

儿童OSA腺样体扁桃体术后症状残留的危险因素分析

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摘要

目的: 系统分析儿童阻塞性睡眠呼吸暂停(OSA)行腺样体扁桃体切除术后症状残留的危险因素, 为临床防治提供依据。方法: 检索国内外相关文献, 从术前疾病严重程度、肥胖、遗传综合征及合并症等方面对POSA的危险因素进行归纳与综述。结果: 术前中重度OSA、肥胖(>95th)及遗传综合征(如唐氏综合征)是POSA的明确独立危险因素。肥胖患儿术后残留风险是非肥胖患儿的3.47倍($RR = 3.47$, 95%CI: 2.04~5.92)。合并哮喘与变应性鼻炎与POSA的关联目前尚存争议。结论: 术前准确识别高风险患儿至关重要, 对于存在明确危险因素的患儿, 应加强围术期评估与管理, 并探索多学科协作的个体化治疗策略以改善预后。

关键词

阻塞性睡眠呼吸暂停, 儿童, 腺样体扁桃体切除术, 危险因素

Analysis of Risk Factors for Residual Symptoms After Adenotonsillectomy in Children with OSA

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Abstract

Objective: To systematically analyze the risk factors for residual symptoms following adenotonsillectomy in children with obstructive sleep apnea (OSA), thereby providing evidence for clinical prevention and management. **Methods:** Relevant literature was retrieved and reviewed to summarize the risk factors for persistent OSA (POSA) from aspects of preoperative disease severity, obesity, genetic syndromes, and comorbidities. **Results:** Preoperative moderate-to-severe OSA, obesity (>95th percentile), and genetic syndromes (e.g., Down syndrome) were identified as independent risk factors for POSA. The risk of residual OSA in obese children was 3.47 times higher than that in non-obese children (RR = 3.47, 95%CI: 2.04~5.92). The associations between comorbidities (asthma and allergic rhinitis) and POSA remain controversial. **Conclusion:** Preoperative identification of high-risk children is crucial. For children with established risk factors, perioperative assessment and management should be strengthened, and multidisciplinary collaborative individualized treatment strategies should be explored to improve prognosis.

Keywords

Obstructive Sleep Apnea, Child, Adenotonsillectomy, Risk Factors

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1. 背景

阻塞性睡眠呼吸暂停(Obstructive Sleep Apnea, OSA)是儿童期常见的睡眠相关呼吸障碍,其特征为睡眠期间反复发生的上气道部分或完全阻塞,导致间歇性低氧血症、高碳酸血症及睡眠结构片段化[1] [2]。儿童 OSA 患病率约为 2%~4% [3], 高峰年龄为 2~8 岁[4], 与腺样体及扁桃体生理性肥大的年龄段相重叠。OSA 对儿童神经认知功能、心血管系统、代谢及生长发育具有显著负面影响[4] [5], 可表现为注意力缺陷、学习能力下降、肺动脉高压、心室重构及发育迟缓等[3] [6]-[8], 这突出了早期识别、诊断与干预的迫切性。

腺样体扁桃体肥大引起的上气道梗阻是儿童 OSA 的主要原因,腺样体扁桃体切除术(AT)是儿童 OSA 的一线治疗方式[7] [9]-[12], 但其疗效存在一定的局限性。近年研究表明,该手术的治愈率不足 50% [13]。部分儿童(2~18 岁)在接受腺样体扁桃体切除术后,仍可能持续存在 OSA, 其被称为持续性 OSA (Persistent Obstructive Sleep Apnea, POSA)。然而,目前学术界对 POSA 尚无统一定义,主要分歧在于诊断依据是主观症状还是客观多导睡眠监测(Polysomnography, PSG)。为便于本文讨论并基于当前循证医学证据,本文将 POSA 统一界定为:术后经 PSG 客观证实,呼吸暂停低通气指数(Apnea-Hypopnea Index, AHI) > 1.5 次/小时[14]。而将仅通过问卷或家长主诉存在的打鼾、口呼吸等症状,但未经过 PSG 证实的状态,称为“症状残留”。

不同研究采用的 POSA 诊断标准存在显著差异,这直接影响了其报道的发病率及危险因素分析的准确性。Ersu 等人[14]近期将 POSA 定义为术后未缓解的 OSA, 基于多导睡眠监测(Polysomnography, PSG)且呼吸暂停低通气指数(Apnea-Hypopnea Index, AHI) > 1.5 次/h, 但术后 PSG 复查率低,因此依赖 PSG 诊断可能导致 POSA 被低估。另外有研究[15]则采用经过验证的问卷报告的持续性 OSA 症状作为诊断标

准,但因主观性强可能导致 POSA 的发生率被高估。在一项 Meta 分析[10]中,其被定义为术后仍存在至少一种 OSA 症状(打鼾、喘息、口呼吸或目击睡眠呼吸暂停)和/或术后 PSG 确诊 OSA。这些诊断标准的异质性,是导致文献中 POSA 患病率在 20%至 40%之间大幅波动,尤其是在重症患者中报道不一的重要原因[16]。

目前已明确多种儿童 POSA 的危险因素,包括男性、肥胖、既往部分腺样体切除或部分扁桃体切除史、早期(<2 岁)手术、哮喘及过敏性鼻炎。其中,舌扁桃体肥大是 POSA 最常见的解剖学病因。不同人群中危险因素的分布差异可能导致 POSA 患病率的重要原因[10]。值得注意的是,即使是不伴有肥胖症、基础疾病或颅面结构异常的健康儿童,也可能发生 POSA。POSA 可导致患儿反复缺氧、睡眠结构紊乱,进而引发神经认知功能障碍及心血管系统并发症,严重影响儿童的生长发育和长期健康[13] [14]。因此,如何提高手术疗效、优化术后管理,是临床亟待解决的问题。

近年来,随着肥胖儿童比例上升及 OSA 诊断技术的进步,POSA 的危险因素研究取得了显著进展。现有证据表明,术前疾病严重程度、肥胖、遗传综合征及合并症等因素共同影响术后结局。本文旨在系统综述儿童 POSA 的危险因素及其潜在作用机制,并在讨论中审慎考量不同研究诊断标准差异对结论的影响,为临床早期识别高风险患儿和指定个体化治疗策略提供依据。

2. POSA 的危险因素

2.1. 术前疾病严重程度

术前疾病严重程度是儿童 OSA 患者腺样体扁桃体切除术后症状残留的重要危险因素。多项研究[17]-[20]表明,术前呼吸暂停低通气指数(AHI)与术后疗效呈现显著相关性,其中一项 Meta 分析[21]显示,术后 AHI 阳性率(持续存在率)与术前 AHI 呈正相关。

一项针对儿童 OSA 的前瞻性研究[22]发现术后仅 6.7%患儿被治愈,且均为轻度病例,中重度病例无一例治愈。多因素分析进一步证实,术前较高的疾病严重程度(中重度)是术后症状残留的独立预测因素,表明中重度 OSA 患者的 POSA 风险显著增加。这一结论与后续多项研究[23] [24]结果高度一致,这些研究结果共同表明术前疾病严重程度,特别是达到中重度标准的 OSA,是影响腺样体扁桃体切除术疗效的关键预后因素,对临床决策具有重要的指导意义。

2.2. 肥胖

肥胖通过多种病理生理机制[25]与 OSA 相互影响。脂肪组织沉积导致上气道机械性狭窄并降低肺容积,从而加重气道阻塞和低氧程度。同时脂肪组织分泌的炎症因子与缺氧诱发的氧化应激形成恶性循环,共同加重病情。Dayyat 等人的研究[26]表明肥胖儿童产生相同程度 OSA 所需的腺样体体积更小。因此,肥胖儿童 AT 术后更容易残留 OSA [23] [27]-[31],需要综合治疗。

既往研究[32]-[34]显示 OSA 的严重程度与肥胖程度成正比。肥胖(BMI > 95th 百分位数)是术后残留 OSA 的独立危险因素,在校正年龄、术前 AHI 等其他变量后,其风险增加 3.2 [29]~3.7 [30]倍。Scheffler 等人的[31]研究表明腺样体扁桃体切除术虽能显著改善肥胖儿童 OSA 的睡眠参数(如呼吸暂停低通气指数、呼吸紊乱指数、血氧饱和度),但其术后 OSA 残留率(高达 51%~66%)显著高于正常体重儿童。一项系统评价及 Meta 分析[28]显示术前肥胖患儿发生 POSA 的风险是非肥胖患儿的 3.47 倍[RR = 3.47, 95%CI (2.04, 5.92), P < 0.01], 是正常体重患儿的 4.11 倍[RR = 4.11, 95%CI (1.68, 10.07), P < 0.01], 而患儿术前超重[RR = 0.76, 95%CI (0.20, 2.96), P > 0.05]及低体重[RR = 0.68, 95%CI (0.28, 1.67), P > 0.05]并未显著增加发生 POSA 的风险。

同时,中国儿童阻塞性睡眠呼吸暂停诊断与治疗指南[35]也明确指出肥胖是 AT 术后疾病持续存在的

危险因素, 可使用 PSG 或者借助便携/简易替代诊断工具来评估术后 OSA 持续存在状态, 必要时应采用无创正压通气(non-invasive positive pressure ventilation, NPPV)、口腔矫治器、减重等补充治疗。

2.3. 遗传综合征

2.3.1. 唐氏综合征

约 80% 的唐氏综合征(Down syndrome, DS)患儿会并发 OSA, 其发生率显著高于正常儿童[36], 然而, 仅 16%~30% 的患儿通过腺样体扁桃体切除术后症状得到缓解[37]。DS 患者特有的颅面及气道结构异常、肥胖症及肌张力低下发生率高, 导致一线 AT 治疗后 OSA 持续存在的风险显著增加[38]。

一项关于评估 DS 患儿扁桃体切除术后疗效的回顾性研究[39]显示, 尽管手术显著改善了 AHI 和血氧指标, 但 58% 患儿术后仍存在 POSA, 甚至有 18.5% 出现病情加重。该研究同时发现, 哮喘[OR = 4.77, 95%CI (1.61, 14.09), $P < 0.01$]和年龄增长[OR = 1.25, 95%CI (1.09, 1.43), $P < 0.01$]是 DS 患儿发生 POSA 的独立危险因素。另一项针对 3 岁以下不同种族患儿的研究[24]也证实, 合并 DS 的患儿出现术后 POSA 的风险显著增高, 需通过术后多导睡眠监测(PSG)进一步评估。

DS 儿童腺样体切除术后残留 OSA 常见, 但最佳管理策略尚未确立, 亟待更多研究以制定个体化治疗规范, 改善 DS 儿童 OSA 的长期预后[40]。

2.3.2. Prader-Willi 综合征

Prader-Willi 综合征(Prader-Willi syndrome, PWS)由于肥胖、肌张力减退和异常通气反应而增加阻塞性睡眠呼吸暂停(OSA)的风险[41]。腺样体扁桃体切除术与 PWS 患儿 OSA 改善相关, 但患儿术后常发生 OSA 残留[41] [42]。

2.4. 变应性鼻炎与哮喘

变应性鼻炎(allergic rhinitis, AR)和哮喘作为儿童常见的慢性气道炎症性疾病, 可能通过多种机制影响 OSA 的病理生理过程。研究表明, AR [43] [44]可导致鼻黏膜水肿及鼻腔阻力增加, 而哮喘[45]则与气道高反应性及慢性炎症相关, 这些因素可能共同促进上气道阻塞的持续存在。然而, 现有关于 AR 及哮喘与术后持续性 OSA 关联的研究结论尚不一致。

已有证据[46]表明 AR 会增加儿童患 OSA 的风险, 规范治疗 AR 有助于预防 OSA 的发生或减轻现有 OSA 的严重程度。一项多中心回顾性研究[47]首次发现哮喘与非肥胖儿童术后持续睡眠呼吸障碍风险增加相关, 后续研究[23]证实合并哮喘的 OSA 患儿腺样体扁桃体切除术后 POSA 的风险较高。然而, 一项系统评价及 Meta 分析[28]显示, 术前合并哮喘[RR = 1.31, 95%CI (0.50, 3.41), $P > 0.05$]及 AR [RR = 0.96, 95%CI (0.39, 2.39), $P > 0.05$]并未显著增加发生 POSA 风险; 不过, 该分析中关于合并症的研究数量有限, 故尚需进一步扩大样本量加以证实。中国儿童阻塞性睡眠呼吸暂停诊断与治疗指南[35]指出, 当前研究提示伴随疾病(哮喘和变应性鼻炎)不增加术后 OSA 持续存在的风险, 但是基于既往指南建议和指南制订组专家意见, 临床医生仍需注重对合并这些疾病的 OSA 患儿进行术后评估和气道管理。

3. 总结与展望

儿童阻塞性睡眠呼吸暂停综合征(OSA)腺样体扁桃体切除术后发生持续性 OSA (POSA)是一个多因素共同作用的复杂过程。现有研究明确将术前中重度 OSA、肥胖及遗传综合征(如 DS 和 PWS)列为 POSA 的独立危险因素。基于此, 临床实践应从“一刀切”的模式转向基于风险分层的个体化管理路径, 以实现早期识别、精准干预和改善预后。本文基于文献证据, 构建了以下临床管理路径(见图 1), 旨在为不同风险层次的患儿提供差异化的术后管理方案。

如图 1 所示, 对于所有接受 AT 手术的 OSA 患儿, 首要步骤是进行术前风险评估。对于存在任何一项明确高危因素(术前中重度 OSA、肥胖或遗传综合征)的患儿, 均应纳入高危管理路径, 强制在术后 2~3 个月进行多导睡眠监测(PSG)以客观评估手术效果[47]-[49]。一旦 PSG 确诊 POSA, 应立即启动由多学科协作(MDT)支持的强化干预措施, 如无创正压通气(PAP)、针对肥胖患儿的系统性减重管理, 以及对合并颅面结构异常的遗传综合征患儿进行正畸或外科会诊。而对于无明确高危因素的患儿, 则可遵循标准随访路径, 主要依据临床症状进行观察和随访。

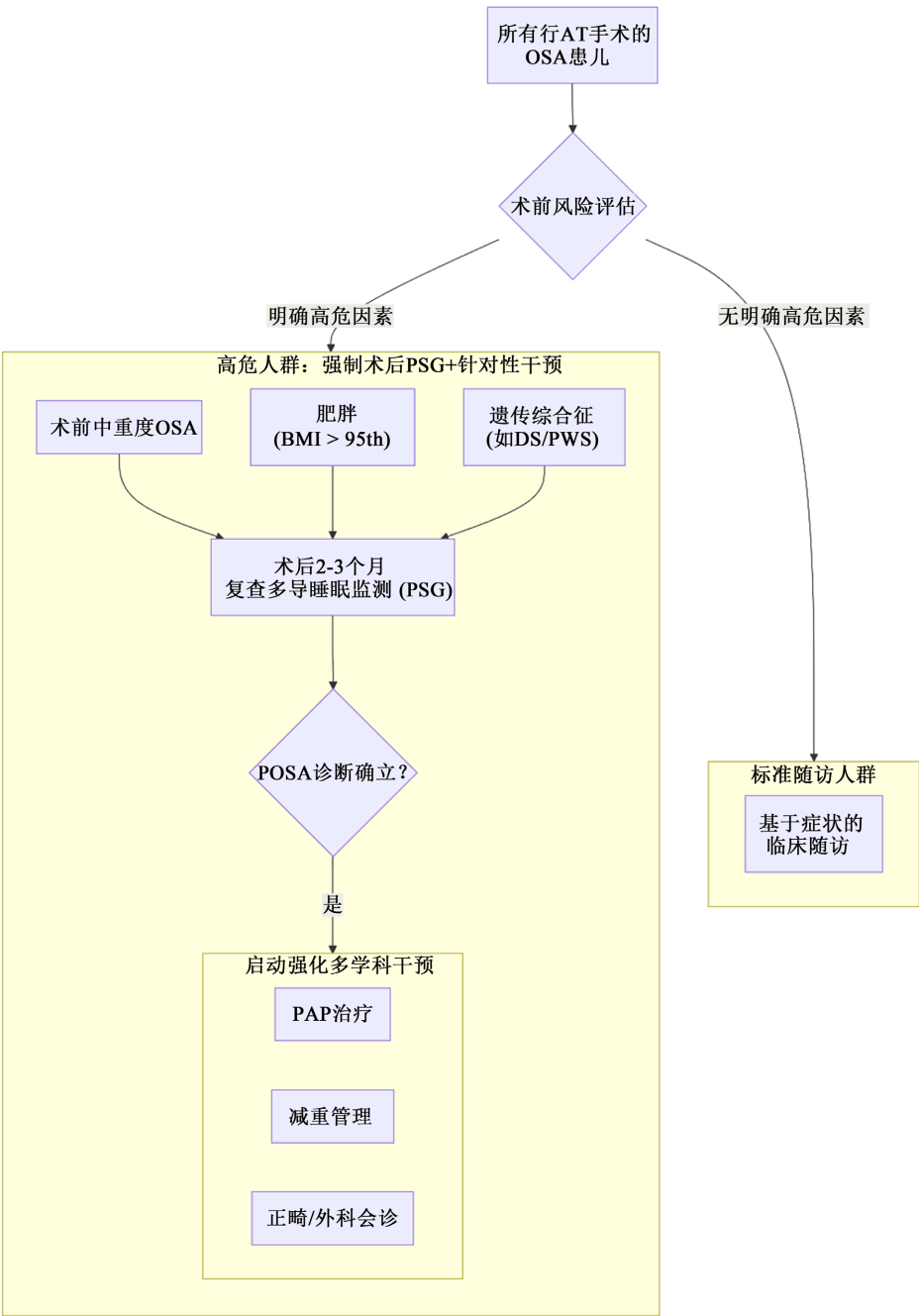


Figure 1. Risk stratification-based management pathway for persistent OSA (POSA) following adenotonsillectomy in children
图 1. 儿童 OSA 腺样体扁桃体术后持续性 OSA (POSA) 的风险分层管理路径图

未来研究需进一步验证上述风险分层路径的成本效益与临床效益。同时, 应积极探索针对不同病理生理机制的多元化治疗, 如针对中枢成分的神经刺激技术、针对炎症通路的药物疗法等。通过强化多学科协作, 并基于共享决策模式为不同风险层次的患儿制定从评估、手术到长期随访的全程化、个体化管理方案, 是最终改善 POSA 患儿预后的关键。

参考文献

- [1] Marcus, C.L., Brooks, L.J., Draper, K.A., Gozal, D., Halbower, A.C., Jones, J., *et al.* (2012) Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome. *Pediatrics*, **130**, 576-584. <https://doi.org/10.1542/peds.2012-1671>
- [2] Muzumdar, H. and Arens, R. (2013) Physiological Effects of Obstructive Sleep Apnea Syndrome in Childhood. *Respiratory Physiology & Neurobiology*, **188**, 370-382. <https://doi.org/10.1016/j.resp.2013.05.006>
- [3] Lumeng, J.C. and Chervin, R.D. (2008) Epidemiology of Pediatric Obstructive Sleep Apnea. *Proceedings of the American Thoracic Society*, **5**, 242-252. <https://doi.org/10.1513/pats.200708-135mg>
- [4] Gozal, D., Tan, H. and Kheirandish-Gozal, L. (2013) Obstructive Sleep Apnea in Children: A Critical Update. *Nature and Science of Sleep*, **5**, 109-123. <https://doi.org/10.2147/nss.s51907>
- [5] Smith, D.F. and Amin, R.S. (2019) OSA and Cardiovascular Risk in Pediatrics. *Chest*, **156**, 402-413. <https://doi.org/10.1016/j.chest.2019.02.011>
- [6] Perez, C. (2018) Obstructive Sleep Apnea Syndrome in Children. *General Dentistry*, **66**, 46-50.
- [7] Marcus, C.L., Brooks, L.J., Ward, S.D., Draper, K.A., Gozal, D., Halbower, A.C., *et al.* (2012) Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome. *Pediatrics*, **130**, e714-e755. <https://doi.org/10.1542/peds.2012-1672>
- [8] Amin, R., Somers, V.K., McConnell, K., Willging, P., Myer, C., Sherman, M., *et al.* (2008) Activity-Adjusted 24-Hour Ambulatory Blood Pressure and Cardiac Remodeling in Children with Sleep Disordered Breathing. *Hypertension*, **51**, 84-91. <https://doi.org/10.1161/hypertensionaha.107.099762>
- [9] Ehsan, Z. and Ishman, S.L. (2016) Pediatric Obstructive Sleep Apnea. *Otolaryngologic Clinics of North America*, **49**, 1449-1464. <https://doi.org/10.1016/j.otc.2016.07.001>
- [10] Alhalabi, O., Al-Naimi, A.R., Abdulkader, F. and Abu-Hasan, M. (2024) Persistent Obstructive Sleep Apnea Post-Adenotonsillectomy in Children. *Cureus*, **16**, e63899. <https://doi.org/10.7759/cureus.63899>
- [11] Morton, S., Rosen, C., Larkin, E., Tishler, P., Aylor, J. and Redline, S. (2001) Predictors of Sleep-Disordered Breathing in Children with a History of Tonsillectomy And/or Adenoidectomy. *Sleep*, **24**, 823-829. <https://doi.org/10.1093/sleep/24.7.823>
- [12] Schechter, M.S. (2002) Technical Report: Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome. *Pediatrics*, **109**, e69. <https://doi.org/10.1542/peds.109.4.e69>
- [13] 杨诗雨, 张亚梅, 赵靖, 等. 中重度 OSAHS 儿童腺样体扁桃体术后症状残留的影响因素分析[J]. 现代诊断与治疗, 2024, 35(18): 2768-2770.
- [14] Ersu, R., Chen, M.L., Ehsan, Z., Ishman, S.L., Redline, S. and Narang, I. (2023) Persistent Obstructive Sleep Apnoea in Children: Treatment Options and Management Considerations. *The Lancet Respiratory Medicine*, **11**, 283-296. [https://doi.org/10.1016/s2213-2600\(22\)00262-4](https://doi.org/10.1016/s2213-2600(22)00262-4)
- [15] Cohen-Levy, J., Quintal, M., Abela, A., Rompré, P., Almeida, F.R. and Huynh, N. (2018) Persistent Sleep Disordered Breathing after Adenoidectomy and/or Tonsillectomy: A Long-Term Survey in a Tertiary Pediatric Hospital. *Sleep and Breathing*, **22**, 1197-1205. <https://doi.org/10.1007/s11325-018-1734-3>
- [16] Locci, C., Cenere, C., Sotgiu, G., Puci, M.V., Saderi, L., Rizzo, D., *et al.* (2023) Adenotonsillectomy in Children with Obstructive Sleep Apnea Syndrome: Clinical and Functional Outcomes. *Journal of Clinical Medicine*, **12**, Article No. 5826. <https://doi.org/10.3390/jcm12185826>
- [17] Tauman, R., Gulliver, T.E., Krishna, J., Montgomery-Downs, H.E., O'Brien, L.M., Ivanenko, A., *et al.* (2006) Persistence of Obstructive Sleep Apnea Syndrome in Children after Adenotonsillectomy. *The Journal of Pediatrics*, **149**, 803-808. <https://doi.org/10.1016/j.jpeds.2006.08.067>
- [18] Suen, J.S., Arnold, J.E. and Brooks, L.J. (1995) Adenotonsillectomy for Treatment of Obstructive Sleep Apnea in Children. *Archives of Otolaryngology—Head and Neck Surgery*, **121**, 525-530. <https://doi.org/10.1001/archotol.1995.01890050023005>
- [19] Lipton, A.J. and Gozal, D. (2003) Treatment of Obstructive Sleep Apnea in Children: Do We Really Know How? *Sleep Medicine Reviews*, **7**, 61-80. <https://doi.org/10.1053/smr.2001.0256>

- [20] Mitchell, R.B. and Kelly, J. (2004) Outcome of Adenotonsillectomy for Severe Obstructive Sleep Apnea in Children. *International Journal of Pediatric Otorhinolaryngology*, **68**, 1375-1379. <https://doi.org/10.1016/j.ijporl.2004.04.026>
- [21] Lee, C.H., Kang, K.T., Weng, W.C., et al. (2016) Polysomnographic Findings after Adenotonsillectomy for Obstructive Sleep Apnoea in Obese and Non-Obese Children: A Systematic Review and Meta-Analysis. *Clinical Otolaryngology*, **41**, 498-510. <https://doi.org/10.1111/coa.12549>
- [22] Suri, J.C., Sen, M.K., Venkatachalam, V.P., Bhool, S., Sharma, R., Elias, M., et al. (2015) Outcome of Adenotonsillectomy for Children with Sleep Apnea. *Sleep Medicine*, **16**, 1181-1186. <https://doi.org/10.1016/j.sleep.2015.02.539>
- [23] Imanguli, M. and Ulualp, S.O. (2016) Risk Factors for Residual Obstructive Sleep Apnea after Adenotonsillectomy in Children. *The Laryngoscope*, **126**, 2624-2629. <https://doi.org/10.1002/lary.25979>
- [24] Rayasam, S.S., Abijay, C., Johnson, R. and Mitchell, R.B. (2022) Outcomes of Adenotonsillectomy for Obstructive Sleep Apnea in Children under 3 Years of Age. *Ear, Nose & Throat Journal*, **103**, 794-800. <https://doi.org/10.1177/01455613221086526>
- [25] Tatlipinar, A. and Kinal, E. (2015) Links and Risks Associated with Adenotonsillectomy and Obesity. *Pediatric Health, Medicine and Therapeutics*, **6**, 123-127. <https://doi.org/10.2147/phmt.s66730>
- [26] Dayyat, E., Kheirandish-Gozal, L., Sans Capdevila, O., Maarafeya, M.M.A. and Gozal, D. (2009) Obstructive Sleep Apnea in Children: Relative Contributions of Body Mass Index and Adenotonsillar Hypertrophy. *Chest*, **136**, 137-144. <https://doi.org/10.1378/chest.08-2568>
- [27] Kearney, T.C., Vazifedan, T. and Baldassari, C.M. (2022) Adenotonsillectomy Outcomes in Obese Adolescents with Obstructive Sleep Apnea. *Journal of Clinical Sleep Medicine*, **18**, 2855-2860. <https://doi.org/10.5664/jcsm.10234>
- [28] 聂晓璐, 杨克虎, 田金徽, 等. 儿童阻塞性睡眠呼吸暂停术后持续存在危险因素的系统评价与 Meta 分析[J]. 中国循证医学杂志, 2021, 21(10): 1179-1186.
- [29] Ye, J., Liu, H., Zhang, G., Li, P., Yang, Q., Liu, X., et al. (2010) Outcome of Adenotonsillectomy for Obstructive Sleep Apnea Syndrome in Children. *Annals of Otolaryngology, Rhinology & Laryngology*, **119**, 506-513. <https://doi.org/10.1177/000348941011900802>
- [30] O'Brien, L.M., Sitha, S., Baur, L.A. and Waters, K.A. (2006) Obesity Increases the Risk for Persisting Obstructive Sleep Apnea after Treatment in Children. *International Journal of Pediatric Otorhinolaryngology*, **70**, 1555-1560. <https://doi.org/10.1016/j.ijporl.2006.04.003>
- [31] Scheffler, P., Wolter, N.E., Narang, I., Amin, R., Holler, T., Ishman, S.L., et al. (2019) Surgery for Obstructive Sleep Apnea in Obese Children: Literature Review and Meta-Analysis. *Otolaryngology—Head and Neck Surgery*, **160**, 985-992. <https://doi.org/10.1177/0194599819829415>
- [32] Redline, S., Tishler, P.V., Schluchter, M., Aylor, J., Clark, K. and Graham, G. (1999) Risk Factors for Sleep-Disordered Breathing in Children. *American Journal of Respiratory and Critical Care Medicine*, **159**, 1527-1532. <https://doi.org/10.1164/ajrccm.159.5.9809079>
- [33] Sogut, A., Altin, R., Uzun, L., Ugur, M.B., Tomac, N., Acun, C., et al. (2005) Prevalence of Obstructive Sleep Apnea Syndrome and Associated Symptoms in 3-11-Year-Old Turkish Children. *Pediatric Pulmonology*, **39**, 251-256. <https://doi.org/10.1002/ppul.20179>
- [34] Chay, O.M., Goh, A., Abisheganaden, J., Tang, J., Lim, W.H., Chan, Y.H., et al. (2000) Obstructive Sleep Apnea Syndrome in Obese Singapore Children. *Pediatric Pulmonology*, **29**, 284-290. [https://doi.org/10.1002/\(sici\)1099-0496\(200004\)29:4<284::aid-ppul8>3.0.co;2-d](https://doi.org/10.1002/(sici)1099-0496(200004)29:4<284::aid-ppul8>3.0.co;2-d)
- [35] 中国儿童 OSA 诊断与治疗指南制订工作组, 中华医学会耳鼻咽喉头颈外科学分会, 中华医学会儿科学分会呼吸学组. 中国儿童阻塞性睡眠呼吸暂停诊断与治疗指南(2020) [J]. 中华耳鼻咽喉头颈外科杂志, 2020, 55(8): 729-747.
- [36] Qubty, W.F., Mrelashvili, A., Kotagal, S. and Lloyd, R.M. (2014) Comorbidities in Infants with Obstructive Sleep Apnea. *Journal of Clinical Sleep Medicine*, **10**, 1213-1216. <https://doi.org/10.5664/jcsm.4204>
- [37] Chieffe, D. and Hartnick, C. (2024) Neurostimulation for Pediatric Obstructive Sleep Apnea. *Otolaryngologic Clinics of North America*, **57**, 447-455. <https://doi.org/10.1016/j.otc.2024.02.007>
- [38] Gastelum, E., Cummins, M., Singh, A., Montoya, M., Urbano, G. and Tablizo, M. (2021) Treatment Considerations for Obstructive Sleep Apnea in Pediatric down Syndrome. *Children*, **8**, Article No. 1074. <https://doi.org/10.3390/children8111074>
- [39] Abijay, C.A., Tomkies, A., Rayasam, S., Johnson, R.F. and Mitchell, R.B. (2021) Children with down Syndrome and Obstructive Sleep Apnea: Outcomes after Tonsillectomy. *Otolaryngology—Head and Neck Surgery*, **166**, 557-564. <https://doi.org/10.1177/01945998211023102>
- [40] Ravutha Gounden, M. and Chawla, J.K. (2022) Management of Residual OSA Post Adenotonsillectomy in Children

- with down Syndrome: A Systematic Review. *International Journal of Pediatric Otorhinolaryngology*, **152**, Article ID: 110966. <https://doi.org/10.1016/j.ijporl.2021.110966>
- [41] Clements, A.C., Dai, X., Walsh, J.M., Sterni, L.M., Prichett, L., Boss, E.F., *et al.* (2020) Outcomes of Adenotonsillectomy for Obstructive Sleep Apnea in Prader-Willi Syndrome: Systematic Review and Meta-Analysis. *The Laryngoscope*, **131**, 898-906. <https://doi.org/10.1002/lary.28922>
- [42] Lee, C., Hsu, W., Ko, J., Yeh, T., Lin, M. and Kang, K. (2019) Adenotonsillectomy for the Treatment of Obstructive Sleep Apnea in Children with Prader-Willi Syndrome: A Meta-Analysis. *Otolaryngology—Head and Neck Surgery*, **162**, 168-176. <https://doi.org/10.1177/0194599819893115>
- [43] Chirakalwasan, N. and Ruxrungtham, K. (2014) The Linkage of Allergic Rhinitis and Obstructive Sleep Apnea. *Asian Pacific Journal of Allergy and Immunology*, **32**, 276-286.
- [44] Siddiqui, Z., Walker, A., Pirwani, M., Tahiri, M. and Syed, I. (2022) Allergic Rhinitis: Diagnosis and Management. *British Journal of Hospital Medicine*, **83**, 1-9. <https://doi.org/10.12968/hmed.2021.0570>
- [45] Mims, J.W. (2015) Asthma: Definitions and Pathophysiology. *International Forum of Allergy & Rhinology*, **5**, S2-S6. <https://doi.org/10.1002/alr.21609>
- [46] D'Elia, C., Gozal, D., Bruni, O., Goudouris, E. and Meira e Cruz, M. (2022) Allergic Rhinitis and Sleep Disorders in Children—Coexistence and Reciprocal Interactions. *Jornal de Pediatria*, **98**, 444-454. <https://doi.org/10.1016/j.jped.2021.11.010>
- [47] Bhattacharjee, R., Kheirandish-Gozal, L., Spruyt, K., Mitchell, R.B., Promchiarak, J., Simakajornboon, N., *et al.* (2010) Adenotonsillectomy Outcomes in Treatment of Obstructive Sleep Apnea in Children: A Multicenter Retrospective Study. *American Journal of Respiratory and Critical Care Medicine*, **182**, 676-683. <https://doi.org/10.1164/rccm.200912-1930oc>
- [48] Tauman, R. and Gozal, D. (2011) Obstructive Sleep Apnea Syndrome in Children. *Expert Review of Respiratory Medicine*, **5**, 425-440. <https://doi.org/10.1586/ers.11.7>
- [49] Galluzzi, F. and Garavello, W. (2021) Impact of Adenotonsillectomy in Children with Severe Obstructive Sleep Apnea: A Systematic Review. *Auris Nasus Larynx*, **48**, 549-554. <https://doi.org/10.1016/j.anl.2020.10.008>