

内镜下经口翼下颌皱襞内侧入路颈静脉孔区解剖学研究

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【摘要】 **目的** 探讨内镜下经口翼下颌皱襞内侧入路进入颈静脉孔区的解剖步骤,分析其临床施行之可行性。**方法与结果** 于复旦大学附属眼耳鼻喉科医院鼻颅底肿瘤外科治疗技术创新单元解剖实验室以 5 具(10 侧)尸头标本作为研究对象,模拟经口翼下颌皱襞内侧入路进入颈静脉孔区及其相邻结构的解剖步骤,观察并描述重要解剖标志。(1)颈静脉孔区解剖步骤:首先通过翼下颌皱襞内侧切口切开软腭黏膜、咽上缩肌进入咽旁前间隙,剔除间隙内脂肪组织,显露茎突咽筋膜和茎突肌群,切除茎突咽筋膜后进入咽旁后间隙,进一步显露颈内动脉并进入颈静脉孔区。(2)颈静脉孔及其毗邻解剖结构:颈静脉孔上界为颈静脉球窝,前方为颈内动脉,前外侧为茎突前外侧,后方为头外侧直肌、寰椎横突,内侧为舌下神经和枕髁内侧,外侧为乳突、二腹肌和面神经。**结论** 经口翼下颌皱襞内侧入路进入颈静脉孔区视野良好,显露范围广泛,路径更短。

【关键词】 颈静脉孔; 咽旁间隙; 内窥镜检查; 尸体解剖

Endoscopic transoral-medial pterygomandibular fold approach anatomic study for jugular foramen

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【Abstract】 **Objective** To investigate the endoscopic transoral-medial pterygomandibular fold approach anatomic procedures for jugular foramen, and to analyze the clinical feasibility of this approach. **Methods and Results** In the anatomical laboratory of the Surgical Treatment Technology Innovation Unit of Nasal Skull Base Tumor in Eye & ENT Hospital of Fudan University, a total of 5 specimens of necroheads (10 sides) were taken as research objects to simulate the anatomical steps of entering the jugular foramina and its adjacent structures through the oral pterygomandibular fold medial approach, and observe and describe important anatomical markers. 1) Anatomical procedures of the jugular foramen: firstly, the soft palate mucosa and suprapharyngeal retractive muscle were cut through the medial incision of pterygomandibular fold to enter anterior parapharyngeal space, the adipose tissue in the space was removed, and the stylopharyngeal fascia and stylopharyngeal muscle group were exposed. After the stylopharyngeal fascia was removed, the internal carotid artery (ICA) was further exposed and the jugular foramen was exposed. 2) The jugular foramen and its adjacent anatomical structures: the upper boundary of the jugular foramen was jugular bulbous fossa, the anterior was ICA, the anterolateral lateral was styloid process, the posterolateral boundary was the lateral rectus of head and transverse process of atlas, the medial boundary was the hypoglossal nerve and medial of occipital condyle, and the lateral boundary was the mastoid, digastric and facial nerves. **Conclusions** Endoscopic transoral-medial pterygomandibular fold approach

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for jugular foramen has better visual field, wider exposure range and shorter path.

【Key words】 Jugular foramina; Parapharyngeal space; Endoscopy; Autopsy

Conflicts of interest: none declared

颈静脉孔区肿瘤包括自鼻咽部和颅颈交界区起源的鼻咽部恶性肿瘤,以及脊索瘤等向外生长累及颈静脉孔区的颅底肿瘤,其手术切除极具挑战性。这是由于颈静脉孔区解剖结构复杂、肿瘤位于脑深部并与重要神经血管(如后组脑神经、颈内动脉和颈内静脉等)相邻,手术复杂,风险高。目前,于内镜下经鼻入路切除自斜坡或岩斜区侵犯颈静脉孔区的肿瘤(非原发性颈静脉孔区肿瘤)疗效显著。然经鼻入路路径较长、显露范围狭小,一般仅适用于颈静脉孔岩部受累肿瘤的手术治疗^[1],而对颈静脉孔岩部外侧原发性肿瘤则难以达到有效切除之目的。虽然,传统的经侧颅底前方进入颈静脉孔区和颞下窝的外侧显微手术入路(如经 Fisch 颞下窝 C 型入路和经耳前颞下入路)是既往颈静脉孔岩部外侧原发性肿瘤手术的重要方式^[2],但因术中面神经移位、需“牺牲”颞下颌关节等缺点,使其难以作为首选方案。与之相比,经口翼下颌皱襞内侧入路进入颈静脉孔区无骨性结构遮挡且路径较短,不仅可以完整保留翼突、翼内肌、翼外肌等肌肉,而且可以最大程度保留咀嚼功能,无需似经外侧入路移位面神经和“牺牲”颞下颌关节。颈静脉孔由颞骨岩部和枕骨颈静脉部形成,是后颅窝侧壁的孔口,富含神经血管,分岩部(岩下窦)、神经部(含第 IX ~ XI 对脑神经和咽升动脉或枕动脉脑膜支)、乙状窦部(乙状窦汇入颈静脉球处)等三部分。咽旁间隙是一呈倒“金字塔”空间,自颅底下行延伸至舌骨水平,位于咽外侧,茎突隔膜将其分为茎突前间隙和茎突后间隙^[3],茎突前间隙包含脂肪组织以及腭帆张肌、腭帆提肌和软骨咽鼓管;茎突后间隙则含有颈内动脉、颈内静脉、后组脑神经和交感干等重要神经血管。通过咽旁间隙到达颈静脉孔区为经侧颅底前方入路的通道^[4-5],但经鼻入路路径较长、显露范围有限。近年来,孙希才教授团队针对经口入路进入咽旁间隙手术切除颅底肿瘤进行了大量解剖学研究^[6],并成功将其应用于咽后淋巴结清扫^[7],证实经口翼下颌皱襞内侧入路进入咽旁间隙安全有效。为进一步优化手术入路,以最小创伤达到最佳疗效,本研究拟探讨内镜下经口翼下颌皱襞内侧

入路、经咽旁前间隙进入其深层结构颈静脉孔区的主要骨性结构、解剖步骤和解剖标志,以为提高该区域手术疗效和安全性提供理论依据。

材料与方法

一、实验材料

1. 标本来源 共 7 具标本,均由复旦大学医学院解剖教研室提供。其中,头骨标本 2 具(死亡年龄、原因、时间、性别不详);尸头标本(死亡年龄、原因、时间、不详)5 具(10 侧),男性 3 具、女性 2 具。本试验于复旦大学附属耳鼻喉科医院鼻颅底肿瘤外科治疗技术创新单元解剖实验室进行,并获复旦大学道德伦理委员会审核批准(审批号:2021165)。

2. 试剂与仪器 彩色色素乳胶由复旦大学解剖实验室制备。富士 GFX100S 数码相机购自日本 Fuji 株式会社;3D-4K 内窥镜摄像主机(型号:Matrix P Spectar)和大图像光学试管棒状透镜内窥镜(直径为 4 mm,长度 17.50 cm)均购自德国 Xion 公司;显示器(型号:Sony310MC)为日本 Sony 株式会社产品。

二、研究方法

1. 标本制备 采用红色或蓝色水溶性色素乳胶灌注尸头标本双侧颈总动脉、椎动脉和颈内静脉;Davis 开口器撑开口腔,沿翼下颌皱襞内侧纵行切开软腭黏膜,上至软硬腭交界、下至磨牙后三角;由浅至深依次显露咽上缩肌、翼内肌、茎突肌群、茎突咽筋膜;最后打开茎突咽筋膜,显露颈内动脉咽旁段。

2. 结构观察 (1)颈静脉孔区骨性结构:采用数码相机拍摄,观察并描述经口翼下颌皱襞内侧入路所涉及颈静脉孔、颈动脉管、茎乳孔、舌下神经管与颈静脉结节之间的骨性解剖关系。(2)模拟实验:采用 3D-4K 内窥镜摄像主机和大图像光学试管棒状透镜内窥镜,对经口翼下颌皱襞内侧入路、经咽旁前间隙进入颈静脉孔区的主要解剖结构以及毗邻关系进行拍照并记录。

结 果

一、颈静脉孔区骨性结构

于数码相机下,颈静脉孔区骨性结构可见颈静

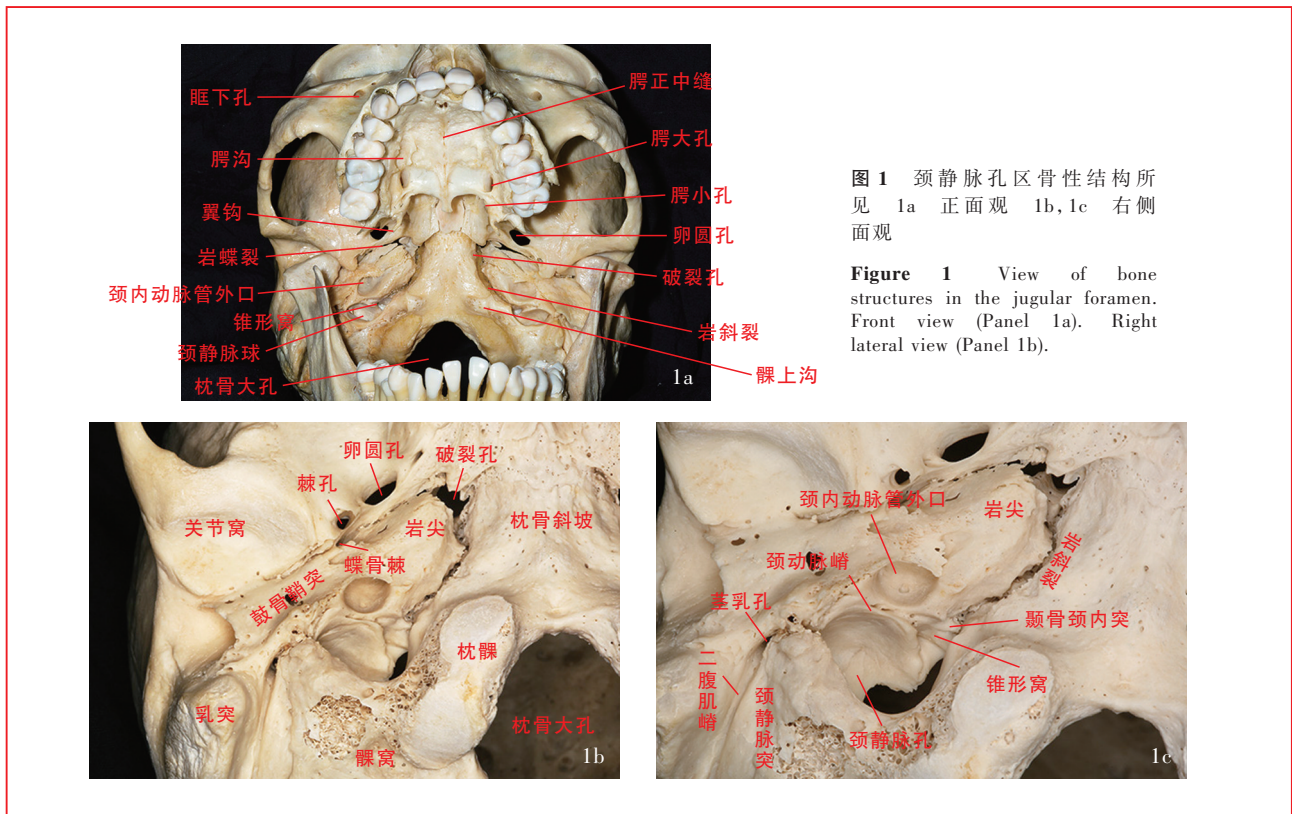


图1 颈静脉孔区骨性结构所见 1a 正面观 1b,1c 右侧面观

Figure 1 View of bone structures in the jugular foramen. Front view (Panel 1a). Right lateral view (Panel 1b).

脉孔、舌下神经管、颈内嵴、颈动脉嵴和枕髁。(1)颈静脉孔:位于颞骨与枕骨之间(图1),颞骨岩部形成颈静脉孔和穹顶的前上部,枕骨颈静脉突形成颈静脉孔的后缘。经口入路进入颈静脉孔区无骨性结构遮挡(图1a),可获得较大的显露范围。颈静脉孔位于外侧的枕乳缝和内侧的岩斜裂之间(图1b,1c)分为三部分,即岩部(岩下窦穿过)、乙状窦部(乙状窦穿过)和神经部(神经穿行),神经部位于乙状窦部与岩部之间,颞骨与枕骨相邻骨面(称为颈内突)的骨性突起(图1c),舌咽神经、迷走神经和副神经于神经部穿过颈静脉孔。(2)舌下神经管:位于颈静脉孔内侧、颈静脉结节与枕髁之间。(3)颈内嵴:为颞骨颈内突沿颈静脉球内侧边缘的向前延伸,是颈内突表面的浅槽,舌咽神经走行于此。(4)颈动脉嵴:颈动脉嵴将颈静脉孔与颈动脉管分开,并在外侧边缘与茎突相交(图1b,1c)。(5)枕髁:位于颈静脉孔下方和枕骨大孔前部的的外侧缘(图1b,1c),以及髁窝浅凹陷的前下方。髁窝中后髁静脉进入后髁管,开口于乙状窦。枕骨颈静脉突自枕髁后半部正上方向外延伸,形成颅骨后缘;当经枕下外侧入路手术或行迷路下乳突切除、颈部手术时,磨除颈静脉突可进入颈静脉球后缘;枕乳线穿行于颈静脉突外侧边缘与二腹肌沟和茎突内侧边缘之间,终止

于颈静脉孔(图1b,1c);面神经穿过位于颈静脉突前外侧的茎乳孔(图1c)。

二、经口翼下颌皱襞内侧入路进入咽旁前间隙
经口翼下颌皱襞内侧入路进入咽旁前间隙可逐一显露茎突前间隙、茎突后间隙以及颈静脉孔及其毗邻解剖结构。

1. 茎突前间隙 翼下颌皱襞将咽上缩肌与颊肌分开(图2a);于翼下颌皱襞内侧切开间隙内黏膜,显露咽上缩肌(图2b)并切开,可进一步显露茎突前间隙内脂肪垫(图2c);剔除咽旁前间隙内脂肪组织,于茎突咽肌外侧可见腭升动脉(图2d)。茎突隔膜是源于茎突的纤维结缔组织,为分隔茎突前后间隙的重要解剖标志,包裹二腹肌后腹、茎突肌群(茎突舌骨肌,茎突舌肌,茎突咽肌)、茎突舌骨韧带、茎突下颌韧带,并向上与腮腺筋膜相连;茎突隔膜内侧增厚部分为茎突咽筋膜,位于茎突肌群和咽缩肌之间的三角区(图2e)。舌根邻近咽旁间隙软组织内有舌咽神经、迷走神经分支和舌神经走行,手术操作需谨慎,以免造成上述神经损伤。茎突前间隙内容物主要有脂肪组织、腭升动脉、腭静脉、少许腮腺组织,自茎突顶点向外延伸至下颌角后部的茎突下颌韧带覆盖茎突舌骨肌和部分颈外动脉(图2f)。

2. 茎突后间隙 经口翼下颌皱襞内侧入路进入

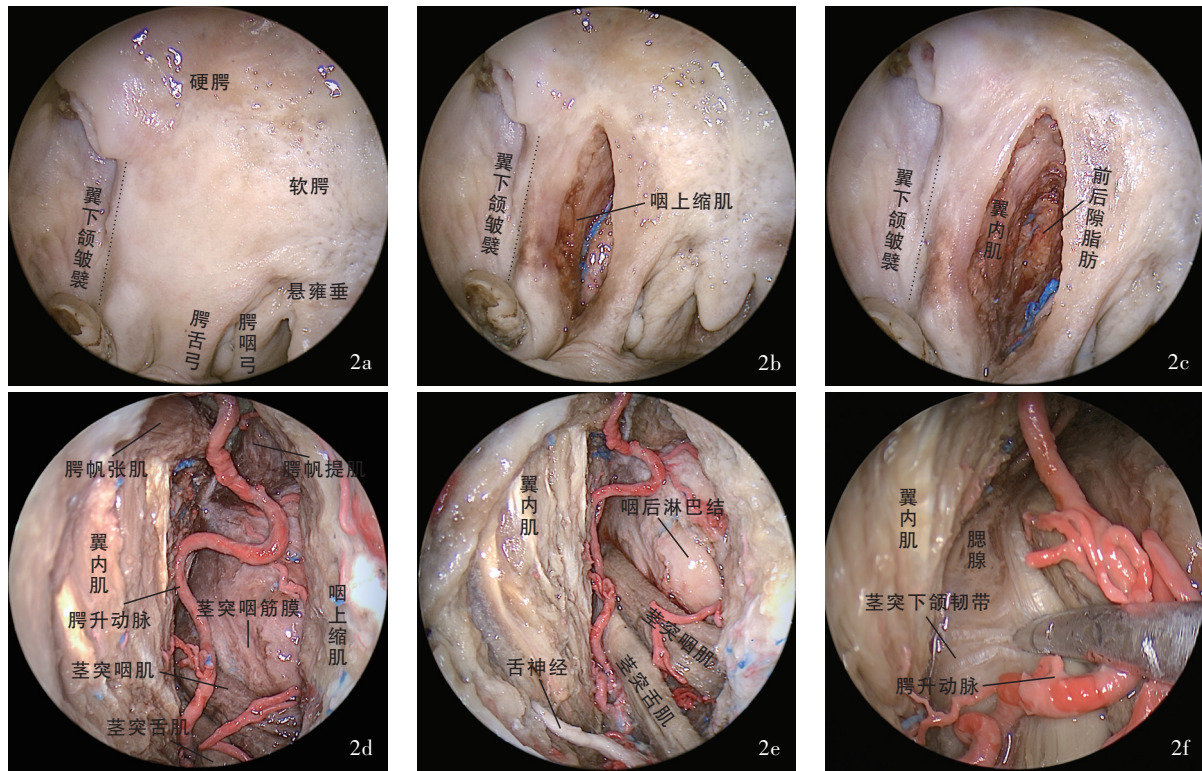


图 2 经口翼下颌皱襞内侧入路进入咽旁前间隙所见茎突前间隙解剖结构 2a 软腭解剖标志由中线向外依次为悬雍垂、腭咽弓、腭舌弓、翼下颌皱襞 2b 切开间隙内黏膜,显露咽上缩肌 2c 切开咽上缩肌,显露咽旁间隙外侧翼内肌以及间隙内脂肪组织 2d 剔除咽旁前间隙内脂肪组织,可见其上方外侧为腭帆张肌、上方内侧为腭帆提肌、内侧为咽上缩肌,茎突咽筋膜位于茎突肌群及咽上缩肌之间的三角区 2e 颈动脉鞘与头长肌之间可见咽后淋巴结,舌神经位于翼内肌前下缘自颞下窝穿行进入舌体 2f 茎突肌群外侧、翼内肌内后方可见茎突隔膜增厚形成茎突下颌韧带,茎突下颌韧带覆有茎突舌骨肌和部分颈外动脉分支

Figure 2 Anatomy of anterior styloid space through transoral - medial pterygomandibular fold approach into the anterior parapharyngeal space The anatomical marks of the soft palate were uvula, palatopharyngeal arch, palatoglossus arch and pterygomandibular fold from the center line outward (Panel 2a). The internal mucosa was incised to reveal the suprahyoid retractor (Panel 2b). The suprahyoid retractor muscle was incised to reveal the internal muscle of lateral parapharyngeal space and the adipose tissue within the space (Panel 2c). After removing the adipose tissue in the anterior parapharyngeal space, it could be seen the upper outside of the parapharyngeal space was the tensor veli palatine muscle, and the upper medial side was the levator veli palatine muscle, the inner side was the superior pharyngeal constrictor muscle, the stylopharyngeal fascia was located in the triangular area between the styloid process muscle group and the superior pharyngeal constrictor muscle (Panel 2d). The posterior pharyngeal lymph nodes could be seen between the carotid sheath and the longus capitis. The lingual nerve was located in the anterior inferior limb of the medial pterygoid muscle and passes through the inferior temporal fossa into the tongue body (Panel 2e). The styloid septum thickened to form the styloid mandibular ligament, which was covered by the styloid hyoid muscle and some branches of the external carotid artery (Panel 2f).

咽旁前间隙,侧向牵拉茎突舌肌和茎突咽肌,切除茎突隔膜和颈动脉鞘表面之茎突咽筋膜,即可显露茎突后间隙结构,包括颈内动脉、颈部交感干、咽升动脉和头长肌(图 3a)。(1)颈内动脉:显露茎突后间隙(图 3b),颈内动脉外后方为颈内静脉,依次显露后组脑神经,迷走神经、舌下神经及舌咽神经于颈内静脉内侧下行,副神经跨越颈内静脉前方或后方。头外侧直肌位于颈内静脉正后方,为连接寰椎横突与枕骨颈静脉突的深部肌肉,有助于头部前屈和侧弯,以及维持寰枕关节稳定性。向内侧拨开颈内动脉(图 3c),于头外侧直肌表面、颈内动脉管内

侧可见后组脑神经和 C₁ 神经,以及由咽颅底筋膜构成的咽旁间隙顶之内侧界(图 3d);自鞘突和腮腺深叶之间向前上方切开茎突隔膜、茎突下颌韧带,可见颈外动脉分支通过位于舌骨与茎突肌群之间的间隙上升,进一步切除茎突下颌韧带有助于显露颈外动脉、茎突舌骨肌和二腹肌后腹(图 3e)。(2)颈部交感神经链:颈部交感干在颈动脉鞘与椎前筋膜之间延伸至颅底。(3)咽升动脉:多起源于颈外动脉主干起始部后内侧,并延伸至颈内动脉后内侧颅底。

3. 颈静脉孔及相邻结构 视野转移至颈内动脉、颈内静脉内侧,切除头长肌,显露头前直肌,此

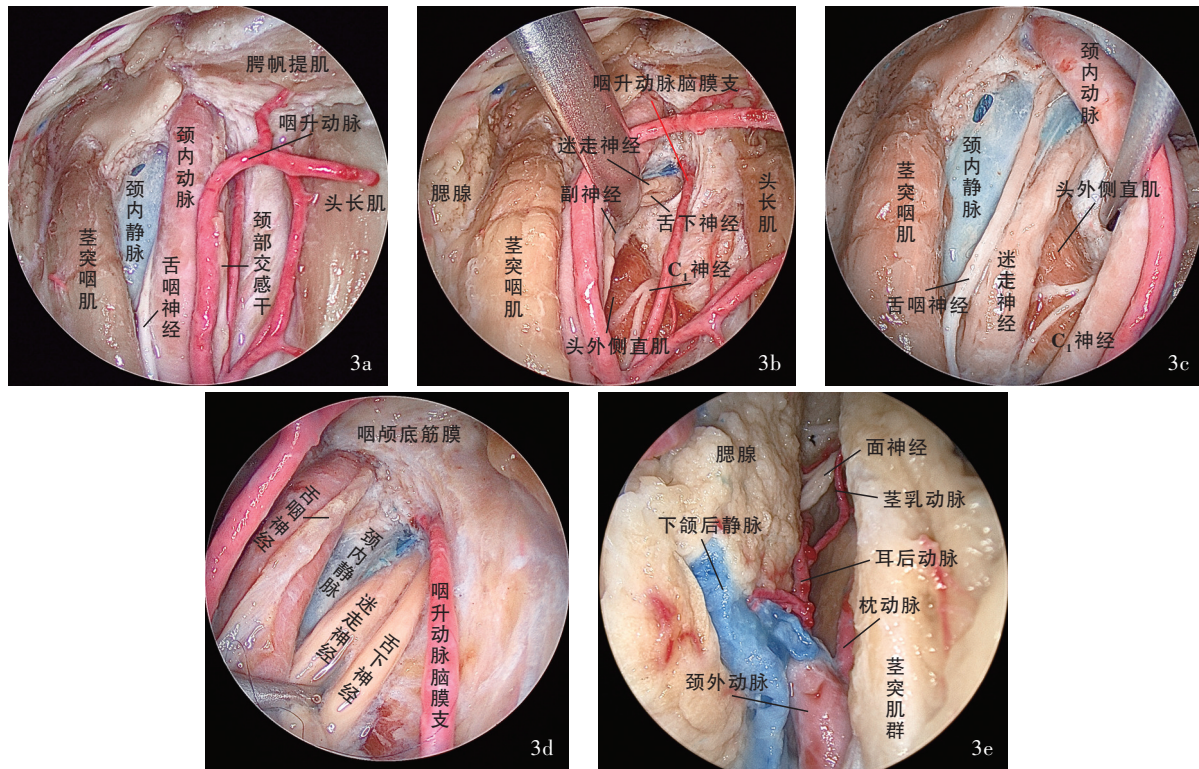


图3 经口翼下颌皱襞内侧入路进入咽旁前间隙所见茎突后间隙解剖结构 3a 切除茎突咽筋膜和茎突隔膜,显露颈内动脉、颈内静脉及后组脑神经 3b 向外侧拨开颈内动脉,可见头外侧直肌和C₁神经位于颈内静脉后方,后组脑神经及咽升动脉脑膜支位于其内侧 3c 向内侧拨开颈内动脉,可显露位于头外侧直肌表面的后组脑神经和C₁神经 3d 岩骨下方、颈内动脉内前方有咽颅底筋膜附着 3e 于茎突肌群和腮腺之间切除茎突隔膜、茎突下颌韧带,逐一显露颈外动脉主干以及穿行于腮腺内部的下颌后静脉;颈外动脉分支枕动脉向内后方走行,穿行于二腹肌后腹与头外侧直肌之间,耳后动脉发出茎乳动脉进入茎乳孔营养面神经

Figure 3 Anatomy of the posterior styloid space through transoral-medial pterygomandibular fold into the anterior parapharyngeal space The stylopharyngeal fascia and stylopharyngeal septum were excised to reveal the ICA, internal jugular vein and posterior cranial nerve (Panel 3a). Pulling the ICA outside to see the rectus capitis lateralis, the C₁ nerve, the medial posterior cranial nerve and the meningeal branch of the ascending pharyngeal artery behind the internal jugular vein (Panel 3b). The ICA was pushed aside, the posterior cranial nerve and the C₁ nerve located on the surface of the lateral rectus capitis muscle (Panel 3c). Under the petrous bone, the pharyngobasilar fascia attached to the inside and front of the ICA (Panel 3d). The styloid septum and the styloid mandibular ligament were removed between the styloid muscle group and the parotid gland, and the main ECA and the posterior mandibular vein running through the parotid gland were exposed one by one. The ECA branches and the occipital artery run inward and backward between the posterior abdomen of the digastric muscle and the lateral rectus of the head. The posterior auricular artery sent out the stylomastoid artery into the stylomastoid foramen to feed the facial nerve (Panel 3e).

时可见咽升动脉脑膜支,以及舌下神经出舌下神经管后穿行于枕侧韧带,然后下行(图4a)。寰枕侧韧带向上与岩斜裂中纤维软组织相连,向下止于寰椎横突;切除头前直肌,以提供进入整个斜坡的通道,包括髁上沟、枕骨大孔前缘、寰椎侧块和寰枕关节囊,以及髁上沟枕髁囊和头前直肌的共同附着区(图4b~4d),通过髁上沟测算出舌下神经管准确位置。进一步解剖、分离茎突肌群与颈内动脉之间组织,可显露副神经、颈内静脉和深面内侧的头外侧直肌、外侧的二腹肌,枕动脉在头外侧直肌与二腹肌后腹之间由外侧向内侧走行,并可见副神经越过头外侧直肌表面向外侧走行(图4e)。磨除该区域

骨质显露舌下神经管前部皮质骨,后者将斜坡下外侧区分为上隔室和下隔室,上隔室为颈静脉结节、下隔室为枕髁,剔除颈静脉结节以及相对应的脑膜,显露颈静脉孔岩部和神经部(图4f~4h),岩下窦引流至颈静脉孔腹内侧,后组脑神经(第IX~XI对)于岩下窦后方出颅,颈静脉球位于后外侧,占据颈静脉孔的较大部分。岩下窦、前髁导静脉注入颈静脉孔岩部静脉汇,岩部静脉在舌咽神经与迷走神经之间汇入颈静脉球(图4f)。椎动脉硬膜外段在离开寰椎横突孔时向内侧穿过头外侧直肌,并向后走向其硬脑膜入口(图4i)。颈静脉球和颈内静脉相邻部分接受颅内和颅外静脉引流,包括乙状窦和岩下

窦、椎静脉丛、舌下神经管静脉丛、髁后导静脉和岩斜下静脉。岩下窦上端与海绵窦和基底静脉丛、颈静脉球相通。磨除颈内静脉后端部分颈静脉突、切除头外侧直肌内侧部分,可以显露乙状窦汇入颈内静脉入口处(图 4h,4i)。

讨 论

颈静脉孔区位置较深、组织致密,内含面神经、后组脑神经、颈内动脉、颈内静脉和椎动脉等神经血管结构,经此区域行肿瘤切除术难度较高、手术入路复杂,因此精确的解剖标志至关重要,尤其是存在解剖变异者更是不可或缺。既往,经 Fisch 颞下窝入路是颈静脉孔区肿瘤切除术的常规入路,分为 A、B、C 三型,其中 A、B 两型主要针对颈静脉孔和岩尖周围区域肿瘤,行耳后切口,术中需横断外耳道、切除中耳结构和移位面神经,故术后常并发传导性听力丧失、短暂性或永久性面神经麻痹;C 型入路无需面神经移位,适用于生长于颞下窝以及鼻咽部、鞍旁、上颌后和咽鼓管旁区域肿瘤^[8],但该型对于开放外侧入路进入颈内动脉内侧者较为困难。神经内镜技术的应用给颅底外科带来巨大变革,于内镜下经鼻入路可接近整个腹侧颅底^[9],被称为“扩大经鼻内侧入路”,包括前颅窝、中颅窝和后颅窝。但是,到达颈静脉孔岩部已是经鼻内镜手术的后外侧极限^[10-11],其手术入路只能达到舌下神经管区和颈静脉孔神经部。开放入路和经硬腭入路在以往的文献中均有描述,但经此入路手术存在创伤大、面颈部形成较明显疤痕和影响咀嚼功能等缺点^[12-14]。目前认为,颈静脉孔区手术需满足两个条件,一是术中显露广泛,二是以最小创伤获得最大程度的病变切除。近年来,随着内镜技术以及机器人手术的快速发展,经口入路手术越来越受到临床医师的重视^[15-16]。孙希才教授团队既往针对经口翼下颌皱襞内侧入路进入咽旁间隙的解剖标志进行了详细描述^[6,17],并以此为基础开展经口翼下颌皱襞内侧入路咽后淋巴结清扫术,与传统手术入路相比,该入路可快速显露颈动脉鞘和咽后淋巴结,并于手术全程显露颈内动脉咽旁段,具有病灶切除彻底、无需磨除骨质、手术时间短、术中出血少、术后恢复快等优点^[7]。经该入路行咽旁肿瘤切除术可于内镜下直视颈内动脉咽旁段,从而避免损伤颈内动脉;此外,由于手术视野良好、显露范围广泛,对术中严重出血患者,可于内镜下通过直接堵塞或结扎颈内动脉

咽旁段止血,避免不良后果。从咽旁间隙向深部解剖,经口翼下颌皱襞内侧入路向内侧可达舌下神经管、颅颈交界区和斜坡,向上达岩尖和颈内动脉岩骨段,向后达乙状窦入口、椎动脉硬膜外段和头外侧直肌,向外侧达腮腺、面神经主干并显露颈外动脉分支;入路所经范围无骨性结构阻挡,无需进行下颌骨外旋手术、移位面神经或“牺牲”听力等。

经口翼下颌皱襞内侧进入颈静脉孔区,首先于翼下颌皱襞内侧切开黏膜,显露咽上缩肌(图 2b)并切开,显露茎突前间隙脂肪垫(图 2c)和腭升动脉(图 2d);并可见由茎突隔膜分隔的茎突前后间隙,前间隙主要包含脂肪组织、腭升动脉、腭静脉,以及少许腮腺组织,茎突隔膜内侧增厚形成茎突咽筋膜,位于茎突肌群和咽缩肌围成的三角区(图 2e),切除茎突咽筋膜即可显露颈内动脉、颈部交感干、咽升动脉和头长肌(图 3a);向内侧拨开颈内动脉(图 3c),可见后组脑神经和位于头外侧直肌表面的 C₁ 神经;由此向中线延伸即是椎前肌肉,切除头长肌、显露头前直肌(图 4a),切除头前直肌则可进一步显露岩斜区髁上沟、枕骨大孔前缘、寰椎侧块和寰枕关节囊(图 4b~4d),磨除骨质后即显露舌下神经管前部皮质骨,后者将枕骨斜坡分为颈静脉结节部和髁部,剔除颈静脉结节和相应脑膜,显露颈静脉孔岩部和神经部(图 4f~4h),岩下窦经此引流至颈静脉孔腹内侧,后组脑神经(第 IX~XI 对)于岩下窦后方出颅,颈静脉球位于其后外侧,占据颈静脉孔较大部分。岩下窦、前髁导静脉汇入颈静脉孔岩部静脉汇,岩部静脉在舌咽神经与迷走神经之间汇入颈静脉球(图 4f)。

寰枕侧韧带向上与岩斜裂中纤维软组织相连接,向下止于寰椎横突,由于其位置较深且靠外侧,故在颅颈交界区相关解剖文献中较少描述,但经口入路则可清晰显示。本研究纳入的 5 具尸头标本均能够很好地解剖寰枕侧韧带,并发现进入舌下神经管的神经、血管均穿行于此韧带,且覆盖枕骨与寰椎横突之间空隙,椎动脉硬膜外段位于其下方。颈静脉球和颈内静脉相邻部分接受颅内和颅外静脉引流,包括乙状窦和岩下窦、椎静脉丛、舌下神经管静脉丛、髁后导静脉和岩斜下静脉。岩下窦在上端开口与海绵窦和基底静脉丛相通,向下与颈静脉球相通。

颈静脉孔上界为颈静脉球顶壁,前方为颈内动脉,前外侧为茎突之前外侧,后方为头外侧直肌、寰



图4 经口翼下颌皱襞内侧入路进入咽旁间隙所见颈静脉孔区及其周围解剖结构 4a 显露咽旁后间隙,切除头长肌,可见咽升动脉脑膜支以及舌下神经出舌下神经管,并穿越寰枕侧韧带后下行 4b,4c 切除头前直肌,以提供进入整个斜坡的通道,包括髁上沟、枕骨大孔前缘、寰椎侧块和寰枕关节囊 4d 切除咽颅底筋膜、寰枕侧韧带、寰枕关节囊,显露岩尖 4e 于颈内动脉与茎突肌群之间,依次显露副神经、颈内静脉,以及颈内动脉和茎突肌群深面内侧的头外侧直肌、外侧的二腹肌,枕动脉于头外侧直肌与二腹肌后腹之间由外侧向内侧走行,并可见副神经越过头外侧直肌表面向外侧走行 4f 磨除颈静脉结节及枕髁骨质,显露颈静脉结节和舌下神经管,并进一步显露岩斜裂中岩斜下静脉,岩斜下静脉汇入岩部静脉汇 4g 完全显露颈静脉孔神经部,以及岩下窦,岩下窦与岩斜下静脉为脑膜内外的镜像结构,共同汇入岩部静脉汇,并在舌咽神经与迷走神经之间汇入颈内静脉 4h 磨除颈内静脉后方的部分枕骨颈静脉突以及附着其上的部分头外侧直肌,可见乙状窦汇入颈静脉球 4i 于寰椎横突孔和头外侧直肌内侧,可见椎动脉硬膜外段,向上向后穿入脑膜

Figure 4 Anatomy of the jugular foramen and adjacent anatomy through transoral-medial pterygomandibular fold approach After exposing the posterior parapharyngeal space, the longus capitis muscle was excised, and the ascending pharyngeal artery meningeal branch and the hypoglossal nerve emerged from the hypoglossal neural tube and passed through the atlanto-occipital ligament to descend posteriorly (Panel 4a). The anterior rectus capitis was resected to provide access to the supracondylar groove, lateral mass of the atlas, and capsule of the atlanto-occipital joint (Panel 4b, 4c). Resecting the pharyngobasilar fascia, lateral atlanto-occipital ligament, exposing the petrous apex (Panel 4d). Between the ICA and the styloid muscles, the accessory nerve, the internal jugular vein, and the deep medial rectus capitis lateralis, and the digastric muscle laterally, the occipital artery runs from the inside to the outside between the lateral rectus capitis and posterior belly of digastric muscles. And the accessory nerve crosses the surface of the lateral rectus capitis and runs to the outside (Panel 4e). Grinding away the bone of the jugular tubercle and occipital condyle, exposing the jugular tubercle and the hypoglossal canal, and further exposing the inferior petroclival vein in the petroclival fissure, which flows into the petrosal vein confluence (Panel 4f). The inferior petrosal sinus and inferior petroblaque vein were mirror structures inside and outside the meninges, and they were merged into the petrosal venous confluence, and into the internal jugular vein between the glossopharyngeal nerve and the vagus nerve (Panel 4g). Grinding away part of the jugular process and part of the lateral rectus capitis attached to it, the sigmoid sinus can be seen to merge into the jugular bulb (Panel 4h). In the medial side of the transverse process foramen and the lateral rectus muscle, the epidural VA can be seen, and was upward and then penetrating the meninges (Panel 4i).

椎横突,内侧为舌下神经和枕髁内侧,外侧为乳突、二腹肌和面神经(图1)。由于颈静脉孔位于颈部与颅底之间交界区,因此进入颈静脉孔各边界需选择不同的手术入路^[18]:颈静脉孔区手术入路分为外侧组(通过乳突)、后侧组(通过后颅窝)和前侧组(通过鼓骨),其分组原则是基于颞骨(不包含鳞部)被视为不规则“金字塔”形,其基底位于乳突表面。

综上所述,内镜下经口翼下颌皱襞内侧入路进入颈静脉孔区可广泛显露手术视野且手术路径较短。但经口进入颈静脉孔区的咽旁间隙通道缺乏骨性标志,对初学者具有一定难度,而且颈静脉孔区解剖结构复杂,包含颈内动脉和后组脑神经等重要血管神经,因此扎实的解剖学基础是不可或缺的。此外,如病变较大,切除范围较广,该入路可以造成软腭缺损等,需通过颞下瓣或颞肌瓣等进行修复^[19-20];伤口需逐层缝合,防止软腭开裂。

利益冲突 无

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