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## PECULIARITIES OF HELP MANAGEMENT TO PATIENTS WITH ACUTE OTITIS MEDIA COMPLICATED BY MASTOIDITIS\*

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*Today, signs of transition from the stage of inflammation - antrocellulitis (inflammation of the lining cells of the mastoid process) to mastoiditis (purulent fusion of bone cells and systems of mastoid process) have not been studied and identified. The purpose of this work is to improve the treatment of patients with acute mastoiditis by new scheme to use conservative therapy and modified antromastoidotomy with drainage. The study was conducted in hospitals, in the Otolaryngology department of Poltava Regional Hospital and Otolaryngology department of Hospital No.2. All patients with acute otitis media were divided into 2 groups: group 1 (n = 48) and comparison group: (group 2 n = 35). In patients of subgroups 1-B and 1- D of investigated group, new developed technique of surgical sanitation of papillary process with draining the atico-antral rubber drainage and postoperative cavity such as teflon tubes with momentary wound suturing was used. Patients of 1-B group underwent tunnel antrotomy. In cases where we observed the phenomena of destruction and necrosis, antromastoidotomy was conducted by our own methodology. Endoscopic methods were used during surgery. During the treatment of patients with acute mastoiditis it is necessary to know and understand clinical signs of disease, data of cone-beam CT, the presence of atico-antral connection, which probably depends on the anatomical features of the structure of the middle ear and the severity and prevalence of inflammatory process. Morphological data necessitate the inclusion of antiviral drugs, in the scheme of treatment which significantly increases the effectiveness of treatment of patients with acute mastoiditis.*

**Key words:** acute mastoiditis, papillary process, morphological studies, immunotherapy, antrotomy, mastoidotomy.

*Сегодня не изучены признаки перехода от стадии воспаления - антроцелюлита (воспаление слизистой оболочки ячеек сосцевидного отростка) до мастоидита (гнояного расплавления костных перемычек системы ячеек сосцевидного отростка) и не определены четкие показания к срокам и объему хирургического вмешательства. Цель данной работы - повышение эффективности лечения больных острым мастоидитом путем использования новой схемы консервативной терапии и модифицированной антромастоидотомией с дренированием. Исследование проводилось в лечебных учреждениях: на базе ЛОР-отделения Полтавской областной клинической больницы, и ЛОР-отделения 2 городской клинической больницы Полтавы. Всего в период с 2009 по 2016 годы было обследовано и пролечено 83 пациента, больных острым средним отитом, осложненным мастоидитом. Все пациенты были разделены на 2 группы - исследуемая - 1 группа (n = 48) и группа сравнения - 2 группа (n = 35). Результаты. У пациентов 1-б и 1-в исследуемой группы, нами применялась разработанная новая методика хирургической санации сосцевидного отростка с дренированием атикоантрального хода резиновым дренажом, а послеоперационной полости - тefлоновыми трубками с одномоментным ушиванием послеоперационной раны. Пациентам исследуемой 1-б группы проводилась туннельная антротомия, целью которой было выяснение состояния ячеек сосцевидного отростка. В случае, когда наблюдались явления их деструкции и некроза, проводили антромастоидотомию по собственной методике. При проведении хирургического вмешательства использовалась эндоскопическая методика, проводилась пневматическая проба на проходимость атико-антрального соустья. Выводы. При назначении лечения больным острым мастоидитом необходимо принимать во внимание, кроме клинических признаков заболевания, данные конусно-лучевой компьютерной томографии, наличие сохранения аттико-антрального сообщения, которое, вероятно, зависит от анатомических особенностей строения среднего уха и степени выраженности и распространенности воспалительного процесса. Морфологические данные диктуют необходимость включения в схему терапии противовирусных препаратов, что значительно повышает эффективность лечения больных острым мастоидитом.*

**Ключевые слова:** острый мастоидит, сосцевидный отросток, морфологическое исследование, иммунотерапия, антротомии, мастоидотомия.

Ear disorders constitute 28-35% of all diseases in Otolaryngology [1, 14, 22, 32, 34]. 33% of patients suffer from involved in acute otitis media [17, 23], and out of them in 7-8% of cases the spread of inflammation o papillary process is observed [15]. In 16% of cases acute mastoiditis can cause the development of intracranial complications, among them perisinuous abscess, sinus thrombosis, abscesses of brain and cerebellum [15, 16, 25].

Methods for treatment of patients with acute purulent otitis media are not effective nowadays.

Today, signs of transition from the stage of inflammation - antrocellulitis (inflammation of the lining cells of the mastoid process) to mastoiditis (purulent fusion of bone cells and systems of mastoid process) have not been studied and identified.

The role of viral infections of acute otitis media has been studied by many scientists [4, 5, 20, 21, 26, 29, 30]. Some of

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them consider the main cause of viral infections can be etiological factors that is proved by [4, 5, 27] immunofluorescent, immunoenzymatic, cytological and others methods [24, 26], which indicate the viruses of grippe, parainfluenza virus, and adenoid viruses. Other authors consider the viruses of releaser with consequent bacterial flora [7-9, 11, 12, 33]. Herpesvirus of the first and the second types in 40% of patients, adenoid viral infection in 24%, and disorders of air cells of Epstein-Barr virus in 56,7%, adenoid viruses infection in 40% [10, 13] were presented. Acute otitis media indicates inflammatory damage of mucous membrane in auditory tube and eardrum and also in mucous membrane of antrum and papillary process. Thus, in acute otitis media of viral etiology complicated by mastoiditis it is necessary to determine etiological causes [26, 28]. M. K. Drahnyeva concluded that bacterial factor is not leading in mastoiditis etiology and also considered AM as a surgical disease [8].

Operation management has not practically changed since Schwartz. Nowadays, in most cases after AM wound is left open. Conventional AM is a traumatic operation and its technique is not effective. Nowadays such methods of surgeries on papillary process as antrodrainage, bypass surgery, microsurgical surgeries are used. Conservative surgeries during treatment of acute inflammatory processes of the structures of middle ear are needed. It is necessary to provide the search for new effective etiological and pathological approaches.

The aim of the research is to increase the efficacy of patients' treatment who suffer from acute otitis media complicated by mastoiditis by conservative and surgical methods.

**Materials and methods of the research**

The examination was conducted in different medical institutions. 173 patients who suffered from acute otitis media complicated by mastoiditis were examined and treated (2009–2016).

Criteria for patients' examination were as follows:

1. Males and females who are ill with acute otitis media complicated by mastoiditis (18-65 years old).

Criteria for patients' exclusion:

1. People under the age of 18.
2. Pregnancy and breast feeding.
3. Patients with intracranial otogenic complications (meningitis, abscesses of brain and cerebellum).
4. The presence of concomitant diseases (diabetes mellitus, HIV-patients).
5. Patients with chronic purulent diseases of the middle ear.

All patients were divided into 2 groups. The first one contained (n=81) patients and comparison one included (n=92) patients. Correlation of patients of both groups is presented in table 1.

Table 1. Distribution of patients with acute otitis media complicated by mastoiditis.

Age	19-25				26-35				36-45				46-65			
Sex	m		f		m		f		m		f		m		f	
Number	Abscess	%	Abscess	%												
I group.	7	4,05	13	7,51	10	5,78	11	6,36	9	5,20	12	6,94	11	6,36	8	4,62
II group	11	6,36	12	6,94	14	8,09	12	6,94	11	6,36	12	6,94	11	6,36	9	5,20
Total number	18	10,40	25	14,45	24	13,87	23	13,29	20	11,56	24	13,87	22	12,72	17	9,83

Groups were statistically similar. Antiviral therapy was administrated to patients of the first group. Besides, early and short-term (3-5 days) bypass of eardrum was conducted. Surgery was performed to a number of patients such as antromastoidotomy. Depending on the type of therapy patients were divided into subgroups:

1-a – control group (study group) – treatment was done without surgical intervention on the papillary process. Short-term bypass of the eardrum was by the patients of this group. Local and topical therapy of patients of the first group was used.

1-b – control group (study group) – surgical intervention was done: endoscopic tunnel antrotomy or modified antromastoidotomy.

2-a – group of comparison – patients took conservative treatment. Conventional paracentesis of the eardrum and auripuncture was topically – done.

2-b – group of comparison conventional antromastoidotomy was done to this group of patients.

Number of patients is presented in table 2.

Table 2. Patients' distribution based on groups of study

Group of patients:	Number of patients		Total number
	Abscess	%	
Main 1-a	47	27,17	81
Main 1-b	34	19,65	
Group of comparison 2-a	37	21,39	92
Group of comparison 2-b	55	31,79	
Total number	173	100	173

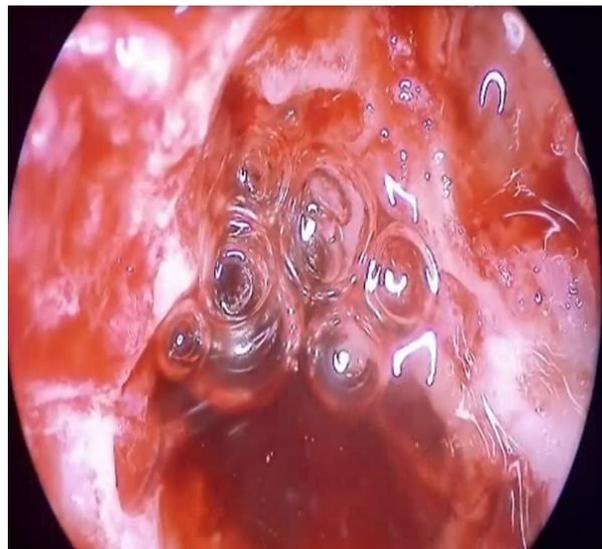
In patients of the subgroup 1-b surgical sanitation of cavities of the middle ear with the drainage of atticoantral passage by rubber drainage was used and after operation teflon tubing with single-step sealing of operative wound was also used.

Tunnel endoscopic antrotomy was conducted to all patients of the investigated 1-b group and the aim to find out the state of antrum and cells of papillary process in periantral zone. Destruction and necrosis, the presence of viscous purulent exudate, rate of surgery were registered. Antromastoidotomy was done by our own methods.

Endoscopic examination of antro-tympanic ostium was done during tunnel endoscopic antrotomy. It expanded to the limits when, during the pneumatic test of air, it began to pass freely through it (Figure 1a, b). Moreover, the injection of air was carried out in the direction of both from the eardrum to the antrum in order to ascertain the absence of the valve mechanism of the disruption of ventilation and drainage in one of the directions. This fragment of surgical intervention was performed by Siegle pneumatic funnel using special sealant obturators. Thanks to the use of endoscopes Ø4 mm with an angle of 0° and 30°, a detailed visualization of the antro-tympanic zone was conducted, which made it possible to more accurately restore its message, to avoid dangerous injury to important anatomical structures of the middle ear.



a



b

Picture 1. a) Use of Siegel Air Pump to determine the functioning of antro-tympanic ostium.  
b) Free air passage during functioning ostium.

Emergent surgical interventions in the first hours after the patients' visit with acute otitis media, complicated by mastoiditis, were performed only in patients with severe clinical course of the disease, with signs of a threat of development of intra- or extracranial complications.

The scheme of the standard examination of patients included audiometry and impedance measurement, computed tomography of the skull, including all structures of the temporal bone. Preference was given to cone-beam computerized tomography, in which the patient receives almost 10 times less radiation exposure (not more than 50  $\mu$ Sv). At the same time, in the course of repeated tomography, only the zone of interest is scanned - the mastoid process, and accordingly the radiation decreases, which allows conducting X-ray examinations during the treatment with minimal harm to the patient's health. The advantage of cone-beam computerized tomography is also the high quality of visualization of bone structures, since the thickness of CT sections is about 0.125 mm, which is sufficient for interpreting the state of the structures of the middle ear.

To objectify the degree of change in the cellular structure of the mastoid process, one proposed a pneumatization index (PI) - the ratio of pneumatized cells to anaplasmatization. The dynamics of the pneumatization index, which can be determined during a repeat computer tomography study, it was one of the main criteria by which one can define the effectiveness of conservative therapy. In those cases when the PI was negative or its positive dynamics was not observed, a decision was generally made about the need to change to active surgical tactics. Endoscopic tunnel antrotomy or modified antromastoidotomy were used for the patients of the group 1-b. Traditional antromastoidotomy was used for the patients of the second one.

When choosing an approach to comprehensive treatment of patients with acute otitis media complicated by mastoiditis, indications for conservative tactics of their management, as well as clinical, radiologic and temporal aspects of the need for transition to surgical intervention were developed. Such combinations of data as influence of the choice

of treatment management: clinical (local and general), radiologic, laboratory and complications were considered.

During surgical interventions on the structures of the middle ear, removed fragments of the mucosa of the antro-tympanic zone were sent for histological examination.

### Results and discussion

Analyzing the results of a histological examination of the mucous membrane of the mastoid process, partially removed with antro-mastoidotomy, we noted the presence of changes which define viral mucosal lesions.

Results of the research lead to the administration of antiviral drugs in comprehensive treatment of acute otitis media complicated mastoiditis. "Proteflazid" was used as effective antiviral drug. Solution of the drug can be used in both systemic and topical therapy during acute mastoiditis.

Conservative treatment was prescribed to all patients which included a standard regimen: antibacterial agents (a combination of 2-3 broad-spectrum antibacterial drugs), anti-inflammatory, dehydration, antihistamines and local (early paracentesis, antiseptic lavage of the eardrum, anemia of the nasal mucosa, etc.). In the presence of non-homogeneous darkening of the system of cells of the mastoid process on the CT images with the presence of even 1-2 intact cells in the preparation of serous contents during the paracentesis of the tympanic membrane, the therapy prescribed by us was carried out for 2-3 days, and then repeated cone-beam computerized tomography was performed. With the improvement of clinical and laboratory data, as well as positive radiological dynamics, which manifested itself in an increase in the number of air-bearing cells, and most importantly in the recovery of mastoid-tympanic messages, surgery was not performed, and conservative treatment continued until recovery.

Complications of AM (acute mastoiditis) were divided into two groups: complications within the middle ear system and complications out of their limits, and it has practical importance in the choice of treatment management. Complications within the middle ear included bullous myringitis, herpetic otitis, as well as paresis of the facial nerve. Complications that were out of the middle ear included intracranial complications (meningitis, menin-

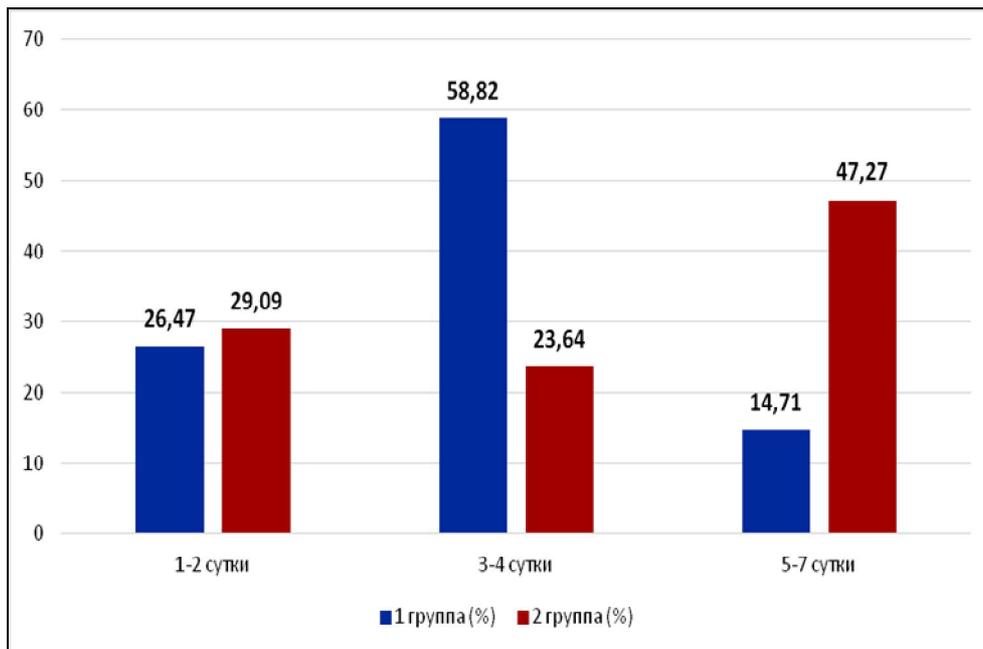
goencephalitis, sinustrombosis, brain abscesses), as well as subperiosteal abscess and zygomatic abscess.

It should be noted that there is the necessity for surgery on the 3<sup>rd</sup>-4<sup>th</sup> or 5<sup>th</sup>-7<sup>th</sup> day of the development of mastoiditis, and each patient had individual differences in both intensity and prevalence of the process. In this regard, it was decided to undertake surgical intervention only in the absence of a positive clinical effect, negative laboratory dynamics, and especially - with a decrease in the number or absence of air-bearing cells in the mastoid process with repeated computed tomography. These changes were interpreted by us as a blockade of the antro-atico-tympanic drainage system.

In all cases, with computed tomography of the temporal bone, in patients with acute mastoiditis different degrees of

expression of the tympanic cavity, antrum and cells of the mastoid process were found. To objectify the degree of disorders in the cavities of the middle ear, a pneumatization index (PI) the ratio of pneumatized cells to the pneumatized cells was proposed. Due to this index there is an opportunity to conclude positive or negative dynamics of the disease against the background of the treatment.

In those cases when restorations were not observed in patients in the first group of papillary process (the pneumatization index either remained at the same level or was negative), the clinical manifestations did not improve, or, conversely, became worse - a surgical operation was carried out with 2 variants: 1) tunnel endoscopic antrotomy; 2 - modified anthromastoidotomy with drainage.



Picture 2. Terms of surgeries in patients of the study group and group of comparison.

The terms of surgical interventions in patients of the compared groups differed significantly (Picture 2). In the dynamics of patients of the 1<sup>st</sup> study group, there is a tendency to decrease in the number of operations relative to the comparison group on the 5-7<sup>th</sup> day of treatment. This is due to a more effective restoration of attic-aural connection, and an early bypass of the tympanic cavity. Due to this, in the first, the study group, the number of postponed surgical interventions was significantly lower ( $P < 0.05$ ) as relative to patients of the comparison group. In total, conservative treatment resulted in the recovery of 26 patients under study and 11 in the comparison group, which is 52.1% and 28.6%, respectively.

One of the informative criteria for the effectiveness of the implemented methods of treatment for patients with acute otitis media complicated by mastoiditis is the study of auditory function according to the tone audiometry. The audiological examination was performed for all patients of the compared groups immediately before the treatment and after the completion of its stationary period - in most cases on the 8th day of examination. According to the data obtained (Table 3, 4), the air conduction indices in patients of subgroups 1a and 1b significantly ( $P < 0.05$ ) differ from subgroups 2a and 2b, which indicates dynamics of restoration of auditory function in patients of the studied group.

Table 3. Dynamics of indices of audiological examination of patients with acute otitis media complicated by mastoiditis and who conservative therapy.

Type of examination	Frequency of hz	Group 1 a (n = 34)		Group 2 a (n = 55)	
		Before treatment	After treatment	Before treatment	After treatment
Air capacity	500	33,8	3,4	31,9	5,1
	1000	32,5	3	31,3	7,6
	2000	31,3	4,1	31,9	8,6
	4000	33,1	5,4	31,3	6,4
Osseous capacity	500	10	1,4	7,5	3,9
	1000	11,3	3,1	10,6	2
	2000	11,9	2,5	12,5	3,4
	4000	10	3,8	9,4	6,8

Table 4.  
Dynamics of indices of audiological examination of patients with acute otitis media complicated by mastoiditis and patients who underwent surgical intervention.

Type of examination	Group	Group 1 b (n = 34)		Group 2 b (n = 55)	
	Frequency of hz	Before treatment	After treatment	Before treatment	After treatment
Air capacity	500	31,8	5,4	31,9	9,8
	1000	29,8	5	33,3	8,6
	2000	30,4	4,1	31,9	8,6
	4000	32,6	5,4	31,3	6,4
Osseous capacity	500	11,3	2,4	7,5	3,9
	1000	12,5	3,1	10,6	2
	2000	10,7	2,5	11,5	3,4
	4000	11,3	5,8	9,4	3,8

18 patients were examined on the 3rd month after the operation. There were no complaints of hearing impairment in patients. Exacerbations of the disease were not detected. There were no pathological changes from the eardrum and the behind-the-ear section. The auditory function was in accordance with the age norm. During the examination, one year after the treatment, the positive results were preserved, and in the future, when patients of the first group were examined for control in 2-4 years (17 patients), there were no complaints of hearing impairment and loss. There were no complications in patients of the examined group.

Thus, comparing the results of clinical observations in the patients of the two groups, one can state that proposed comprehensive treatment of acute otitis media complicated by mastoiditis, including the developed operations (early short-term shunting, tunnel anotomy, modified anthromastoidotomy, and the use of antiviral immunotropic drugs, optimize the treatment of patients with one of the most common and severe diseases in otolaryngology.

### Conclusions

The criteria for the transition from conservative treatment to the surgical one in patients with acute otitis media complicated by mastoiditis were determined.

Surgery of early and short-term bypass of eardrum and tunnel endoscopic antrotomy with drainage of antrotympanic connection was developed and proposed for initial stage of surgical treatment of patients with acute otitis media complicated by mastoiditis.

Comparison of results of the treatment of the main study group with patients of the comparison one determined significantly high level of hearing restoration in both conservative treatment (3,98 dB. и 6,93 dB correspondingly) and in operated patients (4,97dB. and 8,35 dB correspondingly) ( $p < 0,05$ ).

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