

颈静脉孔区颅内静脉窦血管造影及临床意义分析

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【摘要】 研究背景 通过综合分析颈静脉孔区颅内静脉窦血管造影术影像学表现,探讨颅内静脉窦支架植入困难或失败原因,并寻找可预测静脉窦狭窄支架植入困难的临床指标,以提高手术成功率。**方法** 对 118 例接受颅内静脉窦支架植入术患者(窦狭窄伴颅内高压 87 例、窦狭窄致搏动性耳鸣 31 例)的临床资料进行回顾,分析颈静脉孔区静脉窦两个转折夹角及静脉窦直径对支架植入技术成功的影响。**结果** 共 115 例患者术中支架植入成功,3 例因支架植入困难而导致手术失败。颈静脉孔区静脉窦为连接乙状窦和颈内静脉的过渡结构,侧位脑血管造影呈典型“N”形结构,支架植入成功者静脉窦两个转折夹角之和为 $(120.11 \pm 30.32)^\circ$ 、失败者为 $(86.37 \pm 10.72)^\circ$,二者差异有统计学意义($t = 23.420, P = 0.001$);静脉窦直径分别为 (5.10 ± 1.12) 和 (5.11 ± 0.37) mm,差异无统计学意义($t = 7.210, P = 0.352$)。**结论** 颈静脉孔区静脉窦侧位脑血管造影呈“N”形结构,若静脉窦两转折夹角过小易导致支架植入困难,但静脉窦直径不影响支架的植入。

【关键词】 颈静脉; 脑血管造影术; 血管成形术; 支架; 窦血栓形成,颅内

Angiography and clinical analysis of intracranial venous sinus in jugular foramen

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【Abstract】 Background By analyzing the digital subtraction angiography (DSA) of intracranial venous sinus in jugular foramen segment, this article investigates the reasons for difficulty or failure of stent implanting in intracranial venous sinus, and attempts to formulate the clinical index, which can predict the difficulty of venous sinus stenting so as to improve the success rate of stent implantation. **Methods** All of 118 patients treated with venous sinus stent angioplasty were analyzed retrospectively, among whom 87 cases were diagnosed as cerebral venous stenosis and intracranial hypertension, and 31 patients were diagnosed as intractable pulsatile tinnitus caused by venous sinus stenosis. All patients received thrombolysis, anticoagulant and antiplatelet agents, and stent was implanted since the symptoms were not relieved. The two turning angles and diameter of cerebral venous sinus in the jugular foramen were measured to analyze their impact on stent implantation. **Results** Stent implantation of 115 cases were successful, while 3 patients did not complete the surgery due to the difficulty of stent implanting. The cerebral venous sinus in the jugular foramen was a transitional structure between the sigmoid sinus and internal jugular vein. Lateral view of angiography suggested "N" shape. The sum of two turning angles of venous sinus of 115 patients was $(120.11 \pm 30.32)^\circ$, and the diameter of venous sinus was (5.10 ± 1.12) mm. The sum of two turning angles of 3 patients who failed to implant stent was $(86.37 \pm 10.72)^\circ$, and the diameter of venous sinus was (5.11 ± 0.37) mm. There were statistically significant differences between the angles of two groups ($t = 23.420, P = 0.001$), but no significant differences between the diameters of two groups ($t = 7.210, P = 0.352$). **Conclusion** Lateral view of angiography suggested "N" shape of venous sinus in the jugular foramen. Difficulty of stent embedding would be caused by too small turning angles of venous sinus in the jugular foramen. However, the diameter of venous sinus did not influence the surgery of stent implantation.

【Key words】 Jugular veins; Cerebral angiography; Angioplasty; Stents; Sinus thrombosis, intracranial

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近年来,颅内静脉窦支架植入术已经成为治疗颅内静脉窦系统疾病的一种主要方法。然而,陆续有文献报道因颅内静脉窦支架植入困难而导致手术失败的病例^[1-2]。寻找导致颅内静脉窦支架植入困难或失败的原因,评价可以预测颅内静脉窦支架植入术是否可行的临床指标,已成为当务之急。笔者回顾 2001 年 1 月-2012 年 6 月解放军总医院神经外科治疗的 118 例接受颅内静脉窦支架植入术患者的临床资料,并对所有患者颈静脉孔区的结构进行分析,以寻求能够预测颅内静脉窦支架植入难易程度的临床指标。

对象与方法

一、一般资料

118 例颅内静脉窦狭窄患者中 87 例经临床症状、腰椎穿刺脑脊液检查和数字减影血管造影术(DSA)明确诊断为颅内静脉窦狭窄伴颅内高压,其余 31 例根据临床表现、耳鸣检查及脑血管造影诊断为源于静脉窦狭窄的搏动性耳鸣。男性 45 例,女性 73 例;年龄 19~61 岁,平均 (43.82 ± 9.09) 岁,男性 (43.51 ± 9.42) 岁、女性 (44.10 ± 9.81) 岁;病程 7 d~15 年,急性发病者(< 48 h)0 例、亚急性发病(48 h~ 30 d)36 例(30.51%)、慢性发病(> 30 d)82 例(69.49%)。(1)颅内静脉窦狭窄伴颅内高压:87 例患者中颅内高压 72 例(82.76%),头痛、呕吐 25 例(28.74%),视力减退 46 例(52.87%);局灶性神经功能缺损或癫痫发作 7 例(8.05%);亚急性脑病如意识不清或精神症状者 6 例(6.90%)。入院后腰椎穿刺脑脊液检查颅内压 210~600 mm H₂O(1 mm H₂O = 9.81×10^{-3} kPa),平均 (359.19 ± 50.22) mm H₂O,其中 51 例(47.13%)400~800 mm H₂O、29 例(33.33%)300~400 mm H₂O、7 例(8.05%)200~300 mm H₂O。脑血管造影检查显示所有患者全脑循环时间均 > 11 s,最长者为 22 s;右侧横窦乙状窦交界处狭窄者 61 例(70.11%)、左侧 26 例(29.89%)。(2)源于颅内静脉窦狭窄的搏动性耳鸣:31 例均无颅内高压表现,右侧搏动性耳鸣 21 例(67.74%)、左侧搏动性耳鸣 10 例(32.26%),耳鸣响度 30~60 db、频率 100~400 Hz。

二、治疗方法

1. 手术适应证 本组 118 例患者均于明确诊断后先接受 1~2 周的溶栓、抗凝及抗血小板药物治

疗,因颅内静脉窦狭窄导致的颅内高压或搏动性耳鸣症状无改善而选择静脉窦支架植入术。

2. 手术方法 参照文献[3-5]报告的手术方法,采用气管插管全身麻醉,经股动脉入路植入 4F 造影导管至患侧颈动脉和椎动脉。首先确定狭窄部位,观察大脑半球和小脑半球静脉回流至狭窄段静脉窦的影像,并做好随时提供经颈内静脉行静脉窦狭窄支架植入术的引导影像准备。同时经对侧股静脉入路将 8F 导引导管(美国 Boston Scientific 公司)经颈内静脉植入患侧乙状窦远端:将 2.4F 微导管(Renegade,美国 Boston Scientific 公司)送入上矢状窦内行静脉窦内造影,再次确认狭窄部位和长度,同时测量狭窄段血管两端的血流压力,交换后送入 X-celerator 300 cm 微导丝(美国 EV3 公司)至上矢状窦内固定并撤除微导管;然后沿微导丝送入 6 mm × 20 mm Aviator 扩张球囊(美国 Cordis 公司),分段扩张静脉窦狭窄段后撤除,根据测量结果送入 Precise 自膨式支架(美国 Cordis 公司)并释放;最后送入 2.4F 微导管(Renegade)并撤出微导丝,行静脉窦造影并测量狭窄部位两端压力,同时重复施行患侧颈动脉和椎动脉造影检查。

3. 观察项目 经静脉和动脉两条血管造影途径观察颅内静脉窦支架植入后的成形效果,分析大脑半球外侧和小脑表面静脉血液回流至颅内静脉窦的注入静脉(Labbe's 静脉、岩静脉和小脑上、中、外侧静脉等)时是否受到挤压而发生滞留等风险。同时应用 AW 计算机工作站(德国 GE 公司)分析颈静脉孔区静脉窦的解剖结构,分别测量静脉窦直径和侧位脑血管造影所显示的“N”形结构的两个转折夹角,并计算其夹角之和。

结 果

118 例患者中 115 例支架植入获得成功,术后临床症状完全消失(图 1);3 例因支架植入困难(图 2)而改行外科手术,其中静脉窦狭窄伴颅内高压 2 例、源于静脉窦狭窄的搏动性耳鸣 1 例。115 例患者颈静脉孔区静脉窦两个转折夹角之和为 $(120.11 \pm 30.32)^\circ$,3 例支架植入失败患者为 $(86.37 \pm 10.72)^\circ$,二者相比差异具有统计学意义($t = 23.420, P = 0.001$)。术中脑血管造影检查显示,颈静脉孔区静脉窦直径明显小于远端的乙状窦和近端的颈内静脉,其中 115 例乙状窦平均直径为 (9.23 ± 2.12) mm、

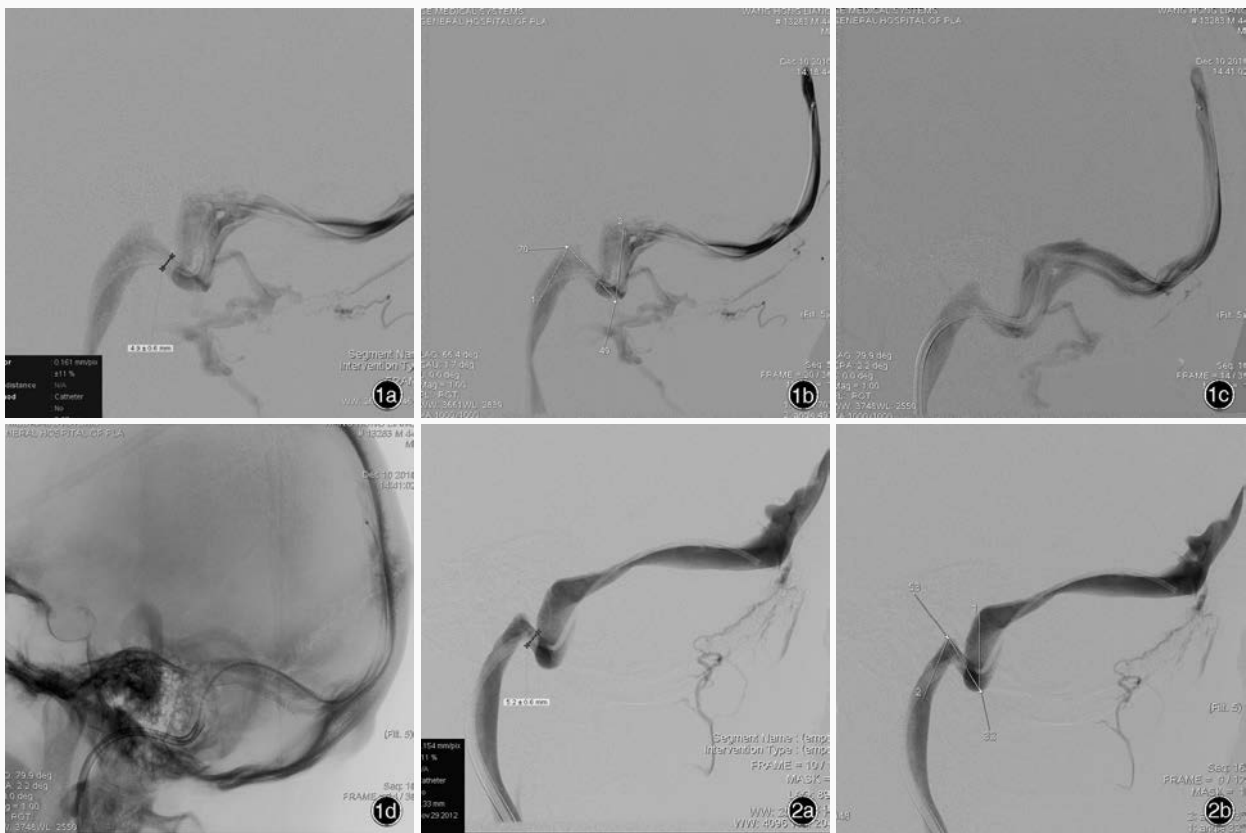


图 1 男性患者,44 岁。主因头痛 4 个月入院。脑血管造影检查发现,右侧横窦乙状窦交界处狭窄,行静脉窦支架植入术,手术过程顺利,术后临床症状完全消失 1a 侧位静脉窦血管造影显示,颈静脉孔区静脉窦直径显著小于乙状窦和颈内静脉,约为 4.90 mm 1b 侧位静脉窦血管造影显示,颈静脉孔区静脉窦呈“N”形结构,两个转折夹角之和为 119° 1c 侧位静脉窦血管造影显示,Precise 支架植入后静脉窦明显增粗 1d 侧位静脉窦血管造影可见植入静脉窦的支架显影 **图 2** 男性患者,24 岁。主因头痛、呕吐、视力下降 2 个月入院。脑血管造影检查显示,右侧横窦乙状窦交界处狭窄,由于颈静脉孔区静脉窦夹角过小导致支架植入困难而终止手术 2a 侧位静脉窦血管造影显示,颈静脉孔区静脉窦直径显著小于乙状窦和颈内静脉,约为 5.20 mm 2b 侧位静脉窦血管造影显示,颈静脉孔区静脉窦呈“N”形结构,两个转折夹角之和为 85°

Figure 1 A 44-year-old male patient was admitted for headache for 4 months. DSA revealed stenosis in the junction of right transverse sinus and sigmoid sinus. The operation was successful, and stent was implanted in venous sinus stenosis segment. The symptoms of patient were relieved after surgery. Lateral angiography of venous sinus revealed the diameter of venous sinus was 4.90 mm and was much smaller than that of sigmoid sinus and jugular vein (Panel 1a). Lateral angiography of venous sinus suggested "N" shape. The sum of two turning angles of venous sinus was 119° (Panel 1b). Lateral angiography of venous sinus revealed the venous sinus became wider after stent was implanted (Panel 1c). Lateral angiography of venous sinus revealed the stent in venous sinus (Panel 1d). **Figure 2** A 24-year-old male patient was admitted for headache, vomit and hypopsia for 2 months. DSA revealed stenosis in the junction of right transverse sinus and sigmoid sinus. The surgery had to be stopped due to the difficulty of stent implantation caused by the undersize of the turning angles of venous sinus in the jugular foramen. Lateral angiography of venous sinus revealed the diameter of venous sinus was 5.20 mm and was much smaller than that of sigmoid sinus and jugular vein (Panel 2a). Lateral angiography of venous sinus suggested "N" shape. The sum of two turning angles of venous sinus was 85° (Panel 2b).

颈静脉孔区静脉窦平均直径(5.10 ± 1.12) mm, 3 例支架植入失败者颈静脉孔区静脉窦直径为(5.11 ± 0.37) mm, 与支架植入成功者相比差异无统计学意义($t = 7.210, P = 0.352$)。

讨 论

颅内静脉窦支架植入术是随着新技术、新材料的发展而实现的,血管内支架成形术旨在扩张狭窄的静脉窦,恢复静脉窦的解剖形态,从而达到治疗

颅内静脉窦系统疾病的目的,临床上主要用于治疗颅内静脉窦血栓导致的静脉窦狭窄和源于静脉窦狭窄的搏动性耳鸣。这两类疾病所引起的颅内静脉窦狭窄的位置主要分布在横窦乙状窦交界处,脑血管成形术主要选择自膨式支架^[6-7]。值得指出的是,源于颅内静脉窦狭窄的难治性搏动性耳鸣是解放军总医院近年发现的一种特殊类型,它对患者生活质量及睡眠质量有很大影响,甚至可诱发抑郁症。笔者应用颅内静脉窦支架植入术治疗此类患

者,截至 2012 年 6 月共完成 31 例,除 1 例支架植入困难外,其余均取得良好临床效果,目前国内尚未见此类似文献报道。

1994 年, Marks 等^[8]首次报告通过支架植入术治疗颅内静脉窦狭窄的手术效果;2002 年,李宝民等^[9]率先在国内报告颅内静脉窦支架植入术。但上述文献所报道的内容,无论是手术开始实施时间,还是手术例数都远低于颅内动脉系统的血管内支架成形术。笔者认为,颅内静脉窦狭窄和颅内动脉狭窄比较,二者除发病率不同外,前者还需要较高的手术技巧。与此同时,也有许多因颅内静脉窦支架植入困难而未能完成手术的文献报道,究其原因,笔者认为与颈静脉孔区特殊的“N”形结构有关。在本研究中,笔者主要分析了颈静脉孔区的两项解剖学指标,即转折夹角和直径。由于颈静脉孔区静脉窦的特殊“N”形解剖结构包含两个夹角,且两夹角的角度并不相同,在本研究中笔者计算了两个夹角之和并进行统计分析,结果显示:未能顺利植入支架的 3 例患者的两夹角之和 $[(86.37 \pm 10.72)^\circ]$ 低于成功植入支架者的两夹角之和 $[(120.11 \pm 30.32)^\circ]$,且差异具有统计学意义($P = 0.001$),但两组患者颈静脉孔区静脉窦直径并无显著差异($P = 0.352$)。结果提示:颈静脉孔区静脉窦转折夹角的大小可以作为预测颅内静脉窦支架植入术难易程度的一项指标。然而,在临床实际操作过程中,如果颈静脉孔区颅内静脉窦两个转折夹角之和小于 90° ,其颅内静脉窦支架植入均较为困难,而颅内静脉窦直径可能与手术难度无关。

笔者在颅内静脉窦支架植入术过程中所应用的导引导管与支架支撑力和顺应性之间是相互矛盾的两项指标^[10-11],为了保证导引导管和支架的支撑力,确保支架植入后能够改善狭窄程度,即会在一定程度上牺牲其顺应性,因此导引导管和支架通过呈“N”形的颈静脉孔时就会出现困难,当颈静脉孔区静脉窦转折夹角过小时,甚至会导致手术失败。笔者通过长时间的临床摸索并结合国内外临床研究结果,总结出以下经验^[12-14]:(1)多采用同轴导引导管技术,在保证导引导管顺应性的同时,增加导引导管植入时的支撑力。(2)尽可能将导引导管置入颈静脉孔远端后,再导入静脉窦支架,以提高支架通过颈静脉孔的成功率。(3)如颈静脉孔区静脉窦确实通过困难,可考虑应用专用的颅内动脉支架(Solitaire、LEO)植入颅内静脉窦,同样可以达到治

疗颅内静脉窦狭窄的目的。

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