·论　著·

颞下硬膜外入路手术切除哑铃状三叉神经鞘瘤

李俊卿　马小二　薛俊锋　杨孔宾

【摘要】**目的** 探讨颞下硬膜外入路的手术解剖、手术技巧及治疗哑铃状三叉神经鞘瘤的效果。**方法** 取8具10%甲醛溶液处理的成人尸头标本，经颞下硬膜外入路暴露Meckel腔、海绵窦区及三叉神经根部，对相关解剖标志进行测量。回顾性分析2010年至2020年颞下硬膜外入路手术治疗的15例哑铃状三叉神经鞘瘤的临床资料，总结手术经验。**结果** 尸头解剖研究显示，颞下硬膜外入路能够充分暴露三叉神经根部，前内侧三角和滑车上三角的面积分别为(52.4±13.1)mm^2、(27.4±6.3)mm^2。15例哑铃状三叉神经鞘瘤术后复查MRI显示肿瘤全切除13例，全切率为87%；次全切除2例(13%)；术后随访6个月，11例(73.3%)症状缓解或保持原状，4例出现新的神经功能障碍。术后5例出现多种并发症，都存在颅神经损伤。**结论** 颞下硬膜外入路切除哑铃状三叉神经鞘瘤具有一定优势，但仍存在较高的并发症风险。需要进一步优化手术技巧，平衡肿瘤切除程度与神经功能保护，以改善手术效果。

【关键词】哑铃状三叉神经鞘瘤；颞下硬膜外入路；显微手术；尸头解剖

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Anatomy, techniques and outcomes of microsurgery via infratemporal epidural approach for dumbbell−shaped trigeminal schwannomas

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【**Abstract**】**Objective** To investigate the anatomy, techniques, and efficacy of microsurgery via infratemporal epidural approach for dumbbell−shaped trigeminal schwannomas. **Methods** Eight cadaveric head specimens were dissected using the infratemporal epidural approach to expose the Meckel's cave, cavernous sinus, and trigeminal nerve root, and relevant anatomical landmarks were measured. Additionally, a retrospective analysis was conducted on the clinical data of 15 patients with dumbbell−shaped trigeminal schwannoma who underwent resection through infratemporal epidural approach between 2010 and 2020, summarizing the surgical experience. **Results** Cadaveric dissection revealed that the infratemporal epidural approach provided excellent exposure of the trigeminal nerve root; the anteromedial triangle and supraorbital triangle had relatively small areas of (52.4 ± 13.1) mm^2 and (27.4 ± 6.3) mm^2, respectively. The postoperative MRI reexaminations of 15 patients with dumbbell−shaped trigeminal schwannomas showed that complete tumor resection was accomplished in 13 patients (87%), and subtotal resection was carried out in 2 (13%). Of the 15 patients followed up for 6 months postoperatively, 11 patients (73.3%) experienced symptom relief or stabilization, while 4 developed new neurological deficits. Postoperative complications occurred in 5 patients, all involving cranial nerve injury. **Conclusions** The infratemporal epidural approach offers certain advantages for resecting dumbbell− shaped trigeminal schwannomas but carries a relatively high risk of complications. Further optimization of surgical techniques is necessary to balance tumor resection and neural function preservation, thereby improving surgical outcomes.

【**Key words**】Dumbbell−shaped trigeminal Schwannoma; Infratemporal epidural approach; Microsurgery; Cadaveric head

三叉神经鞘瘤为颅内常见的神经鞘瘤[1]，以哑铃状较为常见，多发生于颅中、后窝，而且无明显性别差异[2,3]。Meckel's腔位于颅底中央，呈不规则的U形，并与蝶窦相连，周围被硬脑膜所包裹，前部邻近海绵窦[4]。Meckel's腔的位置深、周围的神经血管结构复杂，Meckel's腔病变常侵及海绵窦、挤压脑干，传统治疗是放疗，开颅手术具有一定缺陷[5]。本文以尸头标本模拟颞下入路手术，进行数据测量，分析经颞下入路经由海绵窦至Meckel's腔的解剖特点和方法，并探讨经颞下入路手术治疗哑铃状三叉神经鞘瘤的效果。

1 资料与方法

1.1 尸头解剖　选择10%甲醛固定的成人尸头标本8

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具(暨南大学医学院遗体捐赠),颈动脉与椎动脉灌注红色乳胶,颈静脉灌注蓝色乳胶。将尸头的颧弓处于水平位置,切开皮肤约1 cm,并顺着颧弓上缘做长约4 cm的直线切口。以"Y"形切开颞肌筋膜,并沿中心纵向切开颞肌。向两侧牵拉以暴露颞骨鳞部,在颧弓根部后上方钻孔,并利用铣刀取下一个直径2.0~2.5 cm的小骨片。然后,抬起颞部硬脑膜自颅中窝底,并循脑膜中动脉找到棘孔。在下颌神经表面切开和剥离硬膜以进入海绵窦外侧壁中的浅、深两层之间。

1.2 病例资料 回顾性分析2010年至2020年收治的15例三叉神经鞘瘤的临床资料;其中男性6例,女性9例;年龄18~65岁,平均(40.21±7.85)岁;病程20 d~3年,中位数10个月。颜面部疼痛4例、麻木5例,视力下降3例,听力下降3例。

1.3 影像学资料 15例术前进行头颅MRI检查,病变位于右侧8例、左侧7例;肿瘤最大直径2.3~8.5 cm,平均5.6 cm,其中肿瘤直径<5 cm 6例,≥5 cm 9例。

1.4 手术方法 肿瘤突破海绵窦后壁越过岩尖达颅后窝,在切除颅中窝肿瘤囊内部分后,沿肿瘤生长方向进入颅后窝,将肿瘤从内下方向前外上方牵拉,将颅后窝肿瘤全切除。肿瘤侵入蝶窦、后组筛窦者,切除窦腔内肿瘤后,保留肿瘤最外层的包膜及蝶筛窦粘膜,不进入窦腔。肿瘤全切后,包膜内垫止血纱布或明胶海绵止血。

1.5 术后随访 术后随访6个月至3年,CT和MRI复查观察有无肿瘤复发。

2 结 果

2.1 尸头解剖结果 切开三叉神经节脑池段滑车神经及动眼神经后,可以直接观察到海绵窦后上腔、内侧腔、颈内动脉水平部上面、后曲部及其脑膜垂体干分支。采用剥离子向卵圆孔及圆孔分离硬膜的脑膜层和骨膜层,并暴露海绵窦的外侧面。通过海绵窦三角显露其内部结构,观察颈内动脉在海绵窦段的走向及主要分支。通过Parkinson三角可以揭示海绵窦前下腔、后上腔和内侧腔,以及颈内动脉后升部、水平部、后曲部和与脑膜垂体干相关的分支。外展神经通过Gruber韧带进入海绵窦的位置。滑车上三角及下三角无需向上牵拉滑车神经,向下牵拉在滑车下三角上抬眼神经可观察到外展神经及颈内动脉。经颞部入路可以暴露的Meckel's腔与海绵窦见图1。打开Meckel's腔(图2),测量海绵窦各个三角的边长及面积(表1)。

2.2 手术结果 术后复查MRI显示肿瘤全切除13例(图3),全切率为87%;次全切除2例(13%;1例肿瘤与脑干黏连严重,1例肿瘤侵入海绵窦并与三叉神经黏连紧密)。

2.3 随访结果 术后随访6个月。13例肿瘤全切者无复发。2部分切除者,术后辅以放疗,随访期间残余肿瘤无进展。术后11例(73.3%)症状缓解或保持原状,其中2例视力下降、4例麻木、2例颜面部疼痛、1例听力下降均缓解,1例视力下降、1例颜面部疼痛、1例听力下降保持原状;其余4例出现新的神经功能障碍(1例术后出现头疼和咀嚼无力,1例术后出现面瘫、耳鸣和共济失调,1例术后出现头疼和共济失调,1例术后出现面瘫、咀嚼无力和复视)。5例术后出现多种并发症,其中1例发生癫痫、硬脑膜下出血、后组颅神经和面神经损伤,1例发生癫痫、三叉神经和外展神经损伤,1例发生构音障碍、三叉神经和面神经损伤,1例发生构音障碍、动眼神经和面神经损伤,1例发生颞叶出血、后组颅神经损伤。

3 讨 论

由于三叉神经鞘瘤通常呈现复杂的生长模式,因此,根治肿瘤需要使用基于全面解剖学知识的颅底技术[6]。三叉神经鞘瘤因其独特的解剖特点,横跨于颅中、后窝,后方邻近脑干、基底动脉及其分支,下方邻近颈内动脉、动眼神经、外展神经等[7]。手术充分暴露三叉神经鞘瘤并完整切除仍具有挑战性。

颞下硬膜外入路对海绵窦及岩尖区的暴露更充分。该入路可充分显露海绵窦区,直接到达内听道前部。此入路的关键是充分磨除岩尖以暴露岩下窦和前方的Meckel's腔。自硬膜外操作,颞叶由于重

表1 应用尸头标本进行颞下硬膜外入路解剖测量结果

Table 1 Anatomical measurements of the subtemporal epidural approach using cadaveric head specimens

解剖标志	内侧边(mm)	外侧边(mm)	底边(mm)	面积(mm^2)
Pakinson三角	16.3±3.8	17.7±5.6	8.3±2.2	55.2±9.1
滑车神经上三角	8.7±2.3	8.6±3.4	10.2±3.8	27.4±6.3
前内侧三角	16.1±4.7	11.2±2.7	9.4±2.3	52.4±13.1
前外侧三角	10.8±2.5	5.8±1.3	9.7±2.3	24.5±5.7

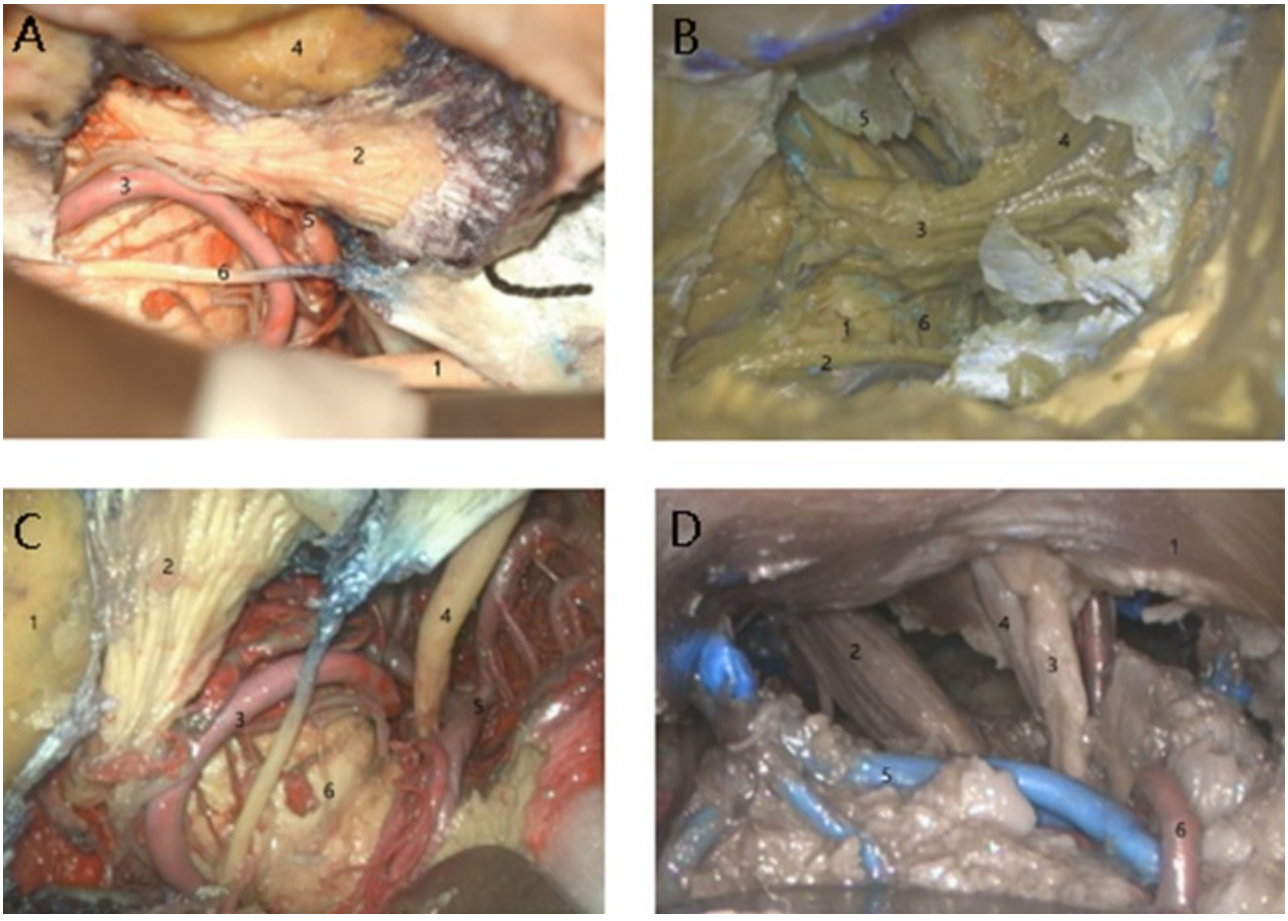

图1 尸头解剖显露Meckel´s腔与海绵窦

A. 颈内动脉垂直暴露的区域(1. 动眼神经;2. 三叉神经节;3. 小脑上动脉;4. 岩骨表面;5. 小脑前下动脉;6. 海绵窦);B. 暴露面听神经后方的岩斜区(1. 桥脑;2. 滑车神经;3. 三叉神经;4. Meckel´s腔;5. 动眼神经;6. 脑干);C. 牵开小脑幕后暴露的区域(1. 岩骨;2. 三叉神经节;3. 小脑上动脉;4. 动眼神经;5. 大脑后动脉;6. 脑桥);D. 暴露岩斜区主静脉(1. Meckel´s腔;2. 三叉神经;3. 面听神经;4. 小脑三叉神经节;5. 岩静脉属支;6. 小脑前下动脉)

Figure 1 Cadaveric head dissection revealing meckel´s cave and the cavernous sinus

A: Region with the nertical exposure of the internal carotid artery (1: Oculomotor nerve. 2: Trigeminal ganglion. 3: Superior cerebellar artery. 4: Surface of the petrous bone. 5: Anterior inferior cerebellar artery. 6: Cavernous sinus.). B: The petroclival region exposed behind the facial and auditory nerves (1: Pons. 2: Trochlear nerve. 3: Trigeminal nerve. 4: Meckel´s cave. 5: Oculomotor nerve. 6: Brainstem.). C: Region exposed after traction of the cerebellar tentorium (1: Petrous bone. 2: Trigeminal ganglion. 3: Superior cerebellar artery. 4: Oculomotor nerve. 5: Posterior cerebral artery. 6: Pons.). D: Exposure of the main veins in the petroclival region (1: Meckel´s Cave. 2: Trigeminal nerve. 3: Facial and auditory nerves. 4: Cerebellar trigeminal ganglion. 5: Petrosal vein branches. 6: Anterior inferior cerebellar artery.).

力作用自然下沉,减少了对脑组织的牵拉,理论上可使术后并发症明显减少[8]。然而,本研究结果显示,采用颞下硬膜外入路仍存在一定的局限性。虽然肿瘤全切除率较高(86.7%),但术后并发症发生率也相对较高(33.3%)。这可能与手术区域解剖结构复杂、邻近多条重要的神经血管有关[9]。同时,在追求高全切除率的同时,可能对周围神经结构造成了过度牵拉或直接损伤[10]。

术后硬脑膜下出血可能与术中对硬脑膜的操作有关,建议术中更加谨慎地处理硬脑膜,必要时进行硬脑膜修补[11]。颞叶出血可能与牵拉脑组织或损伤小血管有关,应进一步优化手术入路,减少对脑组织的牵拉,同时注意保护小血管[12]。颅神经损伤是术后最常见的并发症。在海绵窦区分离、切除肿瘤时,应更加谨慎地保护颈内动脉和外展神经(向内分离时),海绵窦外侧壁内的三叉神经(向下分离时),以及海绵窦内侧壁处和天幕裂孔外侧游离缘处的动眼神经与滑车神经(向上分离时)[13]。可考虑采用神经电生理监测,实时监控颅神经功能[14]。构音障碍与动眼神经和面神经损伤有关,建议术中注意保护神经,必要时可考虑部分切除肿瘤以保护重要神经功能[15]。

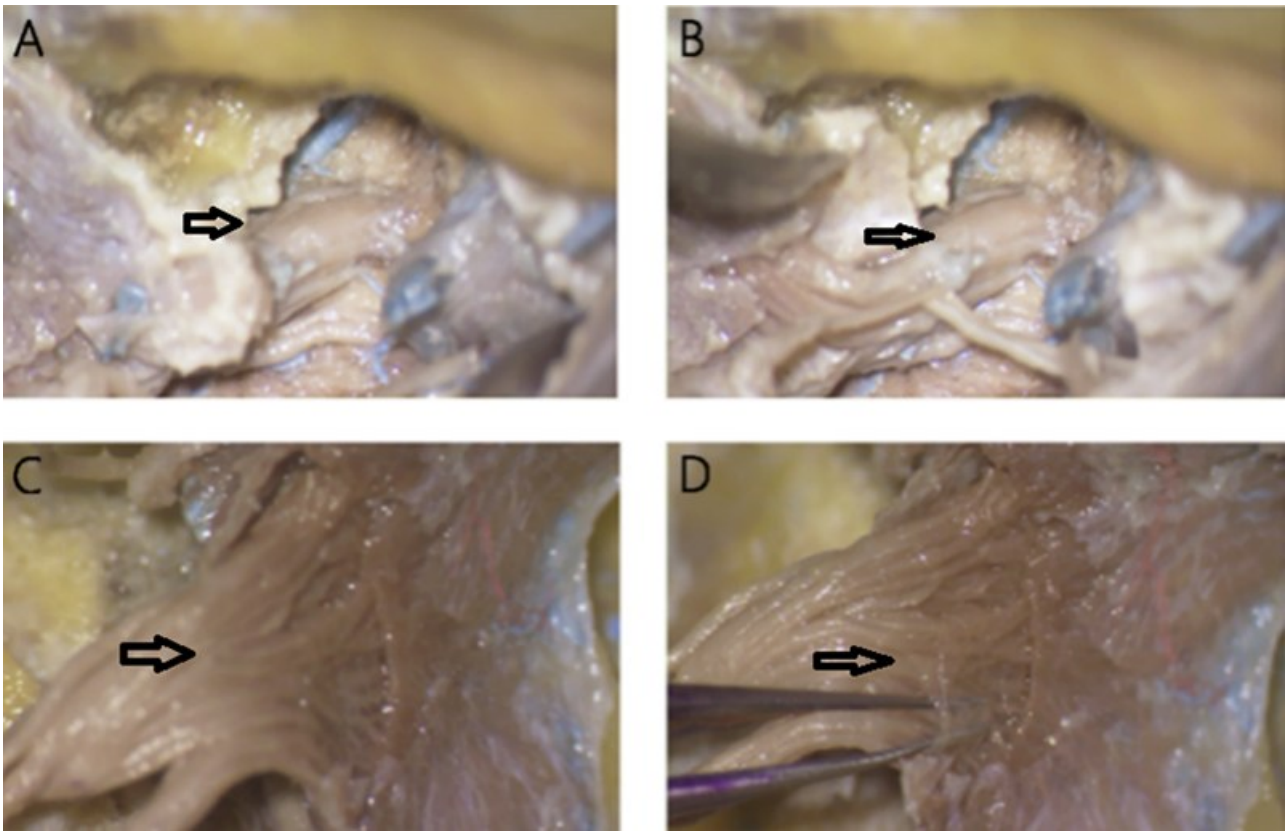

图2 尸头解剖显露三叉神经根部

A、B. 三叉神经在Meckel′s腔的位置；C、D. 显露三叉神经根部

Figure 2 Cadaveric head dissection revealing the root of the trigeminal nerve

A-B: The position of the trigeminal nerve in Meckel′s cave. C-D: Exposure of the root of the trigeminal nerve

手术切口的位置应根据肿瘤占据的颅中、后窝体积进行适当调整[16]。术前可行腰椎穿刺术进行置管，术中持续释放脑脊液，有利于无张力牵拉开脑组织。若难于牵开脑组织或Labbe′s静脉入横窦口处的Meckel′s腔过于偏外妨碍牵开脑组织时，可切除少量颞下回、颞中回脑组织，以便显露充分Meckel′s腔。切开天幕至游离缘处时，在距小脑幕缘0.5 cm和动眼神经后1.0 cm处切开，避免损伤滑车神经、动眼神经、大脑后动脉和小脑上动脉。先切除颅中窝肿瘤，再切除颅后窝肿瘤，否则，有可能损伤海绵窦内侧的滑车神经与动眼神经[17,18]。部分病例的颈内动脉岩骨段和海绵窦段可能裸露于肿瘤下方，应该避免动脉的损伤，适当采取部分切除技术[19]。术中分离、切除小脑桥脑角区域肿瘤时，注意避免损伤面、听神经和小脑前下动脉分支[20]。

总之，颞下硬膜外入路对于切除哑铃状三叉神经鞘瘤具有一定优势，但仍存在较高的并发症风险。未来需要进一步优化手术技巧，平衡肿瘤切除程度与神经功能保护，以提高手术效果，例如加强术前规划、采用神经电生理监测、精细化手术操作、适度切除原则、加强术后管理。

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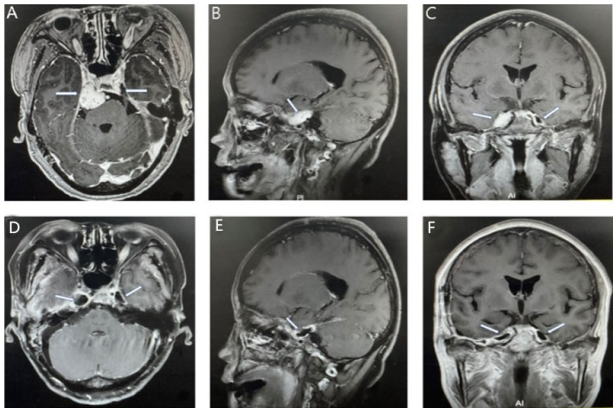

图3 右侧哑铃状三叉神经鞘瘤颞下硬膜外入路手术前后影像

A~C. 术前MRI轴位、矢状位、冠状位像，显示颅底中线偏右侧高信号肿块（白色↑示），主要位于颅中窝，向后延伸至颅后窝，呈现典型的"哑铃状"，直径2~3 cm，呈圆形，边界清晰；D. 术后MRI轴位、矢状位、冠状位显示肿块全切除（白色↑示）

Figure 3 Preo− and post−operative images of a patient with dumbbell− shaped trigeminal schwannoma underwent surgery via infratemporal epidural approach

A− C: Preoperative MRI axial, sagittal, and coronal images reveal a high−signal mass (indicated by the white arrow ↑) slightly to the right of the midline of the skull base, mainly situated in the middle cranial fossa and extending posteriorly to the posterior cranial fossa, presenting a typical “dumbbell shape”, with a diameter of 2~3 cm, being circular and having clear boundaries. D~F: Postoperative MRI axial, sagittal, and coronal images demonstrate complete resection of the mass (indicated by the white arrow ↑).

occupying both the middle and posterior fossae [J]. Neurosurg Rev, 2021, 44(1): 607−616.

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