THE EFFECTIVENESS OF SURGICAL TREATMENTS FOR ADENOID HYPERTROPHY IN CHILDREN IN THE ENVIRONMENTAL CONDITIONS OF THE ARAL SEA REGION

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Abstract. *A comparative evaluation of the effectiveness of various surgical methods for treating adenoid hypertrophy in children in the environmentally disadvantaged Priaralie region was conducted by studying morphological changes in lymphoid tissue. A total of 110 children (ages 3–16) with adenoid vegetations were examined and divided into three groups: traditional surgery, endoscopic shaver adenotomy, and irreversible electroporation. The study included clinical and laboratory tests as well as cytomorphological analysis of nasopharyngeal swabs over time (5, 10, and 15 days after surgery). A comparative analysis showed that endoscopic shaver adenotomy and irreversible electroporation significantly outperform traditional curettage in terms of tissue regeneration rate. By the 15th day of the postoperative period, the groups treated with modern technologies showed a sharp decrease in inflammatory cells (neutrophils to 1.7%, macrophages to 0.4%) and the absence of fibrin clots, whereas signs of active inflammation persisted in the group that underwent traditional surgery. Irreversible electroporation is the most effective and least invasive method of surgical treatment. Its implementation reduces the length of hospital stay, ensures rapid repair of the mucous membrane without the formation of coarse scars, and minimizes the risk of early and late complications compared to conventional methods of adenoid removal.*

Keywords: *Adenoid Hypertrophy (Adenoid Vegetations), Adenotomy, Irreversible Electroporation (IRE), Endoscopic Surgery, Shaver Adenotomy, Children,The Aral Sea Region (Environmental Factors)*

Introduction.

Adenoid hypertrophy is a condition that primarily affects children aged 3–5 years [13]. According to recent epidemiological studies, the prevalence of adenoid hypertrophy in children and adolescents ranges from 42% to 70%. Adenoid hypertrophy can lead to airway obstruction, which may cause sagittal, vertical, and lateral changes in the maxillofacial region due to mouth breathing [8,9,12]. Adenoid vegetations also contribute to the development of halitosis [15]. Adenoids play an important role in the development of the immune system and serve as a defense against infections, being the first organs to come into contact with antigens from the respiratory and digestive systems. The causes of adenoid hypertrophy are not fully understood. Most likely, they are associated with abnormal immune responses, infections, exposure to environmental factors, as well as hormonal or genetic factors [17]. An analysis was conducted on the effect of airborne particle size and crystallinity on the human body in the Aral Sea region: amorphous or crystalline quartz can cause diseases of the upper respiratory tract and lungs [1,3,14].In recent years, some studies have suggested that adenoid hypertrophy may be associated with extra-gastroesophageal reflux, in which pepsin plays a very important role and which, when it enters the upper respiratory tract, causes a number of pathological lesions [11,13]. Surgical intervention (adenotomy) is considered in cases of treatment failure or severe obstruction [4,10]. Among modern methods, radiofrequency ablation using low-temperature plasma in combination with nasal endoscopy is noted for achieving a more pronounced comprehensive effect in the treatment of adenoid hypertrophy in children, as is curettage combined with microwave thermocoagulation [2,5,6,]. Adenoids rarely regrow after surgery, and adenoid regrowth is more commonly observed in children under five years of age and in patients who were repeatedly prescribed antibiotics during the postoperative period [7]. Tubal torus hypertrophy is a rare complication following adenoidectomy, which is more common in boys (75.0%) and in patients who

underwent adenoidectomy before the age of 5 (94.4%)[16,17]. Thus, a comparative analysis of surgical methods for treating adenoid vegetations in children living in the Aral Sea region is highly needed.

Material and methods of research.

A total of 110 children aged 3 to 16 years who had been diagnosed with adenoid hypertrophy were examined and underwent surgery at the "Surgemed" private clinic in Urgench, Khorezm Region, and at the Republican Specialized Scientific and Practical Medical Center for Otorhinolaryngology and Head and Neck Diseases. The control group consisted of 20 generally healthy children. Examinations of the children in all study groups and the control group were conducted from 2022 to 2025. All children were divided into three groups to evaluate the effectiveness of treatment methods:

Group 1 consisted of 40 children with adenoid vegetations who underwent traditional surgical treatment.

Group 2 consisted of 50 children with adenoid vegetations who underwent adenoidectomy using endoscopic techniques and a shaver.

Group 3 consisted of 20 children with adenoid vegetations who underwent adenoidectomy using irreversible electroporation at the Republican Specialized Scientific and Practical Medical Center for Otorhinolaryngology and Head and Neck Diseases. Patients in all three groups underwent a comprehensive examination, which included clinical, laboratory, and morphological studies.

Results and discussion.

Adenoids were detected in all cities and districts of the Priaralie region; among ENT diseases, their prevalence averaged 3.23%. Regional variations in prevalence rates may be associated with environmental, climatic, and socioeconomic factors.

While Group 1 underwent conventional surgery, Group 2 underwent endoscopically guided adenoidectomy using a shaver. Group 3 underwent adenoidectomy using irreversible electroporation.

The composition of nasopharyngeal mucosal secretions was studied by taking cytological smears on days 5, 10, 15, and 30 to track changes following the various surgical interventions. Based on the cytogram obtained, we analyzed the postoperative condition and the morphodynamic repair of the wounds to justify the methods we used.

In patients in Group 1 who participated in our study, protein structures resembling vacuoles—composed of fragments of most mucosal tissues and destructively altered glandular epithelium—were detected in nasal swabs on Day 5.

In Group 1 patients, cytological examination of nasal mucosa samples obtained postoperatively revealed aggregated structures consisting primarily of thromboplastins, red blood cells, neutrophils, and a small number of eosinophils. On day 15, the cytological composition of the nasal mucosa smear showed a relative reduction in the size of most cells, accounting for 38.02 ± 5.1% of the surface area at 400x magnification, corresponding to the number of neutrophils, macrophages, and hyposecretory desquamated epithelial thromboplasts with metaplastic changes. On day 15, the cytogram revealed a small number of metaplastic epithelial cells—1.22 ± 0.5%—active neutrophils—13.1 ± 0.7%—active macrophages—1.9 ± 0.6%, and the area occupied by thromboplastins—4.72 ± 0.5%. These indicators suggest that on day 15 in Group 1, the process of reparative regeneration in the nasal mucosa is continuing, and the wound sites are healing, while the reduction in foci of apoptosis and necrosis leads to a decrease in cell count.

In Group 2, cytological smears were taken from the nasopharynx on the 5th day after surgery. In these smears, the cytological landscape of the mucous membrane in the surgical field contained very few cells; it was found that hypercellularity developed very slowly. Among cells not cytologically associated with neutrophils, eosinophils were detected in tissues 400 times more frequently than in tissues sampled 1–2 times a day. On day 15, a sharp reduction in most of the cellular landscape in cytological smears, obtained again from these patients, is marked by the appearance of isolated cells in the background of a small smear. On the cytogram, the area occupied by cells

magnified 400× is 11.02 ± 1.2%, of which the area occupied by active neutrophils is 3.01 ± 0.3% over the course of 11 days.

Thus, patients in Group 3 are characterized by mild involvement of the nasopharyngeal mucosa, a limited cellular response, and the absence of red blood cells in cytological smears taken from bleeding sites on the mucosal surfaces of the surgical wound area. The fact that fibrous protein structures do not form in the smear on days 5–10 and 15 proves that the vessels do not abruptly lose their permeability and do not form fibrin clots on the surface of the fibrinogenic mucous membrane. On the 5th day, cell counts are low, with plasmocytes predominating; the picture of hypercellularity develops sluggishly. Cytological examination reveals a sharp decrease in the number of neutrophils; there are 3–5 neutrophils per 400x field of view. The cytoplasm of neutrophils is slightly granular; foci of active phagocytosis are small; the number of macrophages is high; and macrophages rich in inclusions are also detected. Cellular structures account for approximately 22.4 ± 1.01% of a 400x field of view on the cytogram, of which the area occupied by active neutrophils is 8.8 ± 0.21% over a 5-day period. Red blood cells are found sporadically in the smear. Clusters of thromboplastins are detected only in the lesion. Only epithelial cells undergoing mucinization and metaplasia are observed in the field of view.

On day 15, a sharp reduction in most of the cellular landscape in cytological smears obtained from these patients is characterized by the appearance of isolated cells against the background of a small smear area. On the cytogram, the area occupied by cells is 400 times larger than the field of view and amounts to 9.02 ± 0.01%; of this, the area occupied by active neutrophils is 1.71 ± 0.01% over 11 days. The number of macrophages also decreased proportionally to 0.4 ± 0.1%. The number of epithelial cells resulting from metaplasia or hypersecretion was 0.7 ± 0.1%. The mucus content is 0.4 ± 0.2%. The eosinophil content is 1.7 ± 0.1%. On the other hand, destroyed cellular components and fibrous protein structures accounted for 2.01 ± 0.1%, indicating that the clinical and morphological efficacy of the treatment was achieved very rapidly.

Thus, patients in Group 3 were characterized by the least impact on the mucous membrane during treatment in the postoperative period, a sharp decrease in the cellular response, and the absence of red blood cells.

Conclusion.

In the treatment of children with adenoid hypertrophy in the Priaralie region, the introduction of irreversible electroporation—a less invasive and effective method—taking into account the patients' clinical and functional status and comorbidities, reduces the length of hospitalization, ensures a rapid recovery, and lowers the risk of complications.

REFERENCES

1. Bazarbayev R, Zhou B, Allaniyazov A, Zeng G, Mamedov D, Ivanitskaya E, Wei Q, Qian H, Yakubov K, Ghali M, Karazhanov S. Physical and chemical properties of dust in the Pre-Aral region of Uzbekistan. Environ Sci Pollut Res Int. 2022 Jun;29(27):40893-40902. doi: 10.1007/s11356-022-18827-6. Epub 2022 Jan 27. PMID: 35084677; PMCID: PMC9135847.

2. Elzayat S, Elsherif H, Aouf M. Trans-oral endoscopic assisted radio-frequency for adenoid ablation; A randomized prospective comparative clinical study. Auris Nasus Larynx. 2021 Aug;48(4):710-717. doi: 10.1016/j.anl.2020.11.010. Epub 2020 Nov 28. PMID: 33261981.

3. Erkudov VO, Rozumbetov KU, González-Fernández FT, Pugovkin AP, Nazhimov II, Matchanov AT, Ceylan Hİ. The Effect of Environmental Disasters on Endocrine Status, Hematology Parameters, Body Composition, and Physical Performance in Young Soccer Players: A Case Study of the Aral Sea Region. Life (Basel). 2023 Jul 3;13(7):1503. doi: 10.3390/life13071503. PMID: 37511878; PMCID: PMC10381241.

4. Feka-Homsy P, Cao Van H. Hypertrophie adénoïdienne chez l'enfant: diagnostic et prise en charge [Adenoid hypertrophy in children: diagnosis and management]. Rev Med Suisse. 2025 Oct 1;21(933):1729-1732. French. doi: 10.53738/REVMED.2025.21.933.47701. PMID: 41035266.

5. 10.Huang H, Zhang L, Zhang Q, Zhong J, Fu L, Mou Y. Comparison of the efficacy of two surgical procedures on adenoidal hypertrophy in children. Arch Pediatr. 2020 Feb;27(2):72-78. doi: 10.1016/j.arcped.2019.11.010. Epub 2019 Nov 30. PMID: 31791828.

6. Juneja R, Meher R, Raj A, Rathore P, Wadhwa V, Arora N. Endoscopic assisted powered adenoidectomy versus conventional adenoidectomy - a randomised controlled trial. J Laryngol Otol. 2019 Apr;133(4):289-293. doi: 10.1017/S0022215119000550. PMID: 31046870.

7. Lesinskas E, Drigotas M. The incidence of adenoidal regrowth after adenoidectomy and its effect on persistent nasal symptoms. Eur Arch Otorhinolaryngol. 2009 Apr;266(4):469-73. doi: 10.1007/s00405-008-0892-5. Epub 2008 Dec 18. PMID: 19093130.

8. Lin L, Zhao T, Qin D, Hua F, He H. The impact of mouth breathing on dentofacial development: A concise review. Front Public Health. 2022 Sep 8;10:929165. doi: 10.3389/fpubh.2022.929165. PMID: 36159237; PMCID: PMC9498581.

9. Ma Y, Xie L, Wu W. The effects of adenoid hypertrophy and oral breathing on maxillofacial development: a review of the literature. J Clin Pediatr Dent. 2024 Jan;48(1):1-6. doi: 10.22514/jocpd.2024.001. Epub 2024 Jan 3. PMID: 38239150.

10. Niedzielski A, Chmielik LP, Mielnik-Niedzielska G, Kasprzyk A, Bogusławska J. Adenoid hypertrophy in children: a narrative review of pathogenesis and clinical relevance. BMJ Paediatr Open. 2023 Apr;7(1):e001710. doi: 10.1136/bmjpo-2022-001710. PMID: 37045541; PMCID: PMC10106074.

11. Niu X, Wu ZH, Xiao XY, Chen X. The relationship between adenoid hypertrophy and gastroesophageal reflux disease: A meta-analysis. Medicine (Baltimore). 2018 Oct;97(41):e12540. doi: 10.1097/MD.0000000000012540. PMID: 30313042; PMCID: PMC6203580.

12. Poddębniak J, Zielnik-Jurkiewicz B. Impact of adenoid hypertrophy on the open bite in children. Otolaryngol Pol. 2019 Apr 5;73(4):8-13. doi: 10.5604/01.3001.0013.1536. PMID: 31474619.

13. Ren J, Zhao Y, Ren X. [An association between adenoid hypertrophy and exstra-gastroesophageal reflux disease]. Lin Chuang Er Bi Yan Hou Tou Jing Wai Ke Za Zhi. 2015 Aug;29(15):1406-8. Chinese. PMID: 26685418.

14. Sakiev KZ, Ibraeva LK, Dyusembaeva NK, Rybalkina DK, Drobchenko EA. Qualitative index of population health losses in the aral sea region. Gig Sanit. 2016;95(10):950-4. English, Russian. PMID: 29431341.

15. Sikorska-Żuk M, Bochnia M. Halitosis in children with adenoid hypertrophy. J Breath Res. 2018 Feb 20;12(2):026011. doi: 10.1088/1752-7163/aa9b3a. PMID: 29146888.

16. Teng ZP, Li Q, Shen XF. Torus Tubarius Hypertrophy After Adenoidectomy. Ear Nose Throat J. 2024 Dec;103(12):769-772. doi: 10.1177/01455613231199676. Epub 2023 Sep 12. PMID: 37700607.

17. Yang SZ, Zhou CY, Wang ZL, Han BC, Sun WHH, Wan Y, Shen GJ, Zhang J, Zhang J. [Preliminary experience of surgical treatment for torus tubarius hypertrophy in children]. Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi. 2022 Apr 7;57(4):505-509. Chinese. doi: 10.3760/cma.j.cn115330-20210412-00196. PMID: 35527449.