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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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CLINICAL-AND-FUNCTIONAL ASSESSMENT OF THE EARLY POSTOPERATIVE OUTCOME OF SURGICAL TREATMENT OF PATIENTS WITH VESTIBULAR SCHWANNOMA

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Abstract.

Relevance of study: The incidence of vestibular schwannoma (VS) increased largely within the last 50 years from 1,5 cases per 100 thousand persons to 4,2 (for the last decade). The approaches to the management of VS patients vary significantly in different medical centers and different countries. The search for the consensus in selecting strategy of VS treatment based on systemic clinical-and-functional assessment of treatment outcome is topical nowadays.

The aim of study: To analyze the clinical-and-functional early postoperative outcome of the surgical treatment of vestibular schwannoma depending on the stage of the disease.

Materials and methods: The findings of the examination and the outcomes of the surgical treatment of 27 VS patients were retrospectively analyzed. The patients were treated at the Department of Subtentorial Neurosurgery of the State Institution "Romodanov Institute of Neurosurgery of the NAMS of Ukraine" in 2018–2019. According to Koos classification, three groups of the patients were delineated for the analysis of the results of the study, namely, group 1 (Koos II) – 8 (29,6 %) patients; group 2 (Koos III) – 6 (22,2 %); and group 3 (Koos IV) – 13 (48,2 %). The complex clinical examination, in particular clinical-and-instrumental otoneurological examination and the evaluation of the neurological status according to the Scale for the assessment of the functional treatment outcome were performed preoperatively and early postoperatively. The data were statistically processed.

Results and their discussion: In the patients with small tumors (group 1, Koos II), the socially useful hearing on the affected side was preserved preoperatively necessitating the caution for selecting the treatment strategy in these patients. When pre- and postoperative clinical symptoms were compared in group 1, the statistically significant worsening of the hearing to the socially non-useful, the unilateral subjective tinnitus, the dysfunction of the facial nerve, the decreased sense of taste/loss of taste on the anterior 2/3 of the tongue on the affected side were found. Upon the surgical treatment, the rate of the neurological deficit increased, and the severity grade of the neurological deficit increased by about 10 points.

The overall preoperative score in group 3 (Koos IV) was significantly different from that in other groups. The progression of the disease to the stage of Koos IV results in the neurological deficit that is equivalent by the set of the neurological symptoms and their severity to that in early postoperative period in patients with Koos III. In group 3, the rate of the dysfunction of the facial nerve and the caudal group of the cranial nerves increased postoperatively with concomitant decreased sense of taste/loss of taste on the anterior 2/3 of the tongue on the affected side and statocoordinatory impairments.

The overall preoperative score differed significantly between all groups. In group 3, the postoperative overall score did not differ from preoperative one, although the postoperative overall score in group 3 (Koos IV) differed significantly from that in other two groups.

Conclusion: The proposed scale for the assessment of the functional outcome of the VS treatment is versatile and represents the integral element of the systemic assessment of the clinical-and-functional status of VS patient. There are good reasons to integrate proposed scale into the general scheme of the medical care for VS patients allowing for the objective assessment of the otoneurological patterns in the patients in the dynamics of the treatment.

The analysis of our own findings and the literature data proved the relevance of the problem requiring further task-oriented scientific inquiry. The important aspects of the problem relate to the optimization and improvement of the diagnostic and treatment strategy according to the principles of individualization and multimodality allowing for increasing the level of consensus and improving the functional outcome of the treatment.

Key words. Vestibular schwannoma, diagnostics, stage, facial nerve, surgical treatment, scale, clinical symptom, cerebellopontine angle, hearing loss, treatment strategy, statocoordination disorders.

Introduction.

The vestibular schwannoma (VS) is the most frequent extracerebral tumor of the cerebellopontine angle (CPA). The incidence rate of VS rose substantially within the last 30 years since 1,5 up to 4,2 per 100 thousand persons (for the last decade) [1,2]. The great majority of VSs (95 %) are unilateral sporadic tumors accounting for about 6-8 % of all primary intracranial tumors and 80 % of the neoplasms located in the CPA [3,4].

Currently, the international recommendations on the diagnosis and treatment of VS are not available. The approaches to the management of VS patients vary significantly in different medical centers and different countries. It looks like the decision-making in selecting the appropriate treatment strategy depends largely on the personal preferences and experience [5]. As a result, the selection of the treatment strategy for VS patients remains a point of controversies. There are three major options for managing VS patients: surgical resection of tumor, radiotherapy – stereotactic radiosurgery or fractional stereotactic radiotherapy, and wait-and-see approach providing

the active dynamical monitoring with regular otoneurological and neurovisualization checks [6].

The surgical resection is the conventional treatment of VS. The technique of the surgical treatment is constantly improving allowing not only saving patient's life and keeping the integrity of the cranial nerves (CN) but also maintaining the functional state and the quality of life minimizing intra- and postoperative complications.

A comprehensive assessment of the functional outcome and the quality of life in patients following VS resection presents certain difficulties. It is true that historically the functional outcome of the treatment is assessed firstly by the sparing of the function of facial nerve and the acoustic portion of the vestibulocochlear nerve (requiring the quantitative data with exact values or the range of the values) and by the control of tumor growth.

Currently, the management of VS patients varies significantly in different medical centers and different countries. The lack of the unified concepts as to VS diagnosis and treatment results in difficulties and delays in clinical decision-making [7,8]. Taking into account that the unified approach for VS diagnoses and treatment is lacking sometimes even within the same medical center, the other factors such as the expertise and experience of the personnel as well as the availability of the modern diagnostic means, and equipment could be brought to the forefront as more significant predictors for selecting the treatment strategy than the age of the patient or tumor size [9]. The outcomes of the surgery are difficult to compare since the experience of the surgeon is non-controlled parameter for being validated; moreover, the surgical techniques and indications for the surgery may differ substantially. Therefore, the assessment of treatment outcome will not be consistent [10].

Our more than 20-year experience of specialized medical care for neurosurgical patients at the tertiary hospital in the setting of the academic institution with diagnosis and treatment provided for at least 50 newly diagnosed VS patients annually made it possible to develop the scale for the assessment of indicators signifying the quality of the surgical treatment of VS patients [11]. Nowadays, the scale is further updated and improved; the scale is modified, and its edited version is named as – The scale for the assessment of the functional treatment outcome (SFTO).

Nevertheless, the discussion on the search for the consensus in the rational selection of treatment strategy of VS based on the systemic clinical-and-functional assessment of treatment outcome is still open and relevant.

The aim of study is to analyze the clinical-and-functional early postoperative outcome of the surgical treatment of vestibular schwannoma depending on the stage of the disease.

Materials and Methods.

The findings of the examination and the outcomes of the surgical treatment of 27 VS patients (code D 33.3 according to the International Classification of the Diseases, 10th edition) were retrospectively analyzed. The patients were treated at the Department of Subtentorial Neurosurgery of the State Institution "Romodanov Institute of Neurosurgery of the NAMS of Ukraine" in 2018–2019.

Criteria of inclusion: unilateral primary solid VS that was not previously treated by surgery or radiation therapy; age over 18 years; pre- and postoperative otoneurological examination; pre- and postoperative MRT with intravenous paramagnetic contrast pre- and postoperatively; gross total or near total tumor resection; histological verification of the diagnosis.

Criteria of exclusion: age below 18 years; neurofibromatosis type II (taking into account specific features of etiopathogenesis and clinical picture of multifocal lesion); subtotal and partial resection of tumor; lack of pre- and postoperative otoneurological examination and pre- and postoperative MRT with intravenous paramagnetic contrast; lack of histological verification.

Currently, 4 grades of the completeness of VS rejection are delineated: gross total, near total (> 95 %), subtotal (< 95 %), partial [12].

In practical neurosurgical activity, the Koos grading scale based on the evaluation of tumor size and its relation to the adjacent brain and cranial structures is a frequently used classification system for assessing the stage of VS [13]. According to Koos classification, three groups of the patients were delineated in our study, namely, group 1 (Koos II) – 8 (29,6 %) patients; group 2 (Koos III) – 6 (22,2 %); and group 3 (Koos IV) – 13 (48,2 %). The groups were characterized as follows: Group 1 (Koos II) – tumor extends into the cerebellopontine angle, size below 20 mm (Figure 1); group 2 (Koos III) – tumor extends to pons but does not displace it, the forth ventricle is not affected, tumor size is 21–30 mm (Figure 2); group 3 (Koos IV) – tumor compresses pons and the forth ventricle, tumor size exceeds 30 mm (Figure 3).

Patients were examined following the protocol for the management of patients with cranial nerve tumors of the posterior fossa [14]. The general clinical examination, laboratory tests and clinical neurological examinations were performed for assessing pre- and postoperative course of the disease.

The score of all but one patient according to Karnofsky performance scale was estimated as 80-100 (compensated state), and in one patient subcompensated state was evident (70 points).

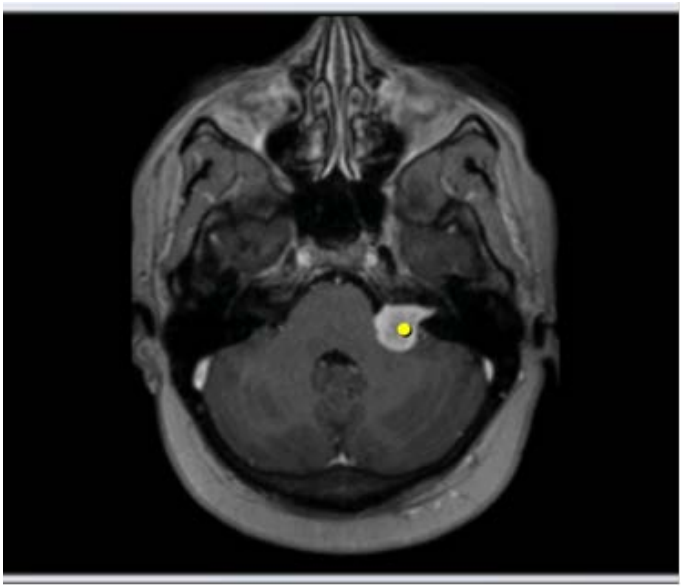

Figure 1. *Patient of the clinical group 1 (Koos II). VS on the left. Brain MRI (T1-weighed image with intravenous paramagnetic contrast, axial view).*

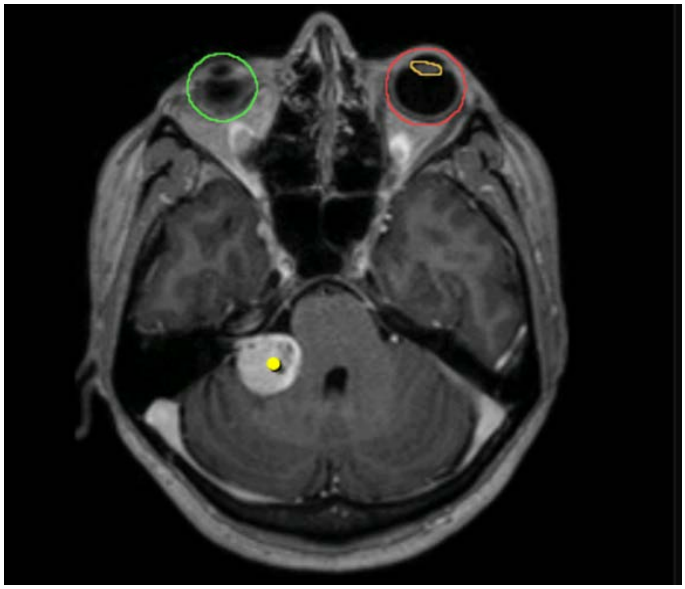

Figure 2. *Patient of the clinical group 2 (Koos III). VS on the right. Brain MRI (T1-weighed image with intravenous paramagnetic contrast, axial view).*

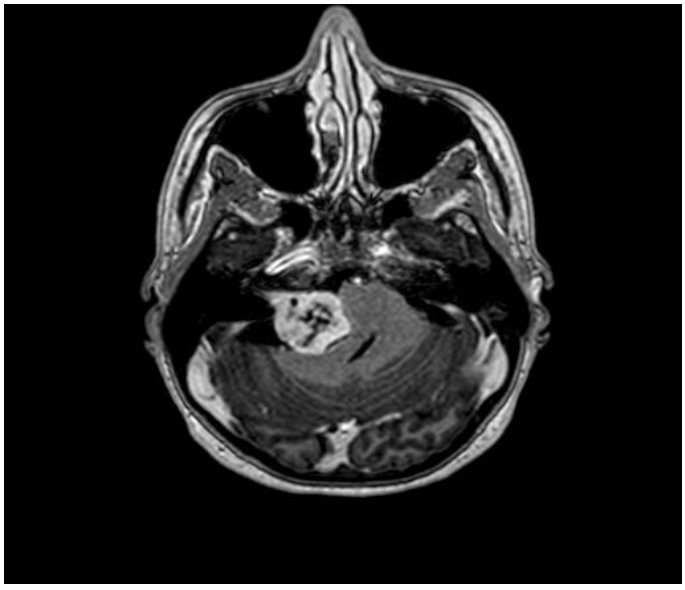

Figure 3. *Patient of the clinical group 3 (Koos IV). VS on the left. Brain MRI (T1-weighed image with intravenous paramagnetic contrast, axial view).*

The complex clinical and instrumental otoneurological examination and the assessment of the neurologic status according to SFTO were performed preoperatively and within 4-10 postoperative days (depending on the severity of state and the level of patient's consciousness). Such assessment comprised the analysis of the complaints, the standard otoneurological examination (anterior and posterior rhinoscopy, otoscopy, oropharyngoscopy), the qualitative analysis of the innervations by CN (I, V, VII, X, IX, XII), and the assessment of the function of the acoustic and vestibular analyzers.

SFTO comprises the assessment of 12 clinical symptoms scored from 0 – absence of the symptom to 1/2/3 – slight, moderate, severe manifestation of the clinical symptom, correspondingly. Unit 1 comprises the assessment of the hearing function according to Gardner-Robertson scale (GRS) [15,16]. Unit 2 comprises the assessment of the preservation of acoustic nerve function according to House-Brackmann scale (HBS) [17,18]. The rest of the clinical symptoms are assessed by recording the objective features according to the rank scale. The scores from 8 to 12 are taken for 0 (the absence of the corresponding symptom) and 2/4 – moderate or severe manifestation of the corresponding symptom. When the symptom could not be assessed, the corresponding scores are not taken into account. Then the overall score is calculated as the sun of the scores in each units (minimal sum is 0, maximal – 41). The empirical limits have been taken for the ranges of the overall scores corresponding to slight, moderate, or severe grade of the neurological impairments, correspondingly.

The standard audiometry was provided with MA–51 audiometer (Germany) in compliance with the established standards.

For brain MRI, the high-field units were used with magnetic field induction of 1.5 T and higher. The sequences with intravenous paramagnetic contrast were obligatory.

The tumor was resected through the suboccipital retrosigmoid approach. The near total resection was performed in 9 (33.3 %) patients including one patient from group 2 and 8 patients from group 3. The gross resection was performed in 18 (66.7 %) patients including 8 patients from group 1, 5 patients from group 2, and 5 patients from group 3.

In 10 (37 %) patients, ISIS IOHM system (Inomed, Germany) was used for intraoperative neurophysiological monitoring. The monitoring included electromyography (t-EMG, f-EMG) of CN V, VII, X, XI, XII combined with recording of acoustic brainstem and somatosensory evoked potentials. Otherwise, the preservation of the facial nerve function was assessed using NIM 2/0 (Nim Eclipse Medtronic, США) system.

All patients were discharged in the satisfactory condition for the follow-up on the outpatient bases at their places of residence.

The data were processed and analyzed with the aid of STATISTICA 10 (StatSoft Inc., USA, license № STA862D175437Q) and SPSS 17.0 (IBM, USA). Taking into account that the sample size was small, the quantitative variables were compared with the aid of non-parametric methods using Mann–Whitney U-test for independent groups and Wilcoxon matched pairs test for dependent groups. For the comparison of the independent groups by the qualitative characters, the contingency tables were analyzed using two-tailed Fisher exact p-test; when the absolute frequencies were less than 10, continuity-corrected Yates Chi-square test was used; for dependent groups, McNemar's test was applied [19].

The quantitative variables were presented as means with standard deviation (M ± SD) in case of the normal distribution or as median with 25 %-75 % interquartile range (Me [Q1;Q3]) when the distribution of the variables was deviated from normal one. For the qualitative attributes, the numerical values with percent of the total were given. The difference were considered as statistically significant when $p < 0,05$.

All the patients gave their informed consent in written for participation in the study according to Helsinki Declaration of the World Medical Association on the Ethical Principles for Medical Research Involving Human Subjects (1964–2008), Directive 86/609 of the European Community on the participation of human subjects in medical-and-biological research as well as the Order by the Ministry of Health of Ukraine No. 690 of 23.10 2009 with the amendments.

Results and Discussion.

The group of VS patients under study comprised 27 patients – 6 males (22,2 %) and 21 females (77,8 %) aged 22-69. The median age was 50 [33; 66] years (in males – 41 [29; 46], in females – 52 [37; 67]. The difference between the median age of female and male patients was not significant ($p > 0,05$).

The duration of the disease starting from the first symptoms varied largely from 1 month to 20 years (36 [12; 54] months). It seems that patients sometimes were not wary of the loss of hearing and some new symptoms for a long time. This fact may explain such variability of the time when the tumor was first diagnosed. Because of such differences in the duration of the disease, tumor size in patients varied largely. The size of the tumor was assessed by the largest extrameatal diameter according to MRI findings obtained with intravenous paramagnetic contrasting taking into account intrameatal portion of tumor [20].

Neither dextral nor sinistral preference for tumor location was evident ($p = 0,09$). Right-sided tumor was detected in 15 (55,6 %) patients and left-sided – in 12 (44,4 %) patients.

Histologically, plexiform schwannoma or cellular schwannoma, anaplasia grade I was confirmed in all patients under study.

The first step for solving the aim of the study was to compare in-group and between-group differences in the rates of clinical (otoneurological) symptoms pre- and postoperatively (Table 1).

The statistically significant differences in the preoperative percentage of the patients with socially useful hearing on the affected side were found when patients in group 1 with small-size tumors (Koos II) were compared with patients of other two groups ($\chi2 = 6,237$; $p = 0,01$). In group 2 (Koos III), the significant differences for any clinical (neurological) symptom being indicative of CPA involvement were not found. In group 3 (Koos IV) comprising patients with large-size tumors compressing brainstem and the fourth ventricle, the significant differences were confirmed for all clinical symptoms specific for CPA lesions. The most significant differences were demonstrated for socially non-useful hearing ($\chi2 = 10,99$; $p = 0,0007$), dysfunction of caudal group CN ($\chi2 = 10,9$ $p = 0,0007$), and statocoordination disorders ($\chi2 = 16,736$ $p = 0,002$).

When the postoperative rates of the clinical neurological symptoms were compared between groups, the significant increase in the rates of the symptoms was not observed. Only in group 3 (Koos IV), the significant increase in the rate of the dysfunction of caudal group CN ($\chi2 = 4,305$ $p = 0,03$) and statocoordination disorders ($\chi2 = 7,994$ $p = 0,005$) was evident.

When pre- and postoperative rate of the clinical symptoms was compared in patients of group 1 with small-size tumors (Koos II), significant differences were demonstrated for all clinical symptoms. In particular, postoperatively the neurological deficit was found to increase significantly (hearing decline to socially non-useful hearing (McNemar's $\chi2 = 5,42$; $p = 0,02$), appearance of the unilateral subjective tinnitus on the affected side (McNemar's $\chi2 = 5,42$ $p = 0,02$), FN dysfunction (McNemar's $\chi2 = 4,05$ $p = 0,04$), decreased sense of taste/loss of taste on the anterior 2/3 of the tongue on the affected side (McNemar's $\chi2 = 5,04$ $p = 0,02$). Although the changes in the dynamics pre/postoperative) of the clinical symptoms are noticeable in group 2 (Koos III), the differences are not significant. In group 3 (Koos IV), the neurological deficit was found to increase significantly postoperatively. Namely, FN function deteriorated (McNemar's $\chi2 = 9,025$ $p = 0,003$), decreased sense of taste/loss of taste on

Table 1. *Pre- and postoperative distribution of the rates of otological and neurological symptoms in groups under study.*

Clinical symptom	Preoperative						Postoperative					
	Group 1 (Koos II) (n = 8)		Group 2 (Koos III) (n = 6)		Group 3 (Koos IV) (n = 13)		Group 1 (Koos II) (n = 8)		Group 2 (Koos III) (n = 6)		Group 3 (Koos IV) (n = 13)	
	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
FN dysfunction on the affected side	0	0	2	33,3	2	15,4	5#	62,5	4	66,7	10##	76,9
Socially useful hearing (class I-II according to GRS) on the affected side	7**	87,5	4	66,7	1	7,7	1	12,5	0	0	0	0
Socially non-useful hearing (class III-IV according to GRS) on the affected side	1	12,5	2	33,3	12**	92,3	7 #	87,5	6	100	13	100
Unilateral subjective tinnitus on the affected side	1	12,5	2	33,3	12**	92,3	7#	87,5	6	100	13	100
Decreased corneal reflex, transient facial paresthesia and/or hypoesthesia on the affected side	0	0	3	50	13	100	5#	62,5	4	66,7	12	92,3
Decreased sense of taste/loss of taste on the anterior 2/3 of the tongue on the affected side	0	0	2	33,3	2	15,4	5#	62,5	4	66,7	10##	76,9
Dysfunction of caudal group CN	0	0	0	0	4*	30,8	0	0	0	0	5*	38,5
Statocoordination disorders	0	0	2	33,3	13**	100	0	0	6	100	13**	100

*Note. Between-group differences in the pre/postoperative rates of the clinical symptoms are significant at *p < 0,05, **p < 0,01 (χ2 test with Yates continuity correction). In-group differences in the pre/postoperative rates of the clinical symptoms are significant at #p < 0,05, ##p < 0,01 (McNemar's χ2 test with Yates continuity correction)*

the anterior 2/3 of the tongue on the affected side was observed (McNemar's $\chi 2 = 9,025$ $p = 0,003$); for other clinical symptoms only slight trend for their increase was detected.

Currently, microsurgery is considered as an optimal treatment modality for VS at Koos III-IV stages. Our findings are in line with this point of view. Nevertheless, both literature data and our own findings allow us to put forward the putative concept considering the subtotal tumor resection for preserving FN function followed by stereotactic radiosurgery as an effective treatment option for patients with VS, Koos III–IV [21]. Subtotal resection aimed at decreasing tumor volume and regressing the symptoms caused by mass effect allows rendering tumor volume compatible with adjuvant stereotactic radiosurgery [22].The choice of the treatment strategy for patients with small-size tumors (Koos I-II) deserves special attention. The epidemiological data of the recent decade demonstrate five-fold increase of the diagnosed VS cases. This could be explained by the broad access to the sensitive neurovisualization techniques allowing for the detection of tumors sized 2-3 mm [23]. Due to such progress, the diagnostic tumor size decreased from 26 mm to 7 mm and the age at diagnosis increased from 49 to 60 years [24]. Up to 25 % of tumors are diagnosed by chance [25,1]. Incidental findings of VS increase the risk of overtreatment in patients who would not have been diagnosed otherwise throughout their lives [24]. Hence, there is a change of views on the treatment strategy towards conservative approach [26].

In recommendations by European Association of Neuro-Oncology (2020) on VS treatment, three variants of clinical course of small-sized tumors have been delineated with principles of the selection of treatment strategy being considered [27]. In the case of asymptomatic tumors, the observation is the best choice. As alternative approach, radiosurgery is possible for controlling tumor growth and preserving CN function over the long term. Some risk of CN dysfunction or worsening of quality of life as a remote consequence following stereotactic surgery exists. If the long-term preservation of CN function is the major goal of the treatment, even surgical intervention is possible, while the risk of any functional deterioration is rather high up to 50 %. Therefore, the authors do not recommend surgery as treatment choice for asymptomatic patients.

One of the major arguments in favor of wait-and-see approach is that in 58–71 % of cases, small-sized VS do not increase in size as was shown by Fieux et al. in the cohort of 1105 VS patients [28]. Moreover, even if tumor growth occurs, the transfer to the active treatment is not indispensable. In fact, the non-effectiveness of the conservative treatment of intrameatal VS is not more than 15 % even in the studies with 10-year follow-up [29]. The retrospective analysis of the statistical data of the respected USA program providing information on cancer statistics (SEER) points to the fact that the share of wait-and-see approach in management of VS patients tends to increase especially in elderly patients with small-sized tumors. According to the forecasts, up to 2026, in 50 % of newly diagnosed VS, wait-and-see approach would be the first option [30].

In case of vestibular and/or hearing symptoms due to small-sized VS, more active strategy is indicated as to avoid further exacerbation. In these cases, radiosurgery rather than microsurgery provides more opportunities for hearing preservation with less risk of the paresis of facial mimic muscles. Meanwhile, the grade of the severity of hearing impairment has not been specified.

In patients with complete loss of hearing, the aim of the treatment consists in control of tumor growth and preservation of FN function. Usually, the wait-and-see approach is the first line choice since any other functions remain non-impaired for a long time. Radiosurgery or microsurgery may be appropriate for providing long-term control of tumor growth and effective treatment. While the risk of damaging FN following radiosurgery or microsurgery is relatively low, radiosurgery is the preferred method when the major objective of the treatment is control of tumor growth [27]. It should be noticed that most guideline recommendations have evidence-based level III and strength level C.

At the second step of our study, we calculated the overall pre- and postoperative score by SFTO according to the grades for the assessment of the clinical (neurologic) symptoms that we have proposed (Table 2).

The in-group differences of the overall SFTO scores (preoperative vs. postoperative) are significant at #$p < 0,05$; ##$p < 0,01$ (Wilcoxon test).

The differences in preoperative overall SFTO scores between group 1 (Koos II) and group 2 (Koos III) are statistically significant. The postoperative overall score in group 1 (Koos II) and group 2 (Koos III) increased significantly as compared to the preoperative score while no difference between postoperative overall score in group 1 (Koos II) and group 2 (Koos III) was evident. It should be noticed that in group 1 (Koos II), postoperative rate and severity grade of the neurological deficit increased by about 10 points. The postoperative overall SFTO score in patients of group 3 with large-sized tumors compressing brainstem (Koos IV) differed significantly from that in other two groups. Nevertheless, in-group comparison of pre- and postoperative values did not reveal significant differences. This could be explained by the preoperative neurological deficit. Therefore, upon progression of the disease to Koos IV, the preoperative neurological deficit is equivalent by its structure and severity to that in early postoperative period in Koos III patients.

To sum up, we have analyzed the use of SFTO for the assessment of the clinical-and-functional outcome in the setting of the surgical treatment of VS patients depending on Koos grade.

Table 2. *The overall pre- and postoperative SFTO score in the clinical groups.*

Group	**Overall SFTO score Me [Q1;Q3]**		
	Preoperative	**Postoperative**	**Δ score**
group 1 (Koos II)	1[0,5;3]	11[9,5;11,5]#	9.5[7;10]
group 2 (Koos III)	5,5[4;9]**	12[10;13]#	6[5;7] *
group 3 (Koos IV)	12[11;24]**	15[12;20]**	1[0;4]**

*Note. The differences of the overall SFTO scores (preoperative vs. postoperative) between the clinical groups (KOOS grade) are significant at *$p < 0,05$; **$p < 0,01$ (Mann-Whitney U-test).*

The advantage of this scale consists in the express assessment of the otoneurological symptoms with accompanying decrease in the subjectivity element when the treatment outcomes as well as otoneurological symptoms assessed by different specialists are to be compared. Pre and postoperative scores provided by SFTO are beneficial for the patients allowing him to cope with the complaints arising in the psychoemotional setting that may even surpass the real physical deficit.

One of the limitations of our study to be noted is the small sample size that impedes the statistical power and does not permit to assess predicatively different factors possibly affecting the outcome of the surgery such as, for example, the density of the tumor and the completeness of tumor resection. So far, there is no complex analysis of the functional outcome of the treatment and the quality of life of VS patients depending on the treatment modalities with patients' stratification by the size of tumor, incidental vs. non-incidental findings underlying the diagnosis, the age of patients, the concomitant pathology, the extent of tumor resection, the rate of tumor growth, the preservation of hearing and facial nerve function, the control of the vestibular impairments. The analysis of the parameters stated above could affect the choice of the rational treatment strategy allowing for developing multiparametric model for assessing the behavior of tumor in each individual case (forecasting the progression of symptoms and finding possible correlations). In our next studies, we shall attempt to stratify patients by the risk (low, moderate, high) of potential tumor growth extending the follow-up with the aim of selecting the rational treatment strategy. Personalized medicine is a medical model that separates people into different groups with the final treatment strategy being tailored to the individual patient based on their predicted response [31]. Not less important is involvement of patients to the discussion of their treatments and the possible consequences. Prior to surgery, patients should be informed on the probability of preservation of hearing and facial nerve function.

All points stated above combining with the variety of methods used in the management of VS patients represent a serious problem for implementation of the national guidelines.

Conclusion.

The proposed scale for the assessment of the functional outcome of the VS treatment is versatile and represents the integral element of the systemic assessment of the clinical-and-functional status of VS patient. There are good reasons to integrate proposed scale into the general scheme of the medical care for VS patients allowing for the objective assessment of the otoneurological patterns in the patients in the dynamics of the treatment.

The analysis of our own findings and the literature data proved the relevance of the problem requiring further task-oriented scientific inquiry. The important aspects of the problem relate to the optimization and improvement of the diagnostic and treatment strategy according to the principles of individualization and multimodality allowing for increasing the level of consensus and improving the functional outcome of the treatment.

Conflict of interest.

Authors have no conflicts of interest to declare.

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РЕЗЮМЕ

Актуальность

Заболеваемость вестибулярной шванномой (ВШ) значительно увеличилась за последние полвека с 1,5 случаев на 100 000 человек в год до 4,2 - в последнее десятилетие. Подходы к менеджменту заболевания ВШ значительно отличаются в различных медицинских центрах и странах. Поиск консенсуса в выборе рациональной тактики ведения пациентов с ВШ на основе системной клинико-функциональной оценки результатов лечения остается открытым и актуальным.

Цель работы – проанализировать клинико-функциональный результат хирургического лечения пациентов с вестибулярной шванномой в зависимости от стадии заболевания в раннем послеоперационном периоде.

Материалы и методы исследования Работа основана на ретроспективном анализе результатов обследования и хирургического лечения 27 пациентов с ВШ, которые находились в отделении субтенториальной нейрохирургии Государственного учреждения «Институт нейрохирургии им. акад. А.П. Ромоданова НАМН Украины» в 2018 – 2019 гг. Наблюдения распределили на три группы: группа 1 (стадия Koos II) – 8 (29,6%) пациента, группа 2 (Koos III) – 6 (22,2%) и группа 3 (Koos IV) – 13 (48,2%). Всем больным проведено комплексное обследование, в частности клинико-инструментальное отоневрологическое обследование и оценка неврологического статуса по Шкале оценки функционального результата лечения (ШОФРЛ) до и после хирургического лечения в раннем послеоперационном периоде. Анализ результатов проводился с использованием статистических методов.

Результаты и обсуждение

У пациентов группы 1 (Koos II) с небольшими опухолями статистически достоверно подтверждено сохранение социально полезного слуха на стороне поражения до операции, данный факт обуславливает осторожность при выборе лечебной тактики у этих пациентов. При оценке клинической картины в данной группе пациентов до и после операции выявлено статистически достоверное снижение слуха до социально неполезного уровня, появление одностороннего субъективного шума в ухе, дисфункции лицевого нерва, снижения/выпадения вкуса на передних 2/3 языка на стороне поражения. Выявлена статистически достоверная разница значений суммарного балла ШОФРЛ до операции между группами 1 (Koos II) и 2 (Koos III). Суммарный балл в группах 1 (Koos II) и 2 (Koos III) после операции статистически достоверно увеличился, однако между собой не отличался. Хирургическое лечение в группе 1 (Koos II) приводило к увеличению частоты и степени тяжести неврологического дефицита почти на 10 баллов по ШОФРЛ.

Статистически достоверной разницы между суммарным баллом ШОФРЛ до и после операции в группе 3 (Koos IV) не выявлено, но статистически достоверно отличался

от 1 и 2 группы. Прогрессирование заболевания до стадии Koos IV приводит к развитию неврологического дефицита, эквивалентного по составу и степени выраженности неврологических симптомов в раннем послеоперационном периоде при стадии Koos III.

Заключение

Предложенная шкала оценки функционального результата лечения – универсальна и может стать элементом системной оценки клинико-функционального статуса пациента с ВШ. Ее целесообразно интегрировать в общую схему медицинской помощи больным с ВШ, это позволит объективизировать динамику отоневрологической картины заболевания в процессе лечения.

Проведенный анализ собственных наблюдений и литературы показал актуальность проблемы, необходимость дальнейшего целенаправленного научного поиска ее решения. Это касается, прежде всего, оптимизации и усовершенствования диагностической и лечебной тактики при ВШ в соответствии с принципами индивидуализации и мультимодальности, что позволит повысить уровень консенсуса и улучшить функциональные результаты лечения.

Ключевые слова: Вестибулярная шваннома, диагностика, стадия заболевания, снижение слуха, лицевой нерв, хирургическое лечение, шкала, клинический симптом, мостомозжечковый угол, тактика лечения, статокоординаторные нарушения.