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Hans汉斯

Sternberg管未闭的诊断和治疗

顾靖宇，沈恪诚，孙　亮，尹子乾，顾令文，虞正权，翟伟伟，吴　江*

苏州大学附属第一医院神经外科，江苏　苏州

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摘　要

目的：分析Sternberg管未闭的病因、临床特点，并指导临床诊断及治疗。方法：收集近1年本医疗组治疗Sternberg管未闭患者的临床资料，并检索国内外数据库收集相关病例进行回顾性分析。结果：2例病例均有明确Sternberg管未闭伴脑膜脑膨出的影像学特征，经过手术治疗后未见明显脑脊液漏表现。文献检索共得相关研究22篇，其中病例为51例，以自发性脑脊液鼻漏为主要症状，均有明确蝶窦骨质缺陷，手术治疗预后良好。结论：Sternberg管人群中发病率低，主要引起不明原因的脑脊液鼻漏。其临床诊断困难，但手术可治愈，预后好，复发率低。

关键词

脑脊液漏，Sternberg管，颅底神经外科，显微外科手术

Diagnosis and Treatment of Patent Sternberg's Canal

Jingyu Gu, Kecheng Shen, Liang Sun, Ziqian Yin, Lingwen Gu, Zhengquan Yu, Weiwei Zhai, Jiang Wu*

Department of Neurosurgery, The First Affiliated Hospital of Soochow University, Suzhou Jiangsu

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Abstract

Objective: To analyze the etiology and clinical characteristics of patent Sternberg's Canal, and to guide clinical diagnosis and treatment. Method: We collect clinical data of patients with patent Sternberg's Canal treated in our medical group in recent years and retrieve relevant cases from Chinese and foreign databases for retrospective analysis. Result: Both two cases had explicit imaging features of patent Sternberg's Canal along with meningoencephalocele. No obvious cerebrospinal fluid leakage was observed after surgical treatment. A total of 22 relevant studies were obtained through

*通讯作者。

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literature search, including 51 cases, with spontaneous cerebrospinal fluid rhinorrhea as the main symptom. All of them had clear sphenoid sinus bone defects and had good prognosis after taking surgical treatment. Conclusion: In epidemiology, the incidence rate in Sternberg's Canal is low, which mainly causes cerebrospinal fluid rhinorrhea of unknown causes. It is difficult to make clinical diagnosis, but it can be cured by surgery, with good prognosis and low recurrence rate.

Keywords

Cerebrospinal Fluid Leakage, Sternberg's Canal, Skull Base Neurosurgery, Microsurgery

1. 引言

蝶窦 Sternberg 管未闭是由于胚胎发育期蝶骨融合不全，致使蝶窦侧壁骨质薄弱甚至缺损形成特殊性类型的颅底型颅裂，常伴蝶窦侧隐窝过度气化，临床上常因自发性脑脊液鼻漏就诊而被发现。最早于 1888 年由 Sternberg 在尸头解剖中发现，并命名为 Sternberg's Canal，该管起源于眶上裂、穿过蝶体进入鼻咽，故又称侧颅咽管[1]。临床医生甚至影像科医生往往缺乏对 Sternberg 管的认知，无法对其相关的疾病进行早期准确诊治。现收集本医疗组所收治病例并结合相关中英文文献进行总结分析，以分享相关疾病的诊治思路。

2. 资料与方法

2.1. 临床资料

2023 年 10 月至 2024 年 10 月，近 1 年期间笔者所在的医疗组收治两例合并 Sternberg 管未闭的患者，分别表现为自发性脑脊液漏和继发性三叉神经痛，较为复杂、罕见且有趣。

病例 1：女性，57 岁。反复鼻腔流液一年，反复发热一个月。重症肌无力病史 32 年，平素需口服免疫抑制剂；同时患甲亢病史 14 年。2022 年新冠感染以来，患者在低头等体位改变后间断出现鼻腔流出清亮液体，反复发热，考虑脑脊液鼻漏所致颅内感染，因重症肌无力需长期口服免疫抑制剂，增加颅内感染治疗矛盾和难度。当时神经内科已予抗感染等治疗，鼻漏自愈后仍反复再漏并颅内感染，且 MRI 发现右前床突脑膜瘤(图 1(A)~(D))，最终请神经外科、耳鼻喉科会诊。我科阅片后考虑前床突脑膜瘤与患者急需解决的脑脊液鼻漏和颅内感染无直接相关性。

我科继续详细观察患者影像学资料发现双侧蝶窦外侧壁、中颅底内下侧可见异常液体信号，考虑为 Sternberg 管未闭，右侧较为显著，且 Sternberg 管前下方考虑脑膜膨出、脑脊液流入蝶窦(图 1(E)~(H))。矢状位可看到范围从眶上裂贯穿蝶骨体外侧至鼻咽部。

至此可阐明本患者发病机制：在先天性 Sternberg 管未闭、骨质缺损合并脑膜膨出的基础上，新冠感染后咳嗽等因素导致颅内压增高，使膨出的脑膜破损形成脑脊液鼻漏，蝶窦细菌逆行至颅内形成颅内感染，而重症肌无力须用的免疫抑制剂进一步加重感染。前床突脑膜瘤则为合并的另一种疾病，与鼻漏无关。治疗方案：1) 内镜经鼻－翼突－蝶窦脑脊液漏修补治疗脑脊液漏，前床突脑膜瘤随访观察；2) 翼点入路切除前床突脑膜瘤，同时中颅底探寻并修补脑脊液漏。术后可继续应用免疫抑制剂控制重症肌无力，但围手术期存在诱发肌无力危象的可能。患者及家属 1 月后决定选择第 2 种方案，至我科手术治疗。手术方法：翼点筋膜间入路开颅，低至颧弓，充分磨除蝶骨嵴后方颞部骨质，充分暴露中颅底(图 2)。

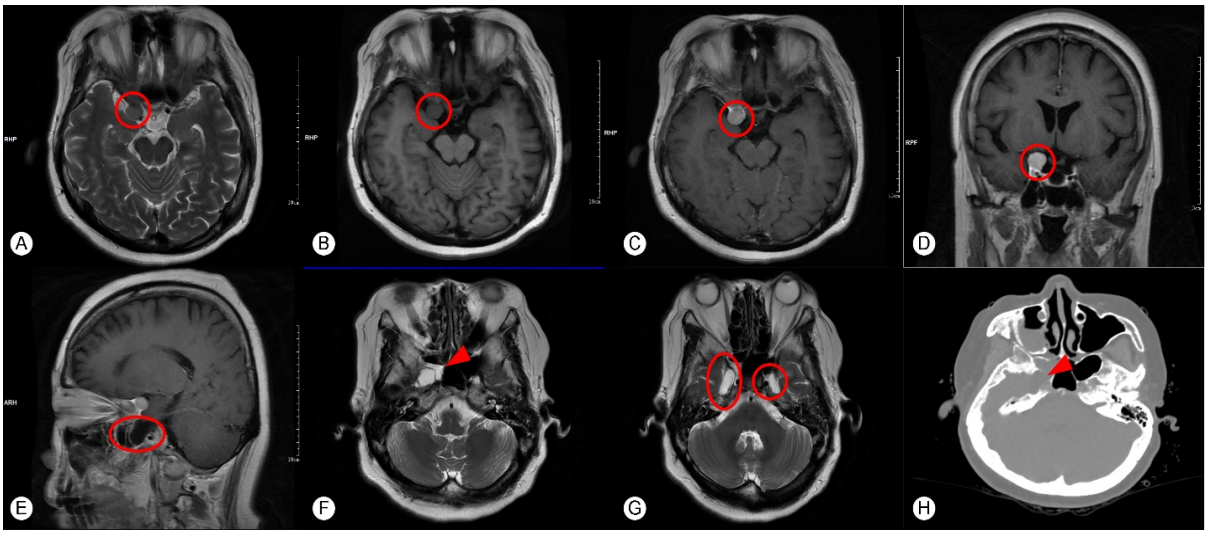

Figure 1. The preoperative imaging data of Case 1. (A) and (B). MRI scan indicates an occupancy with equal signal in T1 and equal-high signal in T2 in the right anterior clinoid process. (C) and (D): Enhanced MRI scan indicates the mass was uniformly enhanced, suggesting an anterior clinoid meningioma. (E)~(G): MRI T2 weighted imaging shows abnormally high signal intensity, and the red arrow indicates the ruptured area formed by meningeal protrusion, which is the site of cerebrospinal fluid nasal leakage. (H) The 3D thin-layer brain CT bone window shows a bone defect in the lateral wall of the sphenoid sinus. Cerebrospinal fluid images can be seen in the sphenoid sinus, posterior ethmoid sinus, and maxillary sinus, and there is excessive gasification of the bilateral sphenoid sinus lateral crypts

图 1. 患者 1 术前影像学资料。(A)和(B)：MRI 平扫提示右侧前床突 T1 等、T2 等高信号占位。(C)和(D)：MRI 增强后占位均匀强化，考虑为前床突脑膜瘤。(E)~(G)：MRI T2 加权成像显示异常高信号，箭头处为脑膜膨出后形成的破裂口区域，即脑脊液鼻漏的漏口部位。(H)：3D 薄层脑 CT 骨窗位显示蝶窦外侧壁骨质缺损，蝶窦、后组筛窦、上颌窦内可见脑脊液影像，双侧蝶窦侧隐窝过度气化

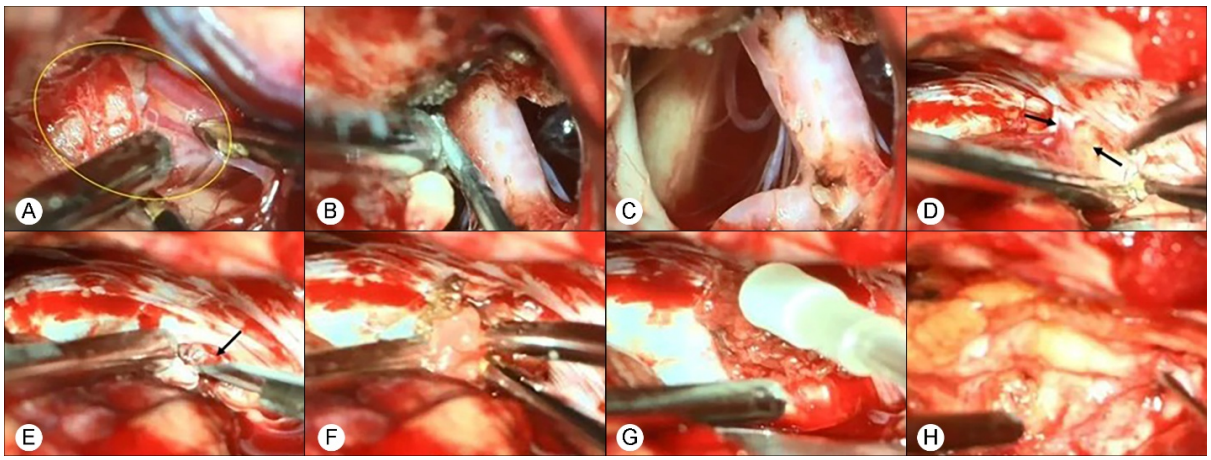

Figure 2. The surgical data of Case 1. (A) Opening the lateral fissure to expose the anterior clinoid process meningioma. (B) Detaching the base and perform block resection, revealing the internal carotid artery and its branches below. (C) After complete resection of anterior clinoid meningioma, cauterizing the base of meningioma. The inner compressed optic nerve, and the outer internal carotid artery were well protected. (D) Turning towards the lower part of the middle skull base, a temporal basal brain tissue hernia was observed (black arrow), indicating that this patient is actually experiencing a meningoencephalocele through Sternberg's Canal. (E) Removing the bulging brain tissue, with the black arrow indicating a ruptured dura mater leak. (F)~(H): Filling the leak with muscle and cover it with biological protein glue, fat, fascia, artificial dura mater, and reconstructing the skull base

图 2. 患者 1 手术资料。(A)：打开侧裂暴露前床突脑膜瘤；(B)：离断基底，分块切除，见下方颈内动脉及分支；(C)：前床突脑膜瘤全切后，电灼基底，内侧受压的视神经和外侧颈内动脉保护完好；(D)：转向中颅底内下方，见颞底脑组织疝入漏口(箭头处)，因此本患者实际上是 Sternberg 管“脑膜脑膨出”。(E)：清除膨出的脑组织，箭头处为硬膜破损的漏口。(F)~(H)：肌肉填塞漏口并覆盖生物蛋白胶、脂肪、筋膜、人工硬脑膜，颅底重建

患者术后脑脊液鼻漏治愈(图 3)，围手术期未诱发肌无力危象，未使用脑脊液引流。至今已随访 1 年，未再现脑脊液漏或颅内感染。该患者同时解决脑脊液漏、颅内感染和前床突脑膜瘤的问题，获得神经内科继续针对重症肌无力随访治疗的机会。

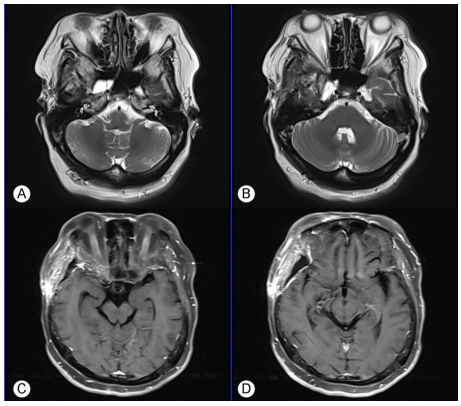

Figure 3. The postoperative MRI of Case 1. (A)~(D): The signal of cerebrospinal fluid in the sphenoid sinus and meningeal brain protrusion at the leakage site disappeared. The signal of fluid in the Sternberg's Canal decreased significantly, and the anterior clinoid meningioma was completely resected

图 3. 患者 1 术后 MRI。(A)~(D) 蝶窦内脑脊液信号消失，漏口处脑膜脑膨出信号消失，Sternberg 管内液体信号明显减少，前床突脑膜瘤全切

病例 2：男性，21 岁，阵发性右面部疼痛半年余。主要表现为右下颌区域阵发性放电样疼痛。结合症状及 MRI 检查(图 4(A)~(F))，一般临床思维会考虑中颅底占位合并左侧 CPA 占位，胆脂瘤？但仍需首先坚持一元论。DWI 证实左侧 CPA 为脑脊液信号，排除左侧 CPA 胆脂瘤(图 4(G)和图 4(H))。

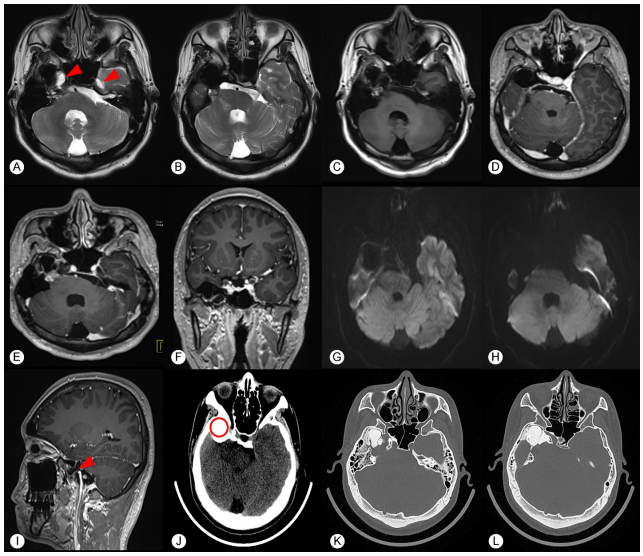

Figure 4. The preoperative imaging data of Case 2. (A)~(C): MRI scan indicates a mass in the right middle skull base, with low signal intensity in T1 and T2. The brainstem is displaced to the right side, and the red arrow indicates abnormal high signal intensity in both middle skull bases. (D)~(F): The enhanced MRI scan shows no enhancement in the middle skull base mass. (G) and (H): DWI sequence of MRI. (I): MRI T1 weighted imaging sagittal plane. The red arrow corresponds to the abnormal fluid signal in the middle skull base on the right side of figure A. (J) and (K): Brain CT scan and bone window

图 4. 患者 2 术前影像学资料。(A)~(C)：MRI 平扫提示右侧中颅底占位，T1、T2 均呈低信号，脑干向右侧移位，箭头处为双侧中颅底异常高信号。(D)~(F)：MRI 增强显示中颅底占位无强化。(G)和(H)：MRI 平扫 DWI 序列。(I) MRI T1 加权成像矢状位，箭头处对应 A 图右侧中颅底异常液体信号。(J)和(K)：颅脑 CT 平扫及骨窗位

仔细阅读 MRI 图像可见两侧中颅底内侧、蝶窦外侧壁高 T2 的液体信号，病灶侧更为显著(图 4(A))，且矢状位可见范围从眶上裂－蝶骨体－鼻咽部(图 4(I))。颅脑 CT 测占位处 CT 值为 1630 Hu，证实中颅底为骨性占位，骨窗发现其为两处边界清晰的骨性结构，外侧者涉及三叉神经 V2 和 V3 出颅的圆孔、卵圆孔，内侧者为异常形态的后床突，其内侧缘为变形的颈内动脉，骨性异常涉及 Meckel 囊附近岩尖区域。此外，右侧蝶窦侧隐窝过度气化，但蝶窦外侧壁骨质未见缺损(图 4(J)~(L))。以上影像学表现非常符合 Sternberg 管未闭，而 Sternberg 管与胚胎发育期蝶骨融合异常相关，因此中颅底骨性占位可能为先天性未融合的蝶骨组成部分，缓慢增生。至此，该患者发病机制基本明确：先天性蝶骨融合异常，Sternberg 管未闭，未融合的蝶骨组成部分缓慢增生，形成两处孤立的中颅底骨性占位，卡压三叉神经尤其卵圆孔内的 V3 支，导致继发性三叉神经痛。中颅底先天性骨性占位牵拉三叉神经和束膜、Meckel 囊等，进而脑干被牵拉向患侧显著移位。尽管 Sternberg 管未闭，但蝶窦外侧壁骨质无缺损，所以该患者未出现脑脊液漏。治疗方案：去除中颅底未融合的增生性骨性占位，三叉神经减压，因 Sternberg 管未闭，骨质薄弱且可能潜藏微小的骨质缺损，注意颅底重建，避免脑脊液漏。手术方法：改良翼点小问号切口，磨除蝶骨嵴及后方颞部骨质，充分暴露中颅底，硬膜外入路处理中颅底病灶(图 5)。

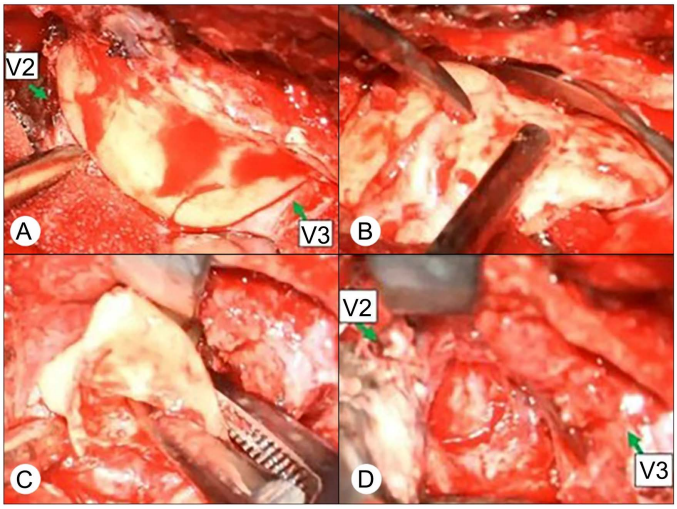

Figure 5. The surgical data of Case 2. (A) Upon detachment of the orbital meningeal ligament, V2 was observed within the foramen rotundum behind the orbital fissure, with a bony protrusion behind V2 and a deformed foramen novale and compressed V3 behind the bony protrusion. Therefore, the bone mass is located between the foramen rotundum and foramen novale and participates in the formation of the posterior and anterior walls. (B) Grinding and reducing the larger bone fragment on the outer side, loosen and separate its interface, and remove it completely. (C) Grinding and reducing the smaller bone fragment in the inner side, loosening and separating the interface, and then removing it completely. (D) After removing the bone mass, the compression of V2 and V3 was relieved, and sufficient decompression was achieved. But after removal, there was a bone support defect in the middle skull base, and the Sternberg's canal bone was weak or had hidden defects. Therefore, muscles, fascia, biological protein glue, artificial dura mater were filled in the cavity for skull base reconstruction. Note: V2 is the maxillary branch of the trigeminal nerve, and V3 is the mandibular branch of the trigeminal nerve

图 5. 患者 2 手术资料。(A) 离断眶脑膜韧带，在眶上裂后方见圆孔内 V2，V2 后方见骨性隆起，骨性隆起后方见变形的卵圆孔和卡压的 V3，因此骨肿物位于圆孔和卵圆孔之间，并参与形成其后壁和前壁。(B) 磨除缩小外侧较大骨块，松动后分离其界面，整体取出。(C) 磨除缩小内侧较小骨块，松动后分离界面，整体取出。(D) 去除骨性占位后，V2 和 V3 骨性卡压解除，充分减压。但取出后中颅底骨性支撑缺损，且 Sternberg 管骨质薄弱或潜藏缺损，所以腔内填塞肌肉、筋膜、生物蛋白胶、人工硬膜，颅底重建。注：V2 为三叉神经上颌支，V3 为三叉神经下颌支

患者术后右面部疼痛完全消失，无面部麻木，无脑脊液漏，未行脑脊液引流术。术后 CT 提示骨性占位消失，颞叶无挫伤(图 6(A)~(D))。出院后规律随访复查，未见面部麻木及脑脊液漏，术后 3 月复查 MRI 提示骨性占位去除，Sternberg 管基本消失(图 6(E)~(H))。

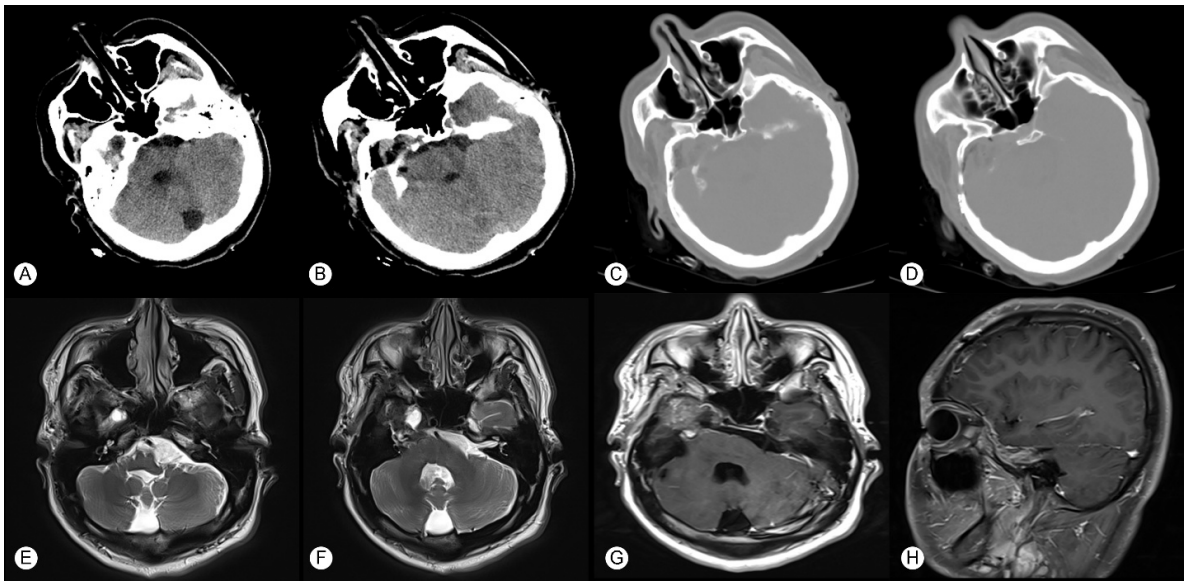

Figure 6. The postoperative imaging data of Case 2. (A)~(D). Brain CT scan and bone window. (E)~(H). MRI and its enhancement scan
图 6. 患者 2 术后影像学资料。(A)~(D) 颅脑 CT 平扫及骨窗位。(E)~(H) MRI 平扫及增强

2.2. 数据检索及收集

通过搜索 Pubmed、知网及万方数据库 2000 年 1 月 1 日至 2025 年 2 月 28 日相关文献，检索关键词为：Sternberg 管、脑脊液漏。总共得到 218 篇外文文献及 2 篇中文文献，排除非中英文文献、会议摘要、综述，得到 31 篇英文文献及 1 篇中文文献。仔细阅读上述文献，排除无临床数据文献，最终纳入 21 篇英文文献及 1 篇中文文献的临床数据。主要纳入标准为：因 Sterngberg 管未闭引起的脑膜脑膨出或脑脊液鼻漏，且有明确影像学特征提示蝶骨骨质缺陷导致脑膜或脑组织从圆孔内侧和翼管进入鼻咽的病例。数据收集内容为患者人数、性别、年龄、症状、影像学特征、部位、手术方式、术后并发症、脑脊液引流及复发人数。

3. 数据结果

从上述 22 篇文献中，收集病例总计 51 例，其中女性占比较高 68.63%，年龄涵盖青少年至老年人，主要以自发性脑脊液鼻漏为首要诊断，均有蝶窦及蝶窦侧壁骨质异常。在报告的病例中，以内镜手术治疗较多，并发症仅有个别病例存在，术中及术后留置脑脊液引流手段人数较少。手术后总体预后良好，较少复发(表 1)。

Table 1. Summary of clinical characteristics of 51 cases of patent Sternberg's Canal along with meningoencephalocele
表 1. Sternberg 管未闭脑膜脑膨出 51 例病例临床特征汇总

作者 年份	人数	女性 人数	年龄 (均值 ± 标准差)	症状 (人数)	影像学 特征 (人数)	发病侧 (人数)	手术 方式 (人数)	并发症 (人数)	脑脊液 引流 (人数)	复发 (人数)
Lubbe 等 2019 [2]	1	1	60	a (1)	q (1)	右侧(1)	内镜(1)	无(1)	0	0
Barañano 等 2009 [3]	1	0	20	NA	r (1)	左侧(1)	内镜(1)	NA	NA	NA

续表

Tomazic 等 2009 [4]	5	4	51.2 ± 6.49	b (5)	q (5)	左侧(2) 右侧(3)	内镜(5)	无(3) 脑膜炎(1) 脑脓肿(1)	0	2
Adachi 等 2023 [5]	2	1	38 ± 3	b, f (1) d (1)	q (1) s, t (1)	左侧(2)	内镜(1) 开颅(1)	无(2)	2	0
Agaev 等 2023 [6]	1	1	34	b (1)	q (1)	左侧(1)	内镜(1)	蛛网膜下腔出血、脑梗死(1)	NA	0
Aggarwal 等 2017 [7]	1	0	44	b, j (1)	q (1)	左侧(1)	内镜(1)	无(1)	1	0
Babu 等 2019 [8]	3	1	53.67 ± 7.59	b (1) b, f, k (1) b, f (1)	q (3)	左侧(2) 右侧(1)	内镜(3)	无(3)	1	0
Bendersky 等 2011 [9]	2	2	59.5 ± 13.5	a (1) b, f, i (1)	q (2)	右侧(2)	开颅(2)	无(2)	NA	1
Castelnuovo 等 2007 [10]	15	9	60.3 ± 9.3	b (15)	q (15)	左侧(8) 右侧(7)	内镜(15)	无(15)	0	0
You 等 2022 [11]	2	1	51.5 ± 11.5	b (2)	q (2)	右侧(2)	内镜(2)	无(2)	2	0
Silva 等 2016 [12]	1	1	52	b, f, g, i, l (1)	q (1)	右侧(1)	开颅(1)	无(1)	0	0
Mann 等 2024 [13]	2	1	54.5 ± 29.5	b, f (1) m (1)	q (1) q, u (1)	右侧(2)	开颅(1) 保守(1)	无(1)	NA	0
Marston 等 2015 [14]	1	1	48	b, n (1)	q (1)	双侧(1)	内镜(1)	无(1)	1	1
Maselli 等 2012 [15]	1	1	45	b (1)	q (1)	右侧(1)	内镜(1)	无(1)	NA	0
Ngu 等 2023 [16]	1	1	40	b, f (1)	q (1)	右侧(1)	内镜(1)	无(1)	1	0
Samadian 等 2012 [17]	1	1	23	b (1)	q (1)	右侧(1)	内镜转开颅(1)	无(1)	NA	0
Sanjari 等 2013 [18]	1	1	45	b, f (1)	q (1)	左侧(1)	内镜(1)	干眼症(1)	1	1
Schmidt 等 2012 [19]	4	4	56.75 ± 2.77	c, i (1) b (1) e (1) b, f, o, p (1)	q (4)	左侧(4)	内镜(4)	无(4)	1	0
Simmonds 等 2017 [20]	1	1	17	b, f (1)	q (1)	左侧(1)	内镜(1)	干眼症(1)	1	0
Tomaszewska 等 2015 [21]	2	2	69 ± 3	b (2)	q (2)	左侧(1) 右侧(1)	内镜(2)	无(2)	0	0
施炜等 2014 [22]	3	1	52.67 ± 21.06	b, h (1) b (2)	q (3)	左侧(3)	内镜(3)	无(3)	3	0

注：a：自发性脑脊液鼻漏复发，b：自发性脑脊液鼻漏，c：脑外伤后脑脊液鼻漏，d：间歇性流涕，e：颅内粘液囊肿术后脑脊液鼻漏，f：头痛，g：头晕，h：发热，i：脑膜炎，j：硬脑膜动静脉瘘栓塞术后，k：视物模糊，l：嗅觉缺失，m：感觉障碍伴肢体乏力，n：特发性颅内压增高，o：良性颅高压，p：鼻窦炎，q：蝶窦侧隐窝骨质缺陷伴脑膜脑膨出，r：侧颅咽管缺陷，s：鞍背骨质侵蚀伴脑膜脑膨出，t：气颅，u：基底节区脑出血伴脑室铸型，NA：未提及。

4. 讨论

脑膜脑膨出根据位置分为四种类型：额部型、顶部型、枕部型和颅底型。颅底型又分为蝶窦型(仅限于蝶窦)和经蝶窦型[23]。蝶窦型在临床实践中很少见，而脑膜脑膨出通常是隐匿发生的。在许多情况下临床症状并不明显，一直会隐藏到脑脊液鼻漏或脑膜炎发生[24]。Sternberg 管未闭引起的脑膜脑膨出可能原因是蝶窦发育异常、颅底骨缺损和颅咽管发育异常。在胚胎发育期蝶骨的形成和蝶窦的气化是复杂的，个体之间差异很大。它涉及五种软骨前体的骨化和融合，当蝶骨前体和蝶骨基底体在形成过程中没有很好地骨化和融合时，就会在蝶窦侧方形成一个沟通颅内外的 Sternberg 管，被称为侧颅咽管[4] [25]-[27]。病例 2 中颅底两块异常增生的骨肿物，可能为未充分骨化融合的蝶骨骨块，在发育中缓慢增生，使圆孔和卵圆孔狭窄卡压三叉神经的 V2 和 V3 支，出现继发性三叉神经痛。

Sternberg 管的发生率报道不一，有流行病学报道人群中发病率为 0.1%，也有研究尸头颅骨解剖发现其发生率为 4.65%，与 Sternberg 当初 1888 年的解剖研究符合。但使用高分辨率 CT 扫描能发现的发病率不到 1% [1]。所以，大部分 Sternberg 管仅能通过尸头解剖发现，不能通过影像学检查发现。根据对既往研究的回顾发现，Sternberg 管的存在与自发性脑膜脑膨出密切相关，然而自发性脑膜脑膨出的发病率远低于 Sternberg 管[24]。这与我们的病例结果相似，我们发现的两例 Sternberg 管是 MRI 显示蝶窦侧方管状的脑脊液信号得到的提示，可能为较明显的 Sternberg 管未闭。单纯 Sternberg 管未闭，若无相关症状无需治疗。

Sternberg 管未闭常伴蝶窦侧隐窝过度气化，蝶窦外侧壁骨质薄弱，在颅内压增高、外伤等因素下[28]，颞叶脑膜和脑组织相对容易疝入蝶窦，形成脑膜脑膨出进而发生脑脊液漏[10] [16] [29]。但 Sternberg 管与脑膜脑膨出的相关性出存在争议，研究认为 Sternberg 管合并骨质缺损时可能更容易导致脑膜脑膨出，骨质缺损常位于眶上裂和视柱之间[1]。

病例 1 明确存在 Sternberg 管前内侧壁即蝶窦外下壁骨质缺损，且存在颅内压增高因素，故发生脑脊液鼻漏；病例 2 骨质无明显缺损，未并发脑脊液鼻漏。也有学者指出 Sternberg 管可能与脑脊液漏无明确关系，因为绝大多数蝶窦外侧壁脑脊液漏发生在眶下神经和圆孔外侧，而 Sternberg 管位于眶上裂内侧[30]。

Sternberg 脑膜脑膨出发生脑脊液鼻漏时需要手术治疗，包括经鼻－翼突－蝶窦修补和开颅修补，随着内镜的普及，经鼻修补已成为耳鼻喉科和神经外科首选的微创术式[22] [31]。病例 1 选择开颅修补目的是切除并存的前床突脑膜瘤，一举两得。经鼻修补方法也是在清除膨出的脑组织后，用肌肉、筋膜、脂肪填塞，再用生物蛋白胶加固，最后可增加带蒂粘膜瓣覆盖，术后根据需要腰大池引流促进漏口愈合，以提高修补成功率。病例 1 经颅硬膜内修补漏内口，术后 Sternberg 管缩小但仍有液体信号，而患者脑脊液鼻漏已治愈，可能脑脊液漏口不直接通过 Sternberg 管内液体囊腔，而是在管内囊腔外的骨质缺损处与蝶窦沟通。病例 2 经硬膜外入路，去除骨肿物后填塞自体组织，Sternberg 管液体信号基本消失，同样经颅填塞达到压迫 Sternberg 管的作用，病例 2 明显较病例 1 残存液体少，其机制有待进一步研究，可能硬膜外较硬膜内压迫更利于缩小充满液体的管内囊腔。

Sternberg 管国内外相关研究较少，主要引起脑膜脑膨出并导致自发性脑脊液鼻漏。因此，经鼻内镜手术为主流术式，仅有反复复发或因颅内占位引起 Sternberg 管未闭的患者考虑首选开颅手术。而术中及术后脑脊液引流术的使用可促进脑脊液循环，有部分研究使用此手段加强漏口的修补效果，尤其是针对有高复发风险的患者[11] [25]。该疾病手术可治愈，预后好，复发率低。目前影响该疾病发现及治疗的最主要原因为诊断困难，临床上经验欠缺，希望本研究可为相关疾病的诊断及治疗提供经验借鉴。

声　明

该病例报道已获得病人的知情同意。

利益冲突

所有作者声明无利益冲突。

作者贡献声明

顾靖宇：设计研究、数据收集及统计、论文撰写；沈恪诚、孙亮、尹子乾、顾令文：数据采集及整理、统计分析；翟伟伟、虞正权：数据收集、文献查询；吴江：研究指导、论文修改、经费支持。

参考文献

[1] Adepoju, A., Carlstrom, L.P., Graffeo, C.S., Perry, A., Pinheiro-Neto, C.D., Link, M.J., *et al*. (2021) Sternberg's Canal and Defectu Is the Lateral Craniopharyngeal Canal a Source of Spontaneous Cerebrospinal Fluid Leak? Anatomic and Radiological Analysis in Pediatric and Adult Populations. *Operative Neurosurgery*, **20**, 426-432. https://doi.org/10.1093/ons/opaa446

[2] Lubbe, D.E., Douglas-Jones, P., Wasl, H., Mustak, H. and Semple, P.L. (2019) Contralateral Precaruncular Approach to the Lateral Sphenoid Sinus—A Case Report Detailing a New, Multiportal Approach to Lesions, and Defects in the Lateral Aspect of Well-Pneumatized Sphenoid Sinuses. *Ear, Nose & Throat Journal*, **99**, 62-67. https://doi.org/10.1177/0145561319846828

[3] Barañano, C.F., Cure, J., Palmer, J.N. and Woodworth, B.A. (2009) Sternberg's Canal: Fact or Fiction? *American Journal of Rhinology & Allergy*, **23**, 167-171. https://doi.org/10.2500/ajra.2009.23.3290

[4] Tomazic, P.V. and Stammberger, H. (2009) Spontaneous CSF-Leaks and Meningoencephaloceles in Sphenoid Sinus by Persisting Sternberg's Canal. *Rhinology Journal*, **47**, 369-374. https://doi.org/10.4193/rhin08.236

[5] Adachi, S., Ueno, H., Magami, S., Fujita, N., Nakajima, S., Ikemura, R., *et al*. (2023) Cerebrospinal Fluid Rhinorrhea with Meningoencephalocele Related to Sternberg's Canal: A Report of Two Cases. *Surgical Neurology International*, **14**, Article 228. https://doi.org/10.25259/sni_260_2023

[6] Agaev, R., Gormolysova, E., Kalinovskiy, A. and Rzaev, J. (2023) Endoscopic Endonasal Repair of Temporal Lobe Meningoencephalocele in the Lateral Recess of the Sphenoid Sinus, Complicated by Intracerebral Hematoma: Illustrative Case. *Journal of Neurosurgery*: *Case Lessons*, **6**, CASE23575. https://doi.org/10.3171/case23575

[7] Aggarwal, V., Nair, P., Shivhare, P., Jayadevan, E.R., Felix, V., Abraham, M., *et al*. (2017) A Case of Evolving Bilateral Sphenoidal Meningoencephaloceles: Case Report and Review of the Literature. *World Neurosurgery*, **100**, 708.e11-708.e17. https://doi.org/10.1016/j.wneu.2017.02.037

[8] Babu, A.R., Prakash, B.G., Kadlimatti, V.I., Sandhya, D. and Kamath, S. (2019) Contrasting Surgical Management of CSF Leak from Lateral Recess of Sphenoid Sinus and Its Surgical Outcomes: Our Experience. *Indian Journal of Otolaryngology and Head & Neck Surgery*, **71**, 531-536. https://doi.org/10.1007/s12070-019-01715-w

[9] Bendersky, D., Ajler, P., Carrizo, A., Landriel, F. and Hem, S. (2011) Sternberg's Canal as a Cause of Encephalocele within the Lateral Recess of the Sphenoid Sinus: A Report of Two Cases. *Surgical Neurology International*, **2**, Article 171. https://doi.org/10.4103/2152-7806.90034

[10] Castelnuovo, P., Dallan, I., Pistochini, A., Battaglia, P., Locatelli, D. and Bignami, M. (2007) Endonasal Endoscopic Repair of Sternberg's Canal Cerebrospinal Fluid Leaks. *The Laryngoscope*, **117**, 345-349. https://doi.org/10.1097/01.mlg.0000251452.90657.3a

[11] Guo, A., You, W., Lin, Z., Wang, Y., Wang, W., Lin, R., *et al*. (2023) Analysis of the Causes and Experience in the Diagnosis and Treatment of Meningocele Caused by Sternberg's Canal of the Sphenoid Sinus: Two Case Reports and a Review of the Literature. *Current Medical Imaging Formerly Current Medical Imaging Reviews*, **19**, 1063-1070. https://doi.org/10.2174/1573405619666230206103036

[12] Cruz e Silva, V., Luís, A., Mora Féria, R., Marques, L., Chorão, M., Reizinho, C., *et al*. (2017) Transsphenoidal Meningoencephalocele Protruding into the Nasal Cavity. *BJR Case Reports*, **3**, Article ID: 20160082. https://doi.org/10.1259/bjrcr.20160082

[13] Mann, P., Gajbhiye, S.S., Sarjare, D., Anand, A., Kalbagwar, S. and Giri, P. (2024) Intrasphenoidal Cephalocoeles: Knowing the Less Known. *South African Journal of Radiology*, **28**, Article 2829. https://doi.org/10.4102/sajr.v28i1.2829

[14] Marston, A.P., Van Gompel, J.J., Carlson, M.L. and O'Brien, E.K. (2015) A Unique Case of Bilateral Recurrent Sphenoid Sinus Cerebrospinal Fluid Leaks: Primary Acquired Leak Within the Lateral Sphenoid Sinus Recess, Followed by a Leak via Sternberg's Canal. *Annals of Otology, Rhinology & Laryngology*, **124**, 593-597. https://doi.org/10.1177/0003489415570936

[15] Maselli, G., Ricci, A. and Galzio, R.J. (2012) Endoscope-Assisted Trans-Sphenoidal Approach for Treatment of

Sternberg's Canal. *Journal of Korean Neurosurgical Society*, **52**, 555-557. https://doi.org/10.3340/jkns.2012.52.6.555

[16] Ngu, C.Y.V., Lee, T.H., Ramachandran, K., Liew, D.N.S. and Tang, I.P. (2022) A Rare Case of Cerebrospinal Fluid Rhinorrhea from Canal of Stenberg. *Indian Journal of Otolaryngology and Head & Neck Surgery*, **75**, 764-767. https://doi.org/10.1007/s12070-022-03347-z

[17] Samadian, M., Moghaddasi, H., Vazirnezami, M., *et al*. (2012) Transcranial Approach for Spontaneous CSF Rhinorrhea Due to Sternberg's Canal Intrasphenoidal Meningoencephalocele: Case Report and Review of the Literature. *Turkish Neurosurgery*, **22**, 242-245.

[18] Amirjamshidi, A., Sanjari, R., Mortazavi, S., Amiri, R. and Samimi Ardestani, S. (2013) Intrasphenoidal Meningo-Encephalocele: Report of Two Rare Cases and Review of Literature. *Surgical Neurology International*, **4**, Article 5. https://doi.org/10.4103/2152-7806.106260

[19] Schmidt, R.F., Choudhry, O.J., Raviv, J., Baredes, S., Casiano, R.R., Eloy, J.A., *et al*. (2012) Surgical Nuances for the Endoscopic Endonasal Transpterygoid Approach to Lateral Sphenoid Sinus Encephaloceles. *Neurosurgical Focus*, **32**, E5. https://doi.org/10.3171/2012.3.focus1267

[20] Simmonds, J.C. and Scott, A.R. (2017) Spontaneous CSF Rhinorrhea from the Trigeminal Canal in an Adolescent. *International Journal of Pediatric Otorhinolaryngology*, **98**, 162-165. https://doi.org/10.1016/j.ijporl.2017.05.001

[21] Tomaszewska, M., Brożek-Mądry, E. and Krzeski, A. (2014) Spontaneous Sphenoid Sinus Cerebrospinal Fluid Leak and Meningoencephalocele—Are They Due to Patent Sternberg's Canal? *Videosurgery and Other Miniinvasive Techniques*, **10**, 347-358. https://doi.org/10.5114/wiitm.2014.47097

[22] 施炜, 陈建, 倪兰春, 等. 内镜经翼突-蝶窦修补 Sternberg 脑脊液漏三例[J]. 中华神经外科杂志, 2014, 30(2): 213-214.

[23] Nager, G.T. (1987) Cephaloceles. *The Laryngoscope*, **97**, 77-84. https://doi.org/10.1288/00005537-198701000-00015

[24] Buchfelder, M., Fahlbusch, R., Huk, W.J. and Thierauf, P. (1987) Intrasphenoidal Encephaloceles? A Clinical Entity. *Acta Neurochirurgica*, **89**, 10-15. https://doi.org/10.1007/bf01406661

[25] Tabaee, A., Anand, V.K., Cappabianca, P., Stamm, A., Esposito, F. and Schwartz, T.H. (2010) Endoscopic Management of Spontaneous Meningoencephalocele of the Lateral Sphenoid Sinus. *Journal of Neurosurgery*, **112**, 1070-1077. https://doi.org/10.3171/2009.7.jns0842

[26] El-Tarabishi, M.N., Fawaz, S.A., Sabri, S.M., El-Sharnobi, M.M. and Sweed, A. (2016) A Modification of Endoscopic Endonasal Approach for Management of Encephaloceles in Sphenoid Sinus Lateral Recess. *European Archives of Oto-Rhino-Laryngology*, **273**, 4305-4314. https://doi.org/10.1007/s00405-016-4125-z

[27] Lai, S.Y., Kennedy, D.W. and Bolger, W.E. (2002) Sphenoid Encephaloceles: Disease Management and Identification of Lesions within the Lateral Recess of the Sphenoid Sinus. *The Laryngoscope*, **112**, 1800-1805. https://doi.org/10.1097/00005537-200210000-00018

[28] Mangussi-Gomes, J., Balsalobre, L.L., Gomes, M.Q.T., Vellutini, E.A.S., Stamm, A.E.C. and Beer-Furlan, A. (2017) In Reference to Intervention for Elevated Intracranial Pressure Improves Success Rate after Repair of Spontaneous Cerebrospinal Fluid Leaks. *The Laryngoscope*, **128**, E271. https://doi.org/10.1002/lary.26982

[29] Schick, B., Prescher, A. and Brors, D. (2000) Sternberg's Canal—Cause of Congenital Sphenoidal Meningocele. *European Archives of Oto-Rhino-Laryngology*, **257**, 430-432. https://doi.org/10.1007/s004050000235

[30] Woodworth, B. and Thompson, H. (2020) Comments on "Sternberg's Canal—A Rare Cause of Spontaneous Cerebrospinal Fluid Rhinorrhea". *Neurology India*, **68**, 701. https://doi.org/10.4103/0028-3886.289009

[31] 施炜, 张晓彪, 倪兰春, 等. 神经内镜下经翼突-蝶窦入路修补自发性 Sternberg 脑脊液漏[C]//江苏省医学会, 江苏省医学会神经外科学分会. 中国江苏省苏州市, 2014: 62-63.