2);(3)行LVIS支架辅助栓塞治疗。排除标准:(1)合并其他位置动脉瘤并同时治疗;(2)Hunt-Hess分级<sup>[4]</sup>为Ⅳ或Ⅴ级;(3)不能耐受手术。共纳入31例患者,男11例,女20例;年龄39~79岁,平均(53.4±8.9)岁;破裂动脉瘤22例,未破裂动脉瘤9例;动脉瘤最大直径2.2~11.8 mm,平均(4.7±1.9) mm。

1.2 治疗方法 患者取仰卧位,全身麻醉后消毒铺巾,利用Seldinger技术穿刺股动脉,置入6 F导引导管,行常规DSA及三维重建。选取合适工作角度,在泥鳅导丝引导下置入6 F导引导管,到达同侧颈内动脉末端;微导管尖端塑形后在微导丝引导下到达动脉瘤腔,选择合适弹簧圈成篮,填入适量弹簧圈;选择合适的LVIS支架(Microvention Terumo公司,美国),经支架微导管半释放支架,继续填入弹簧圈,满意后完全释放支架,经DSA检

查显示栓塞满意后,结束手术。择期手术患者术前3 d起给予阿司匹林100 mg/d+氯吡格雷75 mg/d,急诊患者术前给予阿司匹林300 mg+氯吡格雷300 mg。所有患者术后均给予阿司匹林100 mg/d+氯吡格雷75 mg/d至少1个月,然后改阿司匹林100 mg/d至少6个月。

1.3 随访及评估指标 所有患者均于术后复查颅脑CT,必要时行颅脑MRI检查,术后6~9个月行颅脑DSA检查。根据Raymond分级<sup>[5]</sup>评价动脉瘤栓塞效果,Ⅰ级为完全栓塞,Ⅱ级为次全栓塞、瘤颈残留,Ⅲ级为部分栓塞、瘤体残留。采用改良Rankin量表(modified Rankin scale, mRS)评价预后,mRS评分≤2为预后良好,mRS评分>2为预后不良<sup>[6]</sup>。

1.4 统计学处理 应用SPSS 22.0软件进行数据处理。计量资料以 $\bar{x} \pm s$ 表示,组间比较采用独立样本 $t$ 检验;计数资料以例数和百分数表示,组间比较采用Fisher确切概率法。检验水准( $\alpha$ )为0.05。

## 2 结果

2.1 总体疗效 31例患者中,破裂动脉瘤22例(破裂组),未破裂动脉瘤9例(未破裂组),LVIS支架辅助栓塞术均获得成功。栓塞术后即刻颅脑DSA结果显示,Raymond分级Ⅰ级25例、Ⅱ级4例、Ⅲ级2例,载瘤动脉均通畅。发生缺血并发症4例(术中急性血栓形成2例、术后脑梗死2例),其中破裂组3例,未破裂组1例。术后6~9个月复查颅脑DSA,Raymond分级Ⅰ级27例、Ⅱ级3例、Ⅲ级1例;1例患者(破裂组)脉络膜前动脉轻度狭窄,余30例患者脉络膜前动脉均无明显狭窄或闭塞。29例预后良好(mRS评分≤2分),2例患者预后不良(破裂组和未破裂组各1例,mRS评分均为3分)。破裂组与未破裂组患者性别、年龄、动脉瘤最大直径、术后缺血并发症发生率、术后6~9个月完全栓塞率及预后良好率差异均无统计学意义( $P$ 均>0.05,表1)。所有患者术后及随访期间均未发生再出血,均未进行再治疗。

表1 破裂组和未破裂组宽颈脉络膜前动脉动脉瘤患者临床资料比较

| 组别   | N  | 女, n (%)  | 年龄/岁, $\bar{x} \pm s$ | 动脉瘤最大直径/mm, $\bar{x} \pm s$ | 术后缺血并发症, n (%) | 术后6~9个月完全栓塞, n (%) | 术后6~9个月预后良好, n (%) |
|------|----|-----------|-----------------------|-----------------------------|----------------|--------------------|--------------------|
| 破裂组  | 22 | 14 (63.6) | 53.8 $\pm$ 9.6        | 4.6 $\pm$ 2.2               | 3 (13.6)       | 20 (90.9)          | 21 (95.5)          |
| 未破裂组 | 9  | 6 (66.7)  | 52.3 $\pm$ 7.3        | 4.9 $\pm$ 1.0               | 1 (11.1)       | 7 (77.8)           | 8 (88.9)           |
| P值   |    | 1.000     | 0.216                 | 0.068                       | 1.000          | 0.560              | 0.503              |

2.2 典型病例 患者女, 55岁, 因“突发头痛1 d”于2018年7月9日入院。体格检查: 神志清楚, 脑膜刺激征阳性, 余神经系统体格检查无特殊。经CT血管造影检查考虑左侧后交通动脉瘤, 颅脑DSA检查提示左侧脉络膜前动脉动脉

瘤、脉络膜前动脉从瘤颈发出(图1A、1B)。行LVIS支架(3.5 mm $\times$ 15 mm)辅助栓塞, 手术顺利(图1C~1F)。术后6个月复查, 动脉瘤未见明显残留复发, 脉络膜前动脉显影良好(图1G、1H)。

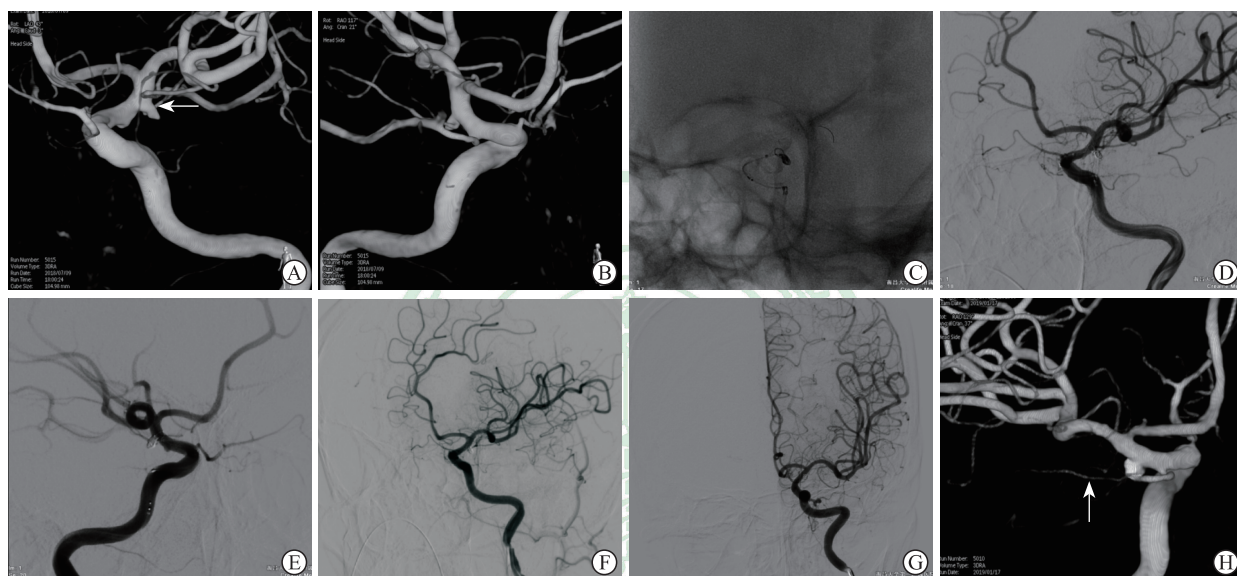


图1 1例左侧脉络膜前动脉动脉瘤患者行LVIS支架辅助栓塞术前、术后影像资料

A,B: 栓塞前三重建, 脉络膜前动脉(箭头所示)从瘤颈处发出;C: 选择合适弹簧圈成篮后填入适量弹簧圈, 输送LVIS支架(3.5 mm $\times$ 15 mm)到位, 半释放支架;D: 半释放支架后造影, 脉络膜前动脉显影良好, 动脉瘤部分残留;E: 继续填入弹簧圈后造影, 栓塞满意, 脉络膜前动脉通畅;F: 完全释放支架后造影, 栓塞满意, 脉络膜前动脉显影良好, 结束手术;G,H: 栓塞术后6个月造影复查, 动脉瘤未见明显残留复发, 脉络膜前动脉(箭头所示)显影良好。

### 3 讨论

脉络膜前动脉动脉瘤临床上少见, 动脉瘤体积较小, 宽颈者多见, 约81.6%~92%直径小于10 mm<sup>[7-8]</sup>。脉络膜前动脉管径细, 平均管径为0.75~1.20 mm<sup>[9]</sup>, 供血内囊、视束等重要部位, 无论介入栓塞还是开颅夹闭都易累及其供血部位而发生严重并发症。LVIS支架是一种新型编织支架, 相比激光雕刻支架具有更好的径向支撑力及顺应性, 可以更好地到达远端动脉或分支血管, 具有更高的孔隙密度和更高金属覆盖率<sup>[10-11]</sup>, 目前已广泛用于颅内宽颈及夹层动脉瘤。与其他支架相比, LVIS支架可获得更高的完全或接近完全闭塞率<sup>[12]</sup>

和更低的症状性血栓栓塞事件发生率<sup>[3]</sup>, 在部分动脉瘤中也可减少术后并发症发生率和致残率<sup>[13]</sup>。本组31例患者术后6个月完全栓塞率为87.1%(27/31)、预后良好率为93.5%(29/31), 略高于Aoki等<sup>[14]</sup>报道的78.4%及90%。

脉络膜前动脉动脉瘤大多瘤腔体积较小, 有时很难达到致密栓塞, 应选择合适大小的弹簧圈成篮, 选择合适大小和长度的支架, 合理控制栓塞密度, 这对提高手术成功率及降低并发症有重要意义。LVIS支架网孔小, 操作中为保持微导管尖端活动度多采用支架半释放或后释放技术。对于累及脉络膜前动脉的动脉瘤不应为追求栓塞效果而过度填塞, 避免过度栓塞造成脉络膜前动脉狭窄或

闭塞。此外,也可在栓塞前于脉络膜前动脉置入微导管,防止弹簧圈移位而影响脉络膜前动脉<sup>[15]</sup>。脉络膜前动脉动脉瘤大多体积较小,LVIS 支架在手术过程中全程可视,除了能防止弹簧圈突入载瘤动脉外,在部分动脉瘤中释放时还可适当推挤、压缩支架,使支架呈“灯笼型”疝入动脉瘤,以增加支架贴壁效果,增加瘤颈处金属覆盖率,促进内皮化,增强血流导向作用,使动脉瘤呈进行性闭塞趋势,但栓塞密度不够也会增加动脉瘤残留复发风险,同样需引起注意。本组 31 例患者均采用支架半释放技术,2 例微小动脉瘤填入弹簧圈后瘤体少许显影(Raymond 分级Ⅲ级),术后 6~9 个月复查,1 例瘤体未显影、瘤颈稍许残留(Raymond 分级Ⅱ级),另 1 例瘤体极少显影(Raymond 分级Ⅲ级),但有进行性闭塞趋势,这与 Cho 等<sup>[16]</sup>报道相符。

支架辅助栓塞治疗的并发症主要有出血并发症和缺血并发症。出血并发症少见,本组 31 例患者中无出血并发症。但缺血并发症并不少见,可能与动脉瘤位置、大小、破裂与否有关。Cho 等<sup>[7]</sup>根据动脉瘤与脉络膜前动脉的关系将其分为 A 型(完全起自脉络膜前动脉)、J 型(起自脉络膜前动脉起始处)和 I 型(起自脉络膜前动脉远端颈内动脉),其中 A 型临床上少见且多与烟雾病有关,J 型多见并且易引起缺血并发症,本组 4 例发生缺血并发症的患者均为 J 型动脉瘤。对于体积小的动脉瘤尤其微小动脉瘤,微导管到位困难,栓塞过程中动脉瘤破裂率也较高<sup>[17]</sup>,尽管 LVIS 支架一定程度上可以弥补非 LVIS 支架不足,但也存在难以致密栓塞或过度栓塞造成动脉瘤破裂的风险。André 等<sup>[18]</sup>研究发现,脉络膜前动脉动脉瘤术后发生缺血并发症的患者,动脉瘤的体积更小,进一步证实了动脉瘤大小与术后缺血并发症的相关性。此外,LVIS 支架在国外主要用于未破裂动脉瘤<sup>[2]</sup>,在急性破裂动脉瘤中可能增加血栓相关风险,但国内田涛等<sup>[19]</sup>的研究表明,LVIS 支架在破裂动脉瘤中安全可行。本组 31 例患者中破裂组和未破裂组完全栓塞率、预后良好率及缺血并发症发生率差异均无统计学意义,与田涛等<sup>[19]</sup>的报道相符。本组 31 例患者中有 4 例出现缺血并发症,其中 2 例为术中急性血栓形成。由于术中可以明确观察动脉通畅性,一般可以避免手术造成的脉络膜前动脉狭窄。对于

术中急性血栓形成,除了术中使用替罗非班等药物外,术后 3 d 内可考虑联合使用低分子肝素,本组 4 例缺血并发症患者,栓塞术后即刻造影显示脉络膜前动脉均通畅、无狭窄,术后 6~9 个月造影复查,除 1 例患者脉络膜前动脉轻度狭窄外均通畅。此外,脉络膜前动脉细长,供血部位重要,血管轻微痉挛也可能引起严重症状,术中、术后应用尼莫地平预防血管痉挛的同时需注意保持一定灌注。

本研究回顾性分析了 LVIS 支架治疗宽颈脉络膜前动脉动脉瘤的疗效和并发症,结果表明 LVIS 支架辅助栓塞安全、可行,在破裂和未破裂宽颈脉络膜前动脉动脉瘤中疗效和并发症无明显差异。但本组样本量较小、随访时间短,研究结果需多中心、大样本数据和长期随访进一步证实。

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