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Chronic tonsillitis in adolescents: clinical features and the role of ultrasound diagnosis in the northern region of Ukraine

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Abstract. ***Background.*** *Chronic tonsillitis is the most common disease among children and adolescents in the structure of pathology of the ENT organs. Untimely diagnosis and irrational treatment lead to decompensation of chronic tonsillitis and the development of lesions of many organs and systems of the child's body of tonsillogenic origin. The aim of the work was to study the clinical features and ultrasound changes of the palatine tonsils in adolescents with chronic tonsillitis.* ***Materials and methods.*** *We have examined 47 children aged 13 to 17 years suffering from chronic tonsillitis: group I — 27 patients with compensated chronic tonsillitis, group II — 20 patients suffering from decompensated chronic tonsillitis. The control group consisted of 16 practically healthy children, representative in terms of age and gender. We used clinical methods, ultrasonography of the palatine tonsils, and statistical methods. The study was approved by the Institutional Bioethics Committee and it conforms to the principles outlined in the Declaration of Helsinki.* ***Results.*** *According to the results of an ultrasound examination of the palatine tonsils in children with chronic tonsillitis, the main changes were an increase in their transverse dimensions by more than 15 mm, deepening of lacunae, thickening of the capsule, fibrous changes. In addition, in patients with tonsillogenic lesions of the cardiovascular system and a decompensated form of chronic tonsillitis, the pathological signs of the disease according to ultrasound were more significant and were manifested by unclear contours, increased echogenicity, heterogeneous hyperechoic structure, diffuse fibrous and cystic changes of the palatine tonsils.* ***Conclusions.*** *Ultrasonography of the palatine tonsils is a non-invasive, painless, accessible and informative method for studying the structure of the tonsils in normal and pathological conditions. It allows for a more thorough assessment of their changes in compensated and decompensated forms of chronic tonsillitis.*

Keywords: *children; ultrasonography; tonsillitis; palatine tonsils*

Introduction

Chronic tonsillitis represents a significant share in the structure of childhood and adolescent diseases and ranges from 20 to 43 %. Despite the improvement and optimization of diagnostic and treatment algorithms for chronic tonsillitis, the frequency of this pathology among children and adolescents has increased by more than 1.5 times in recent years [2].

The development of a chronic inflammatory focus in the tonsils is facilitated by a decrease in the immunological reactivity of the body, allergic factors, disturbances in ecology and nutrition, changes in biological processes in the palatine tonsils [3, 4]. Favorable anatomical and topographical prerequisites for the chronicity of the inflammatory process are: narrow and/or deep lacunae, slit-like passages, cicatricial changes after inflammation, the state of the receptor apparatus [2, 5, 6]. It should be noted that the pathological process in the tonsils develops with the involvement of all its structures. In addition, the replacement of lymphoid tissue that functions as a connective tissue and the development of pathological microflora in the lacunae leads to the formation of a chronic focus of infection and a decrease in both local and systemic immunity of the child's body [7, 8].

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The palatine tonsils have become a reservoir of infection where it can spread throughout the body. It can be the cause of tonsillogenic damage to organs and systems, which, in turn, suppresses immunity and leads to the development of chronic tonsillitis decompensation. In this way, a vicious cycle is formed [9, 10].

Chronic tonsillitis is dangerous due to complications associated with the generalization of infection and toxic effects on the body. These include paratonsillar abscesses, lesions of the kidneys, joints, heart and blood vessels. Thus, the inflammatory process in the tonsils has a toxic, allergic and reflex effect on the organs and systems of the child's body [11].

There are not many diagnostic methods we can use in this case, but one of the available and informative ones is ultrasound. The main advantages of ultrasound examination are high informativeness, non-invasiveness, safety for children's body, painlessness; it can be used at any age. The use of ultrasound examination of the tonsils in children with chronic tonsillitis is a supplement to the visual examination and it allows to determine the condition of the tonsil tissues, the presence of cysts or scar changes [12, 13].

Therefore, the study of ways to improve the diagnosis of chronic tonsillitis in children is extremely relevant at the current stage.

The purpose of the work was to study the clinical features and ultrasound changes of the palatine tonsils in adolescents with chronic tonsillitis.

Materials and methods

The study involved 47 children aged 13 to 17 years (25 girls and 22 boys) suffering from chronic tonsillitis. They were examined to study the clinical features of the course of chronic tonsillitis and the condition of the palatine tonsils according to the ultrasound examination. Patients were divided into two groups: group I — 27 children with compensated chronic tonsillitis, group II — 20 patients suffering from decompensated chronic tonsillitis. The control group consisted of 16 practically healthy children, representative in terms of age and gender. The state of compensation was assessed taking into account the child's well-being, the presence of complaints and damage to other organs and systems of tonsillogenic origin. The state of decompensation was estimated by the presence of not only local signs of chronic tonsillitis, but also persistent low fever, tonsillocardial syndrome, secondary cardiomyopathy, exacerbations of chronic tonsillitis more than three times a year for two years.

All children underwent a general clinical examination and ultrasonography of the palatine tonsils. Ultrasound examination of the palatine tonsils was performed on a Toshiba Nemio 5500 device; a linear sensor of 7–10 MHz was used. During the examination, the child was in a supine position. The ultrasound sensor was placed in the middle of the angle of the mandible, the landmarks were the submandibular glands, m.digastricus, m.stylohyoideus. The scanning plane was directed at an angle of 30–60° to the horizontal plane in order to cut the tonsil as much as possible.

The standard computer system Microsoft Excel (2007), adapted for medical and biological research, was used for statistical processing of the results. Average values are presented as M ± m. The Student-Fisher (t) parametric method was used to estimate the difference between the average values of independent samples.

The study was approved by the Institutional Bioethics Committee and it conforms to the principles outlined in the Declaration of Helsinki.

Results

There were some clinical symptoms of chronic tonsillitis in children of both study groups such as general weakness, discomfort and pain when swallowing, purulent smell from the oral cavity. In addition, patients with decompensated chronic tonsillitis had frequent exacerbations of chronic tonsillitis (more than three times a year for two years) in 70 % of cases, long-term low-grade fever (body temperature of 37.1–37.30 °C) in 45 %, as well as clinical signs of secondary cardiomyopathy (pain in the area of the heart of various nature and severity, general weakness, fatigue and shortness of breath during physical exertion, headaches, dizziness, palpitations, heart failure, changes in heart activity according to electrocardiography) — in 85 % patients.

During the examination, local signs of chronic inflammation of the palatine tonsils were found in patients with chronic tonsillitis of both groups. Thus, hyperemia of the mucous membrane of the posterior pharyngeal wall and palatine tonsils was found in 85 % of children of both groups, hyperemia of the anterior palatine arches (Guise's symptom) in 55.56 ± 9.75 % and 50.00 ± 11.47 % in groups I and II, respectively, cicatricial adhesions between tonsils and palatine arches in 44.44 ± 9.75 % and in 90.00 ± 6.88 % ($p < 0.05$), expanded and deepened lacunae with pathological purulent content in 51.85 ± 9.80 % and 80.00 ± 9.18 % ($p < 0.05$), swelling of the upper corner formed by anterior and posterior arches (Zak's symptom) in 48.15 ± 9.80 % and 45.00 ± 11.41 %, roller-like thickening of the edges of the upper anterior and posterior arches (Preobrazhensky's symptom) in 29.63 ± 8.96 % and 60.00 ± 11.24 % of cases ($p < 0.05$), respectively. In addition, tonsil hypertrophy degree I was observed in 33.33 ± 9.25 % and 15.00 ± 8.19 % ($p < 0.05$) of patients of groups I and II, respectively, degree II — in 55.56 ± 9.75 % and 60.00 ± 11.24 %, and degree III — in 40.00 ± 11.24 % of patients of only group II ($p < 0.05$).

The ultrasound examination in practically healthy children visualized tonsils of medium echogenicity, they had a transverse size of up to 15 mm, an oval shape, clear contours, a homogeneous structure, the lacunae were not deepened, with no pathological content.

Pathological changes of the palatine tonsils, according to ultrasound examination in chronic tonsillitis, differed in patients of groups I and II.

Thus, in children with compensated chronic tonsillitis, the tonsils on the echogram had an average echogenicity (88.89 ± 6.16 %), clear contours and a homogeneous structure (92.59 ± 5.01 %), a transverse size of 15–20 mm (85.19 ± 6.97 %). In addition, there were isolated fibrous changes (48.15 ± 9.80 %), deepening of lacunae up to 2 mm (85.19 ± 6.97 %) and thickening of the tonsillar capsule (81.48 ± 7.62 %).

In patients with decompensated chronic tonsillitis, compared to those with compensated tonsillitis, there were more

pronounced changes in the palatine tonsils. They were manifested by thickening of the capsule, hyperechoic inhomogeneous structure in 95.00 ± 5.00 % of children ($p < 0.05$), an increase in size of more than 20 mm in 80.00 ± 9.18 % of cases and a deepening of lacunae more than 2 mm in 85.00 ± 8.19 % ($p < 0.05$). In addition, multiple diffuse changes in the palatine tonsils (85.00 ± 8.19 %) and cysts (30.00 ± 10.51 %) were detected in the patients of group II, in contrast to group I ($p < 0.05$).

Discussion

Analyzing literary sources on chronic tonsillitis, it was found that ultrasound diagnosis of palatine tonsils and neck is a topical issue for scientists in recent years. However, this problem remains understudied. Thus, Haryuk O.G., Yevdokymenko V.I. developed the technique of ultrasound of the palatine tonsils and studied the role of this method in monitoring the effectiveness of cryosurgical treatment for chronic tonsillitis [14].

Trukhin D.V. studied the state of the palatine tonsils and lymph nodes in chronic tonsillitis by ultrasound, but only in adults. He differentiated the changes in various forms of the disease and found that patients with the allergic-toxic chronic tonsillitis had more pronounced changes in the tonsils, such as their irregular shape, unclear contours, the presence of additional inclusions, hypoechogenicity [13].

Most researchers studied the state of paratonsillar tissues by ultrasound [9, 14] and also analyzed the size of tonsils [10–12].

Thus, Chung D., Bandarkar A. showed that three-dimensional ultrasound would help to assess the degree of tonsillar hypertrophy for the potential identification and stratification of candidates for tonsillectomy [17].

Perry J.L., Haenssler A.E. performed lateral view magnetic resonance imaging to analyze palatopharyngeal variables in 270 participants aged 3 months to 34 years. The authors reported that qualitatively adenoid growth progresses in an anterior and inferior direction, whereas involution occurs in a posterior and superior direction [18].

Aydin S., Uner C. noted that despite the wide use and informativeness of magnetic resonance imaging and computer tomography in assessing the state of the palatine tonsils, these methods have some limitations. First of all, it is high cost. The next one it is necessity to use sedatives, and the impact of ionizing radiation. These factors are quite important in pediatric practice. Whereas, in the absence of these limitations, ultrasound examination is more often used in pediatric practice [19].

However, diagnostic criteria for compensated and decompensated chronic tonsillitis, as well as morphological features of the palatine tonsils in childhood according to ultrasound data, remain understudied.

Conclusions

So, according to the results of an ultrasound examination of the palatine tonsils, the main changes in children with chronic tonsillitis were an increase in their transverse dimensions by more than 15 mm, a deepening of the lacunae, a thickening of the capsule, and fibrous changes. Also, in patients with tonsillogenic lesions of the cardiovascular system and a decompensated form of chronic tonsillitis, the pathological signs of the disease according to ultrasound were more significant and were manifested by unclear contours, increased echogenicity, heterogeneous hyperechoic structure, diffuse fibrous and cystic changes of the palatine tonsils.

Thus, ultrasonography of the palatine tonsils is a non-invasive, painless, accessible and informative method for studying the structure of the tonsils in normal and pathological conditions. It allows for a more thorough assessment of their changes in compensated and decompensated forms of chronic tonsillitis. Therefore, it is expedient and relevant at the current stage to supplement the diagnosis of chronic tonsillitis in children by conducting an ultrasound examination of the palatine tonsils.

References

1. Krjuchko TO, Bezshapochnyj SV, Kushnereva TV, Loburec VV. Optymizatsiia skhem likuvalno-profilaktychnoi dopomohy ditiam z khronichnym tonzylitom: metodychni rekomendacii' [Optimization of treatment and preventive care schemes for children with chronic tonsillitis: guidelines]. Kyiv; 2013. 38 p. (in Ukrainian).

2. Bredun OYu, Melnikov OF, Timchenko MD. Effects of plant-derived immunomodulators and lizak preparation in vitro taken separately or in combination on the immune factors of palatine tonsils of children with chronic tonsillitis. Otorhinolaryngology. 2019;(4-5):13-18. doi:10.37219/2528-8253-2019-4-13. (in Ukrainian).

3. Avramović V, Petrović V, Jović M, Vlahović P. Quantification of cells expressing markers of proliferation and apoptosis in chronic tonsilitis. Acta Otorhinolaryngol Ital. 2015 Oct;35(4):277-284.

4. Duarte VM, McGrath CL, Shapiro NL, Bhattacharrya N. Healthcare costs of acute and chronic tonsillar conditions in the pediatric population in the United States. Int J Pediatr Otorhinolaryngol. 2015 Jun;79(6):921-925. doi:10.1016/j.ijporl.2015.04.019.

5. Belov VA. Modern methods of microbiological diagnostics in exacerbation of chronic and acute forms of tonsillitis in children. Voprosy Sovremennoi Pediatrii. 2012;11(2):128-131. (in Russian).

6. Melnykov OF, Bredun OYu, Timchenko MD, Bredun SO. Content of afferent and effectors cells, regulatory cytokines of hypertrophy and chronic inflammation palatine tonsils in children were estimated. Fiziol Zh. 2019;65(2):84-88. doi:10.15407/fz65.02.084. (in Ukrainian).

7. Hospodarskyi IYa, Hospodarska KhO. Current approaches to the treatment of chronic tonsillitis with frequent exacerbations in adolescents with perennial allergic rhinitis. Sovremennaya pedyatriya. 2016;(1):105-110. doi:10.15574/sp.2016.73.105. (in Ukrainian).

8. Ilchenko SI, Fialkovska AA, Ivanus SH. The effectiveness of using respiratory probiotic Streptococcus salivarius K12 in children with recurrent tonsillitis. Aktual'naâ Infektologiâ. 2020;8(2):25-29. doi:10.22141/2312-413x.8.2.2020.199732. (in Russian).

9. Jiang R, Zhang HM, Wang LY, Pian LP, Cui XW. Ultrasound features of primary non-Hodgkin's lymphoma of the palatine tonsil: A case report. World J Clin Cases. 2021 Oct 6;9(28):8470-8475. doi:10.12998/wjcc.v9.i28.8470.

10. Piccin O, Sorrenti G, Farneti P, Cioccoloni E, Burgio L. Ultrasonographic assessment of tonsillar volume in children. Int J Pediatr Otorhinolaryngol. 2017 Oct;101:262. doi:10.1016/j.ijporl.2017.08.003.

11. Mehwish A, Usmani A. Role of ultrasound in estimation of palatine tonsil volume in obstructive sleep apnea patients. JBUMDC. 2020;10(3):228-233. doi:10.51985/JBUMDC2020021.

12. Chikamori T, Counihan PJ, Doi YL, et al. Mechanisms of exercise limitation in hypertrophic cardiomyopathy. J Am Coll Cardiol. 1992 Mar 1;19(3):507-512. doi:10.1016/s0735-1097(10)80262-1.

13. Trukhin DV, Kim IA, Nosulya EV, Zubareva EA, Garashchenko TI. The use of the ultrasound for otorhinolaryngology, head and neck diseases (literature review). Meditsinskiy sovet. 2020;(11):92-100. doi:10.21518/2079-701X-2020-11-92-100. (in Russian).

14. Gariuk GI, Gariuk OG, Shevchenko AM. Ultrasound diagnosis of paratonsillar abscess at various stages of its development. Journal of ear, nose and throat diseases. 2005;(6):67-69. (in Russian).

15. Smiyan OI, Mozgovaya JA, Moiseenko NM, Bynda TP, Romaniuk OK, Pavlyukova NA. Role of the ultrasound in the diagnosis of tonzillogenic lesions of the cardiovascular system in children. Pediatriya, akusherstvo ta ginekologiya. 2021;(452):19-23. (in Ukrainian).

16. Bandarkar AN, Adeyiga AO, Fordham MT, Preciado D, Reilly BK. Tonsil ultrasound: technical approach and spectrum of pediatric peritonsillar infections. Pediatr Radiol. 2016 Jun;46(7):1059-1067. doi:10.1007/s00247-015-3505-7.

17. Chung D, Bandarkar A, Rana MS, et al. Pilot study of the potential of 3D ultrasound to measure tonsillar volume and hypertrophy. Int J Pediatr Otorhinolaryngol. 2019 Nov;126:109612. doi:10.1016/j.ijporl.2019.109612.

18. Perry JL, Haenssler AE, Kotlarek KJ, et al. A Midsagittal-View Magnetic Resonance Imaging Study of the Growth and Involution of the Adenoid Mass and Related Changes in Selected Velopharyngeal Structures. J Speech Lang Hear Res. 2022 Apr 4;65(4):1282-1293. doi:10.1044/2021_JSLHR-21-00514.

19. Aydin S, Uner C. Normal palatine tonsil size in healthy children: a sonographic study. Radiol Med. 2020 Sep;125(9):864-869. doi:10.1007/s11547-020-01168-0.

20. Smiyan OI, Manko YuA, Loboda AM, et al. Influence of magnesium on the state of the cardiovascular system in children with chronic tonsillitis. Wiad Lek. 2020;73(5):904-908. doi:10.36740/WLek202005112.

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Хронічний тонзиліт у підлітків: клінічні особливості та роль ультразвукової діагностики в північному регіоні України

Резюме. Актуальність. Хронічний тонзиліт є найбільш поширеним захворюванням серед дітей та підлітків у структурі патології лор-органів. Невчасна діагностика й нераціональне лікування призводять до декомпенсації хронічного тонзиліту та розвитку уражень багатьох органів і систем дитячого організму тонзилогенного генезу. **Мета роботи:** вивчити клінічні особливості та ультразвукові зміни піднебінних мигдаликів у підлітків із хронічним тонзилітом. **Матеріали та методи.** Було обстежено 47 дітей віком від 13 до 17 років, хворих на хронічний тонзиліт: I група — 27 дітей із компенсованим хронічним тонзилітом, II група — 20 пацієнтів, які страждають на декомпенсований хронічний тонзиліт. Групу контролю становили 16 практично здорових дітей, репрезентативних за віком та статтю. Використовували клінічні методи, ультрасонографію піднебінних мигдаликів, статистичні методи. Дослідження було схвалено комітетом з біоетики установи та відповідає принципам, зазначеним у Гельсінській декларації. **Результати.** За результатами ультразвукового дослідження піднебінних мигдаликів у дітей, хворих на хронічний тонзиліт, основними змінами були: збільшення їх поперечних розмірів понад 15 мм, поглиблення лакун, потовщення капсули, фіброзні зміни. Крім цього, у пацієнтів із тонзилогенними ураженнями серцево-судинної системи й декомпенсованою формою хронічного тонзиліту патологічні ознаки захворювання за даними ультразвукового дослідження були більш значними та проявлялися нечіткими контурами, підвищенням ехогенності, неоднорідною гіперехогенною структурою, дифузними фіброзними та кістозними змінами піднебінних мигдаликів. **Висновки.** Ультрасонографія піднебінних мигдаликів є неінвазивним, безболісним, доступним та інформативним методом вивчення структури мигдаликів у нормі та патології, дозволяє більш ретельно оцінити їх зміни при компенсованій та декомпенсованій формах хронічного тонзиліту.

Ключові слова: діти; ультрасонографія; тонзиліт; піднебінні мигдалики