

内镜下经鼻入路联合显微镜下开颅手术治疗复杂鼻颅沟通颅底肿瘤初探

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【摘要】 **目的** 探讨内镜下经鼻入路联合显微镜下开颅手术同期切除复杂鼻颅沟通颅底肿瘤的疗效和安全性,以及血管吻合技术对颈内动脉的保护作用。**方法与结果** 2020年1月至2022年12月天津市环湖医院神经外科采用内镜下经鼻入路联合显微镜下开颅手术同期治疗9例复杂鼻颅沟通颅底肿瘤患者,6例通过开颅手术中辨识、显露、移位颈内动脉的方式保护颈内动脉,3例在颈内动脉保护的基础上行颈内动脉岩骨段-桡动脉-颈内动脉床突段搭桥术。8例肿瘤全切除,1例肿瘤大部切除。术后2周,8例恢复日常生活与工作[Glasgow预后分级(GOS)5级],1例视力减退但生活可自理(GOS分级4级);仅1例术后3d发生颅内感染。**结论** 内镜下经鼻入路联合显微镜下开颅手术同期切除复杂鼻颅沟通颅底肿瘤疗效确切,且无严重并发症;术中颈内动脉保护及血管吻合技术的应用可有效减少术中出血及术后并发症。

【关键词】 颅底肿瘤; 内窥镜检查; 神经外科手术; 颈内动脉; 脑血管重建术

Application of endoscopic transnasal approach combined with microscopic craniotomy in complex skull base tumors with nasal cranial communication

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【Abstract】 **Objective** To explore the efficacy and safety of endoscopic transnasal approach combined with microscopic craniotomy in the simultaneous resection of complex skull base tumors with nasal cranial communication, and the protective effect of vascular anastomosis technology in the internal carotid artery (ICA). **Methods and Results** From January 2020 to December 2022, the Department of Neurosurgery of Tianjin Huanhu Hospital used endoscopic transnasal approach combined with microscopic craniotomy to treat 9 patients with complex skull base tumors with nasal cranial communication at the same time, while 6 patients were protected by identifying, exposing and shifting the ICA during the craniotomy, and 3 patients underwent petrosal segment of the ICA-radial artery (RA)-bed segment of the ICA bypass on the basis of ICA protection. Among the 9 patients, 8 cases underwent total tumor resection, and one case underwent partial tumor resection; 8 cases [Glasgow Outcome Scale (GOS) level 5] resumed daily life and work at 2 weeks after surgery, one case (GOS level 4) had decreased vision on the affected side but had self-help, and only one case developed intracranial infection 3 d after surgery. **Conclusions** Endoscopic transnasal approach combined with microscopic craniotomy for simultaneous resection of complex skull base tumors with nasal cranial communication has a definite therapeutic effect and no serious complications, the application of intraoperative ICA protection and vascular anastomosis technology can effectively reduce intraoperative bleeding and postoperative complications.

【Key words】 Skull base neoplasms; Endoscopy; Neurosurgical procedures; Carotid artery, internal; Cerebral revascularization

Conflicts of interest: none declared

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复杂鼻颅沟通颅底肿瘤以外科手术切除为主要治疗方法,由于肿瘤大多包绕颈内动脉(ICA)生长,不仅使手术难度增加,而且颈内动脉破裂出血或神经损伤等并发症可导致患者预后不良甚至死亡,因此被认为是目前鼻颅底外科最为复杂的手术。既往针对此类患者以分次手术为选择,一般先行显微镜下开颅手术切除颅内病灶,而后再择期内镜下经鼻入路切除鼻部病灶。然而,分次手术患者需承受两次全身麻醉手术之痛苦,住院时间延长、费用增加。天津市环湖医院佟小光教授团队自 2020 年以来尝试内镜下经鼻入路联合显微镜下开颅手术^[1]同期切除复杂鼻颅沟通颅底肿瘤,并于开颅手术中显露、移位和标记颈内动脉,以备必要时采取颅内血管搭桥术作为术中颈内动脉出血的补救方案^[2],如此极大地降低了术中颈内动脉破裂出血的风险,并经临床实践效果良好且安全可靠。

临床资料

一、病例选择

入组病例均符合以下纳入与排除标准:(1)经头部 CT 和 MRI 证实肿瘤位于鼻颅沟通部位,颅底骨质不同程度受累或肿瘤经颅底孔道侵袭颅内外组织。(2)符合择期手术适应证,且可于内镜下经鼻入路联合显微镜下开颅手术同期切除肿瘤。(3)患者意识清醒且术后可配合体格检查。(4)排除因肿瘤广泛侵袭后颅窝或颈部需行头颈部联合手术病例。(5)手术前后临床、影像学及随访资料完整。(6)患者及其家属均对手术方案和风险知情并签署知情同意书。

二、一般资料

回顾分析 2020 年 1 月至 2022 年 12 月在我院神经外科行内镜下经鼻入路联合显微镜下开颅手术的 9 例复杂鼻颅沟通颅底肿瘤患者的临床资料,男性 4 例,女性 5 例;年龄 31 ~ 69 岁,平均(50.67 ± 12.90)岁。临床主要表现为头痛(7 例次)、眼动障碍(3 例次)、嗅觉异常(3 例次)、内分泌功能紊乱(2 例次)、视力视野改变(2 例次);原发者 6 例,复发 3 例。术前鼻内镜检查,复发患者均存在鼻中隔黏膜缺损(3 例),可伴有鼻窦炎(1 例),大多数患者(5 例)可无异常所见。术前 CT 扫描可见颅底骨质不同程度受累(5 例),或伴骨质异常增生(4 例);MRI 检查所有患者均显示肿瘤经颅底孔道侵袭颅内外组织;DSA 及球囊闭塞试验(BOT)^[3]提示,复发患者肿瘤完全

包绕颈内动脉,患侧颈内动脉可经 Willis 环前交通动脉和后交通动脉获得来自健侧前循环的部分代偿,而后循环则几乎无代偿(2 例);个别病例尚可合并颅内动脉瘤,肿瘤虽未完全包绕颈内动脉,但 BOT 试验阳性(1 例);本组大多数患者(6 例)肿瘤未包绕颈内动脉,且 BOT 试验阴性(图 1)。

三、治疗方法

1. 内镜下经鼻入路联合显微镜下开颅肿瘤切除术并颅底重建术 患者仰卧位,全身麻醉,根据术前影像学检查定位标画头部单侧额颞颥或双侧额冠状切口线;Sugita 四钉头架固定头部,调整头架同时满足开颅与经鼻入路的头部体位;切取大腿外侧阔筋膜、脂肪供颅底修补使用;健侧上肢外展,标画桡动脉走行切口线,备取桡动脉使用^[4]。(1)显微镜下开颅手术^[5]:沿头部切口线依次逐层切开皮肤、皮下、肌肉,皮瓣牵开固定;颅骨钻孔、铣刀打开骨瓣约 10 cm × 10 cm,骨缘四周悬吊硬脑膜;直径为 2 ~ 3 mm 磨钻磨除蝶骨大翼、蝶骨小翼等颅底骨质,显露硬膜外肿瘤,电凝离断肿瘤基底部供血动脉;于硬膜外磨除前床突,沿视神经孔方向“T”形剪开硬脑膜、打开远近环,显露并移位床突段颈内动脉、颜色记号标识游离的颈内动脉床突段,对于肿瘤向岩斜侵袭者,需于硬膜外磨除岩骨尖、后床突,显露颈内动脉岩骨段,超声吸引器(美国 Stryke 公司)配合双极电凝切除硬膜内外肿瘤。然后,根据解剖位置逐一显露视神经、动眼神经、滑车神经、三叉神经和外展神经等。术前 BOT 试验阳性且术中显示颈内动脉海绵窦段被肿瘤包绕侵袭、难以分离者,可同期行血管搭桥术^[6]。(2)血管搭桥术:于棘孔处电凝离断脑膜中动脉,将中颅底硬脑膜从三叉神经下颌支神经外膜上进一步剥离;磨除 Glasscock 三角骨质,向前方移位三叉神经节并磨除岩骨前部,显露颈内动脉岩骨段,先将桡动脉近端与颈内动脉岩骨段端侧吻合,然后桡动脉远端与颈内动脉床突段端侧吻合^[7];吻合后即刻切换显微镜至血管显影模式,吲哚菁绿荧光血管造影(ICGA)显示桥血管血流通畅;最后一并切除肿瘤及受累动脉。(3)内镜下经鼻入路手术:旋转 Sugita 四钉头架,调整其角度使头部利于鼻腔操作位置,以肾上腺素棉条收缩双侧鼻腔黏膜。Karl Storz 内窥镜手术电视监控系统(德国 Storz 公司)内镜长度 8 cm、直径 4 mm,旋转角度分别为 0°、30°和 45°,双侧鼻腔双人四手操作。首先,于内镜下剔除单侧(或双侧)钩突及中鼻甲下部,开放

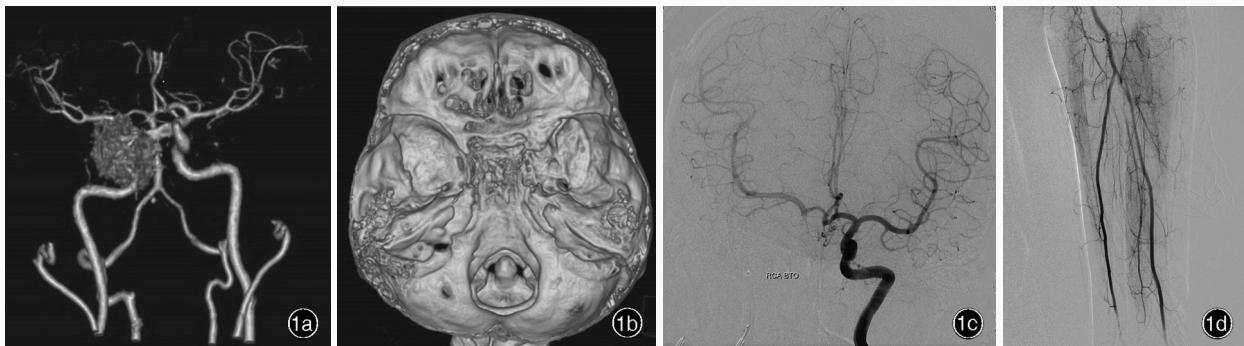


图1 手术前影像学检查所见 1a CT血管三维重建可见肿瘤包绕右颈内动脉海绵窦段 1b CT颅底骨质三维重建显示左侧前床突增生 1c 正位DSA显示球囊临时阻断右颈内动脉,30 min内未出现肢体无力、感觉缺失、失语或意识改变等征象,左颈内动脉经Willis环前交通动脉向右侧前循环代偿良好,BOT试验阴性 1d 正位DSA显示,自肱动脉分出的桡动脉(位置较浅)和尺动脉(位置较深)存在吻合并共同供应前臂血运

Figure 1 Preoperative imaging findings 3D-reconstruction CT of blood vessels showed the tumor surrounding the cavernous sinus segment of the right ICA (Panel 1a). 3D-reconstruction CT skull base bone showed the hyperplasia of the anterior clinoid process (Panel 1b). Anterior-posterior DSA showed the balloon temporarily blocked the blood flow of the right ICA, and no signs of limb weakness, anesthesia, aphasia or changes in consciousness occurred within 30 min. The left ICA compensated well to the right anterior circulation through the anterior communication artery of the Willis circle, and the BOT test was negative (Panel 1c). Anterior-posterior DSA showed anastomosis between the radial artery (shallow location) and ulnar artery (deep location) diverging from the brachial artery and supplying blood to the forearm (Panel 1d).

筛窦,酌情去除部分上鼻甲和下鼻甲,扩大鼻内入路空间;可开放双侧额窦,扩大额隐窝,去除额窦下壁;可切除上颌窦内壁、后壁进入翼腭窝,显露上颌动脉及其分支、翼管神经,以扩大上颌窦外侧视野。经鼻中隔入路,留取带蒂鼻中隔黏膜瓣于后鼻道,显露蝶筛隐窝及蝶窦前壁,探查蝶窦自然开口;磨除蝶嘴及鼻中隔后端,剔除蝶窦内隔,进入蝶窦,辨识业已标记的颈内动脉(图2),以及颈内动脉-视神经隐窝^[8]、视神经管隆起、斜坡隐窝、蝶骨平台等解剖标志,确定肿瘤周围边界后安全切除鼻蝶内肿瘤。(4)颅底重建术:切除肿瘤后,行上下联合、多层修复颅底^[9]。于显微镜下经颅以阔筋膜、颅骨骨膜反转、颞肌筋膜缝合颅底硬脑膜,辅以钛网支撑,肌肉-筋膜缝合^[10];然后,于内镜下经鼻入路以脂肪、阔筋膜^[11]为内衬,肌浆为外衬,人工硬膜加固,最后以鼻中隔带蒂黏膜瓣外铺,完成生理解剖意义上的颅底修复。

2. 疗效评价 (1)评价指标:评价指标包括肿瘤切除率、患者术后恢复和并发症发生情况。术中冰冻病理和术后1周内头部MRI增强扫描显示肿瘤边缘无肿瘤组织或细胞残留为全切除;肿瘤组织残留 $\leq 10\%$ 为大部切除;肿瘤残留 $> 10\%$ 为部分切除。术后2周,按照Glasgow预后分级(GOS)标准^[12]对患者神经功能进行评价(5级,基本恢复正常工作与生活;4级,轻残但可独立生活或在保护下工作;3级,

重残,日常生活需要他人照料;2级,植物状态生存;1级,死亡)。术后2周,根据患者是否发生脑脊液鼻漏、术区出血或颅内感染等并发症评价手术安全性。(2)疗效与预后:本组患者达全切除者8例、大部切除1例,无部分切除病例;其中6例通过术中辨识、显露、移位颈内动脉的方式行血管保护,余3例在此基础上行血管搭桥术。组织病理分型包括脑膜瘤(4例)、脊索瘤(1例)、软骨肉瘤(1例)、骨化纤维瘤并颅内动脉瘤(1例)、多形性腺瘤(1例)和腺样囊性癌(1例)。术后2周GOS分级,8例恢复正常生活与工作(5级)、1例患侧视力减退但生活尚可自理(4级)。本组患者术后无一例出现偏瘫、失明、失语等严重并发症,无脑脊液鼻漏或术区出血,仅1例术后3d发生颅内感染,经腰大池引流2周,以及万古霉素1g/次+生理盐水250ml/次静脉滴注(2次/d)连续治疗3周痊愈。

讨 论

鼻颅沟通复杂颅底肿瘤体积巨大,且多有颈内动脉受累。既往因医疗条件所限需分期进行手术,不仅创伤大、并发症发生率和肿瘤复发风险高,且对于术前评估不充分患者术中极易发生颈内动脉破裂出血^[13],导致预后不良甚至死亡。本研究采用内镜下经鼻入路联合显微镜下开颅手术同期切除复杂鼻颅沟通颅底肿瘤,其优势主要体现在以下方

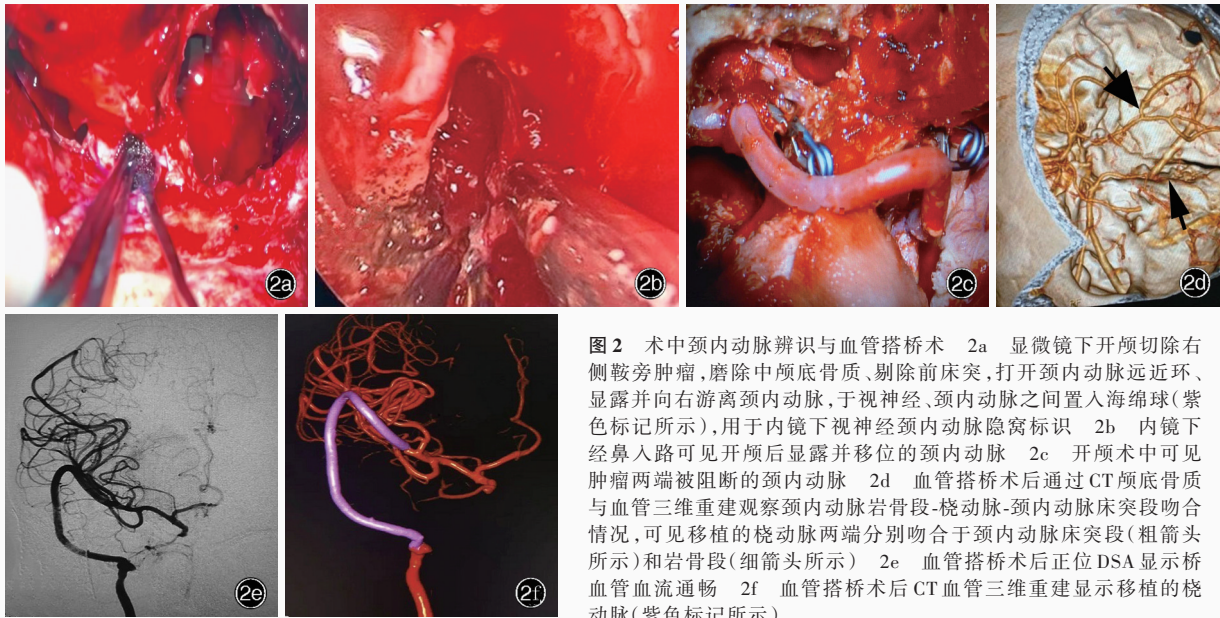


图 2 术中颈内动脉辨识与血管搭桥术 2a 显微镜下开颅切除右侧鞍旁肿瘤,磨除中颅底骨质、剔除前床突,打开颈内动脉远近环、显露并向右游离颈内动脉,于视神经、颈内动脉之间置入海绵球(紫色标记所示),用于内镜下视神经颈内动脉隐窝标识 2b 内镜下经鼻入路可见开颅后显露并移位的颈内动脉 2c 开颅术中可见肿瘤两端被阻断的颈内动脉 2d 血管搭桥术后通过 CT 颅底骨质与血管三维重建观察颈内动脉岩骨段-桡动脉-颈内动脉床突段吻合情况,可见移植的桡动脉两端分别吻合于颈内动脉床突段(粗箭头所示)和岩骨段(细箭头所示) 2e 血管搭桥术后正位 DSA 显示桥血管血流通畅 2f 血管搭桥术后 CT 血管三维重建显示移植的桡动脉(紫色标记所示)

Figure 2 Intraoperative identification of ICA and vascular bypass surgery Craniotomy was performed under a microscope to remove the right parasellar tumor, the middle skull base bone and the anterior bed process, open the proximal and distal ring of the ICA, expose and free the ICA to the right, and insert a sponge ball (purple indicates) between the optic nerve and the ICA for endoscopic indication of the ICA recess (Panel 2a). Endoscopic visualization of the ICA exposed and displaced after craniotomy through nasal approach (Panel 2b). The ICA with both ends of the tumor blocked was seen during craniotomy (Panel 2c). The anastomosis of ICA petrosal segment-RA-bed segment was observed by 3D-reconstruction CT of skull base bone and blood vessels after bypass surgery. It can be seen that both ends of the transplanted RA were anastomosed to the ICA bed segment (thick arrow indicates) and the rock segment (thin arrow indicates, Panel 2d). Anterior-posterior DSA of bypass surgery showed smooth blood flow of anastomotic vessels (Panel 2e). 3D-reconstruction CT of blood vessels after bypass surgery showed the transplanted RA (purple indicates, Panel 2f).

面。(1)通过开颅磨除颅底骨质,扩大显露范围和手术视野:根据术前影像学检查提供的肿瘤边界与范围,首先找到颈内动脉岩骨段至床突段^[14],辨识肿瘤侵袭程度,阻断肿瘤颅底血运、减少术中出血;然后利用血管移位或搭桥手术^[15]保护颈内动脉,安全切除肿瘤。(2)消除手术盲区,完全切除肿瘤:显微镜下开颅视野在颅内、鞍旁等区域,内镜下经鼻视野在鼻腔、鼻窦、眶底硬膜外区域,二者视野在鼻颅底区域相通,同期手术可以很好地显露肿瘤边界,减少或避免术野盲区。(3)多重颅底重建^[16],于内镜和显微镜(双镜)下检验颅底修补牢固程度:肿瘤切除后,通过颅内、鼻腔两个方向进行颅底重建,颅内采用缝合颅底硬脑膜、钛网硬支撑加固、硬膜外填塞脂肪的方法,而鼻腔则采用阔筋膜封堵^[17]、鼻黏膜瓣加固、鼻腔碘仿纱条填塞的方法,从两个方向修复颅底,将脑脊液鼻漏的风险降至最低。

于内镜下经鼻入路联合显微镜下开颅手术对颈内动脉的保护至关重要,一般而言,复发或前次手术过程不详患者,因内镜下经鼻解剖标记缺失,术中颈内动脉受损风险增加。为减少颈内动脉破

裂出血并发症,本研究团队在手术过程中先于显微镜下行开颅手术,磨除颅底骨质,完全显露颈内动脉、移位并标记,以为后续的内镜操作提供“航标”,较好地降低甚至避免盲目操作造成的颈内动脉损伤风险。对于术前影像学检查提示肿瘤侵袭颈内动脉且 BOT 试验阳性患者,首次尝试跨越受累颈内动脉两端施行血管搭桥术,这样既可避免颈内动脉破裂出血风险,亦能减少术后严重并发症、节省手术时间。血管搭桥术大部分用于治疗颅内动脉闭塞、巨大型颅内动脉瘤、烟雾病等脑血管病变,本研究团队将血管搭桥术应用于颅底肿瘤的治疗,并取得显著疗效,进一步为复杂颅底肿瘤外科治疗开创新的探索方向。但要达到上述目的,需在熟悉解剖图谱、尸头标本、术中实践等学习的基础上,建立颈内动脉三维立体观^[18],方能避免术中操作损伤颈内动脉。

综上所述,随着解剖学研究不断进展、颅底手术技术不断提高,神经外科联合耳鼻咽喉头颈外科治疗复杂鼻颅沟通颅底肿瘤的多学科协作已逐渐显示其优势^[19]。术前充分评估肿瘤与颈内动脉位

置关系,结合是否为复发肿瘤、前次手术可能造成的粘连、既往是否接受过放射治疗,以及患者年龄、身体状况、对术后生活质量的期待度等综合指标,制定具有针对性的个体化治疗方案。此外,术中谨慎选择血管搭桥术^[20],在控制出血的前提下,安全且最大程度地切除肿瘤,减少严重并发症,提高患者生活质量,亦是值得关注的问题。本研究采用内镜下经鼻入路联合显微镜下开颅手术并血管搭桥术切除复杂鼻颅沟通颅底肿瘤,取得较好的疗效,未来将进一步扩大样本量以验证手术安全性;同时积极探索以人工血管替代自体血管行高流量搭桥术的可能,研发个体化血管吻合装置,进一步提高手术疗效和安全性。

利益冲突 无

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