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Post-surgical noninvasive monitoring of middle ear in otitis media prolonged forms

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Abstract

Background: Prolonged forms of otitis media (OM) lead to chronic hearing loss and disability from childhood. Wide spectrum of therapeutic approaches is used in management of OM in children. Objective evaluation of the middle ear after different curative modalities will help in analysis of treatment feasibility. The objective of this article was to compare the results of middle ear noninvasive monitoring after different surgical procedures in order to select the most effective one in prolonged otitis media forms.
Material and methods: Patients represent 150 children with prolonged OM. Analyzed treatment modalities: I – myringotomy, II – classical tympanostomy, III – modified tympanostomy. Middle ear monitoring included otoscopy and audiometry what was repeated 4 times during 2 years, otomicroscopy in 1 and 2 years and impedance audiometry in 2 years after surgery. The quality of life and general health scores were analyzed before surgery and in 1 and 2 years after surgery.
Results: Otoscopic and audiometric data showed stable improvement in 32% of children after myringotomy, 90% of children after classical tympanostomy and 97% of children after modified tympanostomy. Impedance audiometry in 2 years after surgery demonstrated complete restoration of middle ear function in 32% of children after myringotomy, in 78% of children after classical tympanostomy, and in 94% of children after modified tympanostomy.
Conclusions: Post-surgical noninvasive monitoring demonstrated advantages of tympanostomy and especially in modified version: improvement and stability of middle ear function and low rate of otitis media persistence or recurrence.
Key words: noninvasive monitoring, otitis media prolonged forms, types of surgery, modified tympanostomy.

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Introduction

Otitis media (OM) represents the group of middle ear (ME) diseases, which affect 90% of small children. Primary forms of OM in childhood are classified by pediatric otology on acute otitis media (AOM) and otitis media with effusion (OME) [1-3]. Symptoms and signs are different, but the common characteristic is hearing loss, what is difficult to suspect in a small child without special clinical diagnostic methods [1-8]. The duration of primary forms is limited: maximum 6 weeks in AOM and 12 weeks in OME. Further evolution of these two forms may be different, including transformation from AOM into OME and vice versa, but in 15-25% of cases they both progress into the prolonged forms such as recurrent acute otitis media (RAOM) and persistent otitis media with effusion (POME) [1]. Prolonged OM forms are characterized functionally by chronic hearing loss what corresponds to chronic pathological changes in the middle ear. The prolonged OM affects child's quality of life and general health [1-8]. Prognostics and detection of prolonged OM in small children and intensive treatment including surgical one have to prevent from the progressive disease evolution [1-14].

Importance of hearing organ function, necessity of early and precise diagnostics and unsatisfactory results of different therapy types facilitated development of objective diagnostic tools – electro-acoustical and electrophysiological methods, as: impedance audiometry (IA), Brainstem Evoked Response Audiometry (BERA) and registration of otoacoustical emissions (OAE) for early detection of ME pathology [1-6]. Are they useful in prognosis of OM negative evolution?

Management of OM prolonged forms such as POME and RAOM, consists of different approaches and methods. Traditional modality includes diagnostic tests for children with evident OM manifestations. Treatment approach is composed by adenoidectomy with/or without physiotherapy as a first, sometimes single, stage. Myringotomy with tympanostomy tube (TT) insertion or tympanostomy (TS) is performed rarely, as a second procedure in a few months or years on a later stage. The effectiveness of this classical intervention is not clear [3-8].

Another therapeutic approach to POME and RAOM treatment is presented in Protocols of OM management from USA, Finland, Australia, Japan, etc. [1-6].

Comprehensive standards are based on early objective

detection of ME pathology in small children with risk factors (RF), "watchful waiting" period of 3 months and relatively early surgical intervention – TS as a first and single procedure. Adenoidectomy, one of the classical "treatment" of OM, is recommended rarely, only in cases of evident and "proven true" hypertrophy of adenoids or in case of further OM progression or recurrence, in complex with second TS-surgery [1-4]. Physiotherapy in OM is not recommended by contemporary Otorhinolaryngology. This modality evidently reduces the OM recurrence, chronicity and complication rates. High prevalence of prolonged OM in the world and standardized surgical approach increases the number of ear surgery and makes TS the most frequently surgery performed in children in USA, Finland, Australia, etc. [1-5].

Chronic suppurative OM, otogenic complications and chronic hearing loss rates still are relatively high, including in Moldova, what stimulates OM researches [9-11].

We conducted several projects in collaboration with Mayo Foundation, Mayo Clinic, Rochester, MN, USA and Society "Pediatricians due Monde", Clermont-Ferrand (France) in order to create a system of OM management in Moldova. The goal of OM management is the ME physical and acoustical restoration and prevention of OM recurrence [10-14].

Our approach includes several steps: 1) evaluating of evident risk factors (RF) for prolonged OM in every child, 2) monitoring of ME status in children with high score of RF, 3) medical treatment of basic pathology, 4) surgical treatment including TS and adenoidectomy, 5) monitoring of ME in post-surgical period.

We formulated the diagnostic algorithm to highlight the somatic conditions and diseases, which predispose to OM prolonged forms. Medical therapy of identified pathology in complex with further ME monitoring helped in differentiation between the symptomatic (treatable) and independent prolonged OM [2, 10-12]. Our surgical complex included tympanostomy in our modification and adenoidectomy. Modified tympanostomy (MTS) is designed in order to improve cleaning and visualization of the tympanic cavity [15]. Monitoring of the otoscopical, physical and acoustical characteristics, dynamics of quality of life (QL) and general health (GH) is necessary for estimation of the feasibility of any therapeutic activities conducted in prolonged OM [1-14, 16-18].

The purpose of this article is to compare outcomes of prolonged OM in function of applied treatment modalities on the base of noninvasive monitoring.

Material and methods

Material. Patients' selection: Children at 1-7 years of age with OM and predisposing factors to recurrence and chronicity in the number of 950 were included in the group for observation. Monitoring of ME included screening-impedance audiometry and screening-otoscopy four times during 1 year (once in 3 months). Additional diagnostic methods and medical treatment of pathological conditions in children with OM improved ME status in the majority of cases. The presence of pathological changes during at least 3 months we classified as persistent otitis media with effusion (POME). Recurrence of OM signs 3 times during 6 months or 4 times during 12 months we classified as recurrent acute otitis media (RAOM) [1-8, 10-14]. As a result of patients' selection we included in this study 150 patients with prolonged OM.

Methods. Monitoring methods included screening otoscopy and otomicroscopy, audiometry, impedance audiometry, quality of life (QL) and general health (GH) characteristics before and after the treatment. Monitoring was performed for 24 months period.

Otomicroscopy test. Were used 2 otoscopy sets: "Carl Storz" set and Otomicroscope "Zeiss". We created the database of every child's otoscopical profile, which includes pre-surgical otomicroscopic data, surgical findings and otoscopical monitoring after surgery. Unification and statistical analysis of otoscopic data were implemented on the base of profile numerical assessment in accordance with elaborated scale. Our scale provides gradation of all TM changes. Normal tympanic membrane appearance was graded 0 points, doubtful otoscopic shifts – 1 point, minimal pathologic changes – 2-5 points, evident inflammatory signs – 6-8 points, manifested otoscopic signs – 9-10 points and formation of chronic purulent OM – 11-13 points.

Electro-acoustical tests. Two sets were used: a) impedance audiometer for screening MT-10, b) clinical impedance audiometer. Both instruments have the probe tone frequency of 226 Hz and a positive and negative pressure sweep between +200 and -400 daPa and sweep speed – 600 daPa/s, near the tympanogram peak – 200 daPa/s, and the compliance range – 0.1-0.6 ml. We analyzed and monitored before surgery and after surgery in 24 months the tympanogram type, compliance, absolute gradient, relative gradient, width and pressure at tympanogram pick.

Audiometry. General hearing assessment, evaluation of hearing thresholds level and differentiation between conductive, sensorineural and mixed hearing loss were done using the conventional audiometry. The objective examination such as registration of otoacoustical emissions (OAE) or brainstem electrical response audiometry (BERA) were performed for children with communication difficulties. We analyzed and monitored before surgery and in 12 and 24 months after surgery hearing thresholds level and pick latency.

General health evaluation. The general health in the group of children with prolonged OM was analyzed during 2 years: before surgery, and in 1 and 2 years after surgery. We evaluated some indexes: the number of days off, clinic visits, antibiotic courses, and OM recurrence rate. The total general health deterioration score was calculated as a sum of these indexes data divided by the number of indexes [10, 13, 14].

Quality of life evaluation. Using elaborated questionnaire we analyzed quality of life of children with prolonged OM. According to the questionnaire parents assessed quali-

ty of life indexes: physical suffering, hearing loss, speech impairment, emotional distress, activity limitations and others by the scale of 7 points (from "very bad" to "very good"). Quality of life deterioration score was calculated by totaling each item's score and dividing the sum by the number of indexes [10, 13, 14, 17-19].

Quality of life and general health deterioration scores of children were calculated for every child before, and in 1 and 2 years after surgical treatment. The data were recorded in database. Statistical analyses: Student-test, Fisher-statistics and discriminate analysis were performed.

Results and discussion

Characteristics of patients. Clinically, prolonged forms of OM had relatively silent course and became evident for child's parents at the age of 3-4 years. Electroacoustical monitoring of small children with RF demonstrated that prolonged OM background developed during 1-3 years. Otoscopical and especially otomicroscopical profile demonstrated prolonged changes of TM and TC, with medium score 5.5 (SD 1.4). Audiometry revealed mild to moderate conductive hearing loss, which correlated to ME pathology independently of OM form. Impedance audiometry examination revealed type B of tympanogram in 73% of patients and stable abnormal type C with low characteristics of curve in 27% of cases. All children with prolonged OM in median had more than 71 days of illness, 8 clinic visits, received 6 courses of antibiotics, including for 4.5 cases of OM. The General health (GH) deterioration mean score in three groups of children was 6.63 (SD 0.3). In all patients with prolonged OM Quality of life (QL) deterioration mean score was 5.5 (SD 0.5).

Surgical treatment modalities. Complex of surgical treatment for the children with POME and RAOM included ear surgery and adenoidectomy. According to ear surgery patients were divided in 3 groups: M – myringotomy, CTS – classical tympanostomy, MTS – modified tympanostomy. Each group of patients consisted of 50 children with prolonged OM.

Myringotomy is a microsurgical procedure, schematically consists of two steps: the incision of the tympanic membrane (TM) in posterior-inferior quadrant and aspiration of the pathological content from tympanic cavity (TC) through this perforation. Classical tympanostomy provides insertion of tympanostomy tube (TT) in the place of incision [3, 4, 14].

We analyzed and compared the advantages and disadvantages of these classical surgery types. The myringotomy incision is enough big in order to eliminate the pathological secret from TC, but in small children the incision closes itself in a few days after the surgery what limits drainage and aeration time. Classical tympanostomy (CTS) differs from classical myringotomy by some important characteristics: 1) the location of incision has to be changed to anterior quadrants of the TM, where tympanostomy tube will not provoke any damages; 2) the size of incision has to be smaller, in correspondence to the small size of tympanostomy tube (TT); 3) the insertion of TT provides longer aeration of TC, but complicates complete drainage. As a result, otorrhea and recurrence of OM are still registered in 18-33% of cases [2-8].

The most important disadvantage of tympanostomy consists in impossibility to solve the 2 different tasks of the surgery by one incision: complete and long evacuation of pathological content and TT fixation. The incision size has to be very small in correspondence to TT size. But effusion thickness and volume in TC make cleaning incomplete through this tiny incision. Remnants of viscous, mucous or purulent liquid are present in TC after surgery. As a result, otorrhea develops in post-surgical period in 11–32%. Additionally, otomicroscopic exploration of the TC through this small incision is practically impossible. Another cause of OM recurrence may be connected to infection from rhinopharynx. Absence of adenoidectomy in a complex surgical procedure may explain relatively high recurrence rate [2, 3, 6, 7].

We elaborated modified tympanostomy in order to avoid these disadvantages [15]. We introduced the additional incision in posterior quadrants for complete evacuation of pathological content from the TC. Second incision opens TC larger than incision for TT what improves evacuation of pathological material from TC and increases the visibility of TC changes. The additional incision closes itself during a few days with no any negative further influence on ME function and/or otoscopical appearance, according to our previous results [10-14].

Results of monitoring. Otoscopic and otomicroscopic data showed an improvement in 61% of children after myringotomy (M group), 90% of children after classical tympanostomy (CTS group) and 97% of children after modified tympanostomy (MTS group). During 2-year follow-up worsening of otoscopic view was characteristic for 42% of patients from M group, 20% of patients from CTS group and 7% of patients from MTS group.

Hearing of patients in MTS group was normalized (from 36 dB to 20 dB in median) during first 1-3 months after the surgery and was stable during 24 months after surgery in 97% of cases (tab.1).

Table 1

Results of hearing examination before and after surgery in 3 groups of childre

Groups	Hearing thresholds level (dB)							
	Before surgery	Time of examination after surgery (months)						
		1	3	6	9	12	18	24
M	36	20	25	30	33	34	35	35
CTS	37	23	24	26	26	26	26	26
MTS	37	20	20	21	20	21	22	22

M – myringotomy, CTS – classical tympanostomy, MTS – modified tympanostomy.

During 2 years we noted a temporary (1–2 weeks) worsening till 25 dB in 1% – 3% of cases. Dynamics of hearing

in patients from CTS group was positive in the majority of cases. Normalization of hearing level (20 dB) during first 1-3 months after surgery was characteristic for 86% of the patients, significant improvement (till 25 dB) was noted in 14% of cases. During next 24 months we registered periodic worsening of hearing level in 28% of patients. Hearing loss till 25 dB was characteristic for 19% of patients from CTS group, lower than 25 dB hearing loss – for 9%.

In M group of patients, hearing dynamics had an undulating character: an improvement of hearing in the majority of patients – 95 % during first 1–3 months after surgery and gradual reduction of hearing level during first 3-6 months in 68 % of cases. Totally, 32 % of children from M group had normal hearing during 2 years of follow up. These results significantly differ from the data of MTS and CTS groups ($p<0.01$).

Impedance audiometry performed in 2 years after surgery (tab. 2) demonstrated complete restoration of middle ear function (type A of tympanogram with normal characteristics of the curve) in 32% of children from M group, in 78% of children from CTS group, and in 94% of children from MTS group. Type B of tympanogram was registered in 42% of cases from M group, 10% of cases from CTS group and 2% of cases from MTS group. Type C of tympanogram was characteristic for 26% of patients from M group, 12% of patients from CTS group and 4% of patients from MTS group ($p<0.01$).

Table 2

Results of impedance audiometry before and after surgery in 3 groups of children

Groups	Ears with tympanogram type (%)					
	Before surgery			24 months after surgery		
	Type A	Type B	Type C	Type A	Type B	Type C
M	0	73	27	32	42	26
CTS	0	72	28	78	10	12
MTS	0	74	26	94	2	4

M – myringotomy, CTS – classical tympanostomy, MTS – modified tympanostomy.

General health. During one year of observation after surgical treatment otitis media recurrence rate in MTS group was 2%, what is significantly lower in comparison with 38% in M subgroup and 16% in CTS group, $p<0.001$ (tab. 3). During the follow up after surgery, we have registered a statistically significant reduction in the number of days off, clinic visits number, antibiotic courses and presence of OM in MTS group.

These children after surgery had less than 10 days of illness in average, 2 clinic visits, received 0.1 courses of antibiotics, including for 0.08 cases of OM. The GH deterioration score in MTS group after surgery was 0.84 (SD 0.3) what differs from the same data before surgery – 6.75 (SD 0.4), $p<0.01$ (tab. 3). The GH deterioration score in CTS group after surgery was 1.99 (SD 0.3), what differs from the same data before surgery – 6.68 (SD 0.4), $p<0.01$. This GH score for children from M group after surgery was 3.34 (SD 0.6), what differs from the data before surgery – 6.62 (SD 0.4), $p<0.05$.

Quality of life. The comparison of QL deterioration scores in 3 subgroups before and after surgery confirmed the most significant shift in MTS group: before surgery – 5.6 (SD 0.5), after surgery – 1.3 (SD 0.5), $p<0.01$. Approximately the same dynamics was found in CTS group, where QL deterioration score improved from 5.5 (SD 0.4) to 2.0 (SD 0.7), $p <0.01$. In group M an improvement of the children's QL index has been less significant. For M subgroup this score before surgery was – 5.5 (SD 0.5), after surgery – 2.83 (SD 1.2), $p<0.05$.

According to our research, post-surgical electro-acoustical monitoring in combination with evaluation of general health and quality of life indexes gives the important information of middle ear status and function and is useful in prognosis of otitis media evolution.

We consider that our medical treatment of predisposing inflammatory diseases in children with prolonged OM permitted to resolve OM cases, which depended on this pathology. This treatment also represented the process of differentiation of true prolonged OM, which is necessary to treat by ear surgery. We think that it determinates lower rate of surgical ear intervention. Classical tympanostomy in our research was performed in complex with adenoidectomy what was the reason for better results in comparison with other researches data [2-8, 11-17]. The monitoring demonstrated the advantages of complex surgical tympanostomy especially in modified version. Better results of modified tympanostomy in comparison with results after classical tympanostomy in our study are explicated by additional incision, which increases cleaning options of surgery. Surgical treatment in our modification is helpful in restoration of the

Table 3

Dynamics of recurrence rate, GH and QL indexes before and after surgery in 3 groups of children

Groups	Recurrence rate (%)	Scores mean (SD)					
		General health			Quality of life		
		Before surgery	12 months	24 months	Before surgery	12 months	24 months
M	38	6.62 (0.4)	3.30 (0.4)	3.34 (0.6)	5.5 (0.5)	2.6 (1.5)	2.8 (1.2)
CTS	16	6.68 (0.4)	1.93 (0.5)	1.99 (0.3)	5.5 (0.4)	1.8 (0.6)	2.0 (0.7)
MTS	2	6.75 (0.4)	0.87 (0.3)	0.84 (0.2)	5.6 (0.5)	1.3 (0.5)	1.3 (0.5)

M – myringotomy, CTS – classical tympanostomy, MTS – modified tympanostomy.

ME anatomy and function and prevention of OM persistence or recurrence.

Conclusions

Post-surgical electro-acoustical monitoring with GH and QL evaluation demonstrated different outcome of existed surgical techniques of prolonged OM. According to the monitoring results, tympanostomy, especially its modified version, is more effective than myringotomy in prevention of OM recurrence, hearing restoration and normalization of GH and QL indexes.

References

1. Rosenfield R, Shin J, Schwartz S, et al. Clinical practice guideline: otitis media with effusion (Update). Otolaryngol Head Neck Surg. 2016;154(1 Suppl):S1-S41. doi: 10.1177/0194599815623467.
2. Venekamp R, Burton M, van Dongen T, et al. Antibiotics for otitis media with effusion in children. Cochrane Database Syst Rev. 2016;(6):CD009163. doi: 10.1002/14651858.CD009163.pub3.
3. Popova D, Varbanova S, Popov T. Comparison between myringotomy and tympanostomy tubes in combination with adenoidectomy in 3-7-year-old children with otitis media with effusion. Int J Pediatr Otorhinolaryngol. 2010;74(7):777-80. doi: 10.1016/j.ijporl.2010.03.054.
4. Browning G, Rovers M, Williamson I, Lous J, Burton MJ. Grommets (ventilation tubes) for hearing loss associated with otitis media with effusion in children. Cochrane Database Syst Rev. 2010;(10):CD001801. doi:10.1002/14651858.CD001801.pub3.
5. *Venekamp R, Mick P, Schilder A, Nunez D. Grommets (ventilation tubes) for recurrent acute otitis media in children. Cochrane Database Syst Rev. 2018;5(5):CD012017. doi: 10.1002/14651858.CD012017.pub2.*
6. *Lous J, Ryborg C, Thomsen J. A systematic review of the effect of tympanostomy tube in children with recurrent acute otitis media. Int J Pediatr Otorhinolaryngol. 2011;75(9):1058-61. doi: 10.1016/j.ijporl.2011.05.009.*
7. Steele D, Adam G, Di M, et al. Effectiveness of tympanostomy tubes for otitis media: a meta-analysis. Pediatrics. 2017;139(6):e20170125. doi: 10.1542/peds.2017-0125.
8. Rajamani SK, Choudhary VC, Mogre DA. Tympanometric screening for Otitis media of paediatric patients with respiratory tract infection in rural setting a prospective observational study. Trop J Ophthalmol Otolaryngol. 2019;4(2):100-108. doi: 10.17511/ jooo.2019.i2.06.
9. Vetricean S. Maladia urechii operate [Operated ear disease]. Chişinău; 2018. 224 p. Romanian.
10. Diacova S. Electrophysiology characteristics of middle ear in understanding of otitis media development in early childhood. In: 2017 E-Health and Bioengineering Conference (EHB 2017); 2017 June 22-24; Sinaia, Romania. Piscataway, NJ: IEEE; 2017. p. 377-381.
11. Diacova S, McDonald T, Ababii I. Clinical, functional, and surgical findings in chronic bilateral otitis media with effusion in childhood. Ear Nose Throat J. 2016;95(8):E31-E37.
12. Diacova S, McDonald T. A comparison of outcomes following tympanostomy tube placement or conservative measures for management of otitis media with effusion. Ear Nose Throat J. 2007,86(9):552-554. https://doi.org/10.1177/014556130708600909
13. Diacova S. Effectiveness of modified miniinvasive otomicrosurgery in recurrent and persistent otitis media in children. In: 2017 E-Health and Bioengineering Conference (EHB 2017); 2017 June 22-24; Sinaia, Romania. Piscataway, NJ: IEEE; 2017. p. 386-390.
14. Diacova S. Electro-acoustical examination in noninvasive monitoring as a basis for treatment selection. In: Tiginyanu I, Sontea V, Railean S, editors. 4th International Conference on Nanotechnologies and Biomedical Engineering; 2019 Sep 18-21; Chisinau, Moldova. Cham: Springer; 2020. p. 627-631. (IFMBE Proceedings; vol. 77, Series Online ISSN 14433-9277). doi: 10.1007/978-3-030-31866-6_111.
15. Diacova S, Ababii I. Metoda de tratament al otitei medii exudative la copii [Method for treating exudative otitis media in children]. Republic of Moldova patent MD 674Y. 2013 March 7. [Official Bulletin of Industrial Property] (Chisinau). 2013;(9):24-25.
16. Kujala T, Alho O, Luotonen J, et al. Tympanostomy with and without adenoidectomy for the prevention of recurrences of acute otitis media. Pediatr Infect Dis J. 2012;31(6):565-569. doi: 10.1097/INF.0b013e318255ddde.
17. Rosenfeld R, Bhaya M, Bower C, et al. Impact of tympanostomy tubes on child's quality of life. Arch Otolaryngol Head Neck Surg. 2000;126(5):585-592. doi:10.1001/archotol.126.5.585.
18. Brouwer C, Maille' A, Rovers M, et al. Health-related quality of life in children with otitis media. Int J Pediatr Otorhinolaryngol. 2005;69(8):1031-1041. doi: 10.1016/j.ijporl.2005.03.013.
19. Brouwer C, Rovers M, Maillé A, et al. The impact of recurrent acute otitis media on the quality of life of children and their caregivers. Clin Otolaryngol. 2005; 30(3):258-265. doi: 10.1111/j.1365-2273.2005.00995.x.

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Author's contribution
SD conceptualized the idea, designed the trial and conducted the study, interpreted the data, wrote the manuscript, revised and approved the final text.

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Conflict of Interests
No competing interests were disclosed.

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