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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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INVESTIGATION OF THE EFFECT OF SUDDEN HEARING LOSS ON VESTIBULAR TESTS

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Abstract.

Objective: Idiopathic sudden hearing loss (ISHL) is associated with vestibular complaints in 30% of cases. In this study, we aimed to determine the change in caloric test responses in ISHL, determine the degree of influence on the vestibular nerve, investigate the correlation between vestibular nerve damage and vestibular complaints during admission, and evaluate the effect of vestibular nerve influence on the recovery process.

Materials and Methods: Patients with ISHL were divided into groups with and without vestibular complaints and classified according to their hearing level. Pure sound thresholds of 250 to 8000 Hz and caloric responses with air stimulus were recorded via videonystamography. Audiometry and videonistagmography were repeated three months after the end of systemic corticosteroid therapy. The difference between the audiometric and caloric test data according to the level of hearing loss at the time of diagnosis and the difference between the patient groups were examined.

Results: 50 patients with idiopathic ISHL were included. The hearing threshold at 8000 Hz frequency in patients with idiopathic hearing loss who had vestibular complaints was found to be more affected. Unilateral weakness in the caloric test was significantly higher in patients with vestibular complaints.

Conclusion: In patients with ISHL accompanied by vestibular complaints, higher frequency hearing thresholds are affected to a higher degree. The presence of vestibular complaints suggests that vestibular function is also affected by ISHL. Improvement in high-frequency hearing thresholds is seen at a lower degree in patients with vestibular complaints.

Key words. Caloric test, videonystagmography, vertigo, sudden hearing loss.

Introduction.

Sudden hearing loss can be defined as the development of a sensorineural hearing loss of at least 30 dB at three consecutive frequencies in <3 days. In 1944, sudden sensorineural hearing loss (SSHL) first occurred in the literature with De Klein. It is seen once in 5,000–10,000 people in a year [1-4]. Sudden hearing loss accounts for 1% of all sensorineural hearing losses [2,3]. It usually occurs in people between the ages of 30 and 60. Viruses (Cytomegalovirus, Mumps, and Rubella virus), vascular pathology, trauma, neoplasms, immunity, toxicity, metabolic, neurological causes, circulatory disorders, and membranous rupture in the inner ear are held responsible for its etiology [1,2].

Steroid therapy is the only treatment demonstrated to be effective for treating sudden hearing loss. Certain factors affect the treatment and determine the prognosis. These are the duration of the period until hospital admission, presence of vertigo, degree of hearing loss, and configuration of the audiogram curve; however, in 65% of cases, spontaneous recovery may be observed [3].

Balance problems may arise because of the vestibular part of the inner ear, central nervous system, and systemic diseases or psychological diseases. In evaluating the balance problem, considering the patient's history, simple bedside physical examination, and evaluation of hearing and eye movements can provide important clues for diagnosis. Nystagmus is the most important objective result in vestibular pathologies [5,6]. Electronystagmography and videonystagmography include a series of test methods used to determine the cause of an individual's balance problem. This system comprising oculomotor, positional, and caloric tests, can provide important information about peripheral vestibular pathologies and cerebellum and brainstem function [7-11].

The purpose of vestibular tests is to provide objective data on peripheral and central vestibular function in patients with vertigo or imbalance complaints.

The aims of this prospective study, conducted in the Otorhinolaryngology (ENT) and Head and Neck Surgery (HNC) department, are to determine the change in caloric test responses in idiopathic sudden hearing loss, the degree of involvement in the vestibular nerve, to examine the correlation between vestibular nerve involvement and vestibular complaints during admission, as well as to evaluate the effect of vestibular nerve impairment on recovery.

Materials and methods.

Eighty patients diagnosed with sudden hearing loss in the Otorhinolaryngology Clinic Izmir Bozyaka Training and Research Hospital were examined between January 2018 and October 2018. The study was prospectively conducted with the approval of the Ethics Committee of the Izmir Bozyaka Training and Research Hospital with No. 08-18 (KA-130042). Information on Informed Consent was given to all patients.

Inclusion Criteria.

- Patients between the ages of 18 and 80 who developed at least 30 dB and more sensorineural hearing loss in at least three consecutive frequencies within 72 h
- Patients who did not receive any other treatment for SSHL before starting treatment in our clinic were included in the study.
- Patients with no prediagnosed vestibular pathology

Exclusion Criteria.

- Patients with retro cochlear pathology, ototoxicity, perilymph fistula, and acoustic trauma,

- Patients with bilateral and recurrent sudden hearing loss,
- Patients who underwent previous surgery on the affected ear,
- Patients with a diagnosis of acute or chronic otitis media,
- Patients diagnosed with Meniere's disease during the follow-up period were excluded from the study.

After routine otolaryngology examinations were performed on the patient's general and neurological examinations. It was questioned whether the patients had a recent upper respiratory tract infection, chronic diseases such as diabetes mellitus, hypertension, coronary artery disease, smoking, and alcohol use, and whether their complaints were accompanied by symptoms such as tinnitus, and vertigo, nausea, and vomiting. Spontaneous nystagmus, gaze nystagmus, head impulse, head shake test, vestibulospinal tests such as Romberg and Fukuda tests, positional tests, and routine blood biochemistries were performed. The patient's informed consent regarding the ethical considerations of this study has been fully obtained.

The patients were divided into two groups per the presence of vestibular complaints at the time of hospital admission: Group 1 comprised patients without vestibular complaints, and Group 2 comprised patients with vestibular complaints.

To exclude retro cochlear pathology, all patients underwent magnetic resonance imaging (MRI) involving brain and ear sections.

Pure tone and speech audiometry tests were performed with clinical audiometers calibrated in a completely isolated cabin in the audiology unit. Hearing thresholds were measured from 250 Hz to 8 kHz. Pure tone averages (PTA) were calculated by considering the arithmetic mean of pure-tone thresholds at 500, 1000, 2000, and 4000 Hz. In speech audiometry, a live audiometric voice was given from the microphone, and speech reception thresholds (SRT) and speech discrimination scores (SDS) were obtained. SRT was then defined as the smallest value that 50% of the two-syllable words read to the patient can be understood. The test was initiated 10 dB above the average airway threshold. Speech discrimination rate (SDS) was determined using a monosyllabic word list. A single-syllable word list was read from the live microphone by the audiometrist, and the patient was asked to repeat it. SDS was then determined by counting how many 25 words were correctly spelled.

According to the American Speech-Language-Hearing Association's (ASHA) data, patients who could not hear sounds of <26–39 dB were considered to have mild hearing loss, and those who could not hear sounds of 40–54 dB have moderate hearing loss, those who could not hear sounds of 55–69 dB have a moderately severe hearing loss, those who could not hear sounds of 70–89 dB have a severe hearing loss and those who could not hear sounds of >90 dB a profound hearing loss [12]. Hearing thresholds at 250, 500, 1000, 2000, 4000, and 8000 Hz before and after treatment were individually recorded to determine frequency-specific changes.

The audiogram curves obtained to determine the audiometric configuration were divided into four groups loss at high frequencies (descending curve audiogram), loss at low frequencies (rising curve audiogram), loss in all frequencies (flat audiogram), and total loss. Siegel's hearing recovery criteria were used as a recovery criterion [13]. It was then evaluated that if there was a difference between the PTA values of the affected ear of the patient before and after treatment up to 25 dB, a complete recovery has been achieved; if there was a difference of 26–44 dB, a partial recovery; if there was a difference of 45–74 dB, a slight improvement; and if there was a difference over 75 dB, no improvement (no response) has been achieved.

Videonystagmography (VNG) test was performed for all patients before treatment. Oculomotor, positional, and caloric tests were then examined with VNG. Spontaneous nystagmus, head impulse, and shake tests were performed. Oculomotor tests included saccade, pursuit, and gaze tests. Positional tests included the Dix–Hallpike and Roll tests. The caloric test was applied using an air stimulus. The irrigation of cold and warm stimuli was performed for 1 min, and then nystagmus was recorded for 2 min. Right cold (RC), left cold (LC), right warm (RW), and left warm (LW) were applied. As the caloric test result, RC (right cold), RW (right warm), LC (left cold), LW (left warm), the total response of the right ear (Total R), the total response of the left ear (Total L), unilateral weakness (UW), and directional preponderance (DP) data were recorded.

Unilateral weakness (UW) and directional preponderance (DP) were determined based on Jongkees' formulas (14). UW > 25% and DP > 30% were considered significant.

UW=((Total right ear response - total left ear response / Total right and left ear response) x 100 DP = (Total right-side response - total left ear response / Total right and left side response) x 100

The results obtained in the pure tone and speech audiometry and videonystagmography tests obtained three months after the end of the treatment were compared with pre-treatment results.

Audiological and vestibular data before and after treatment were statistically compared between patients without (Group 1) and patients with (Group 2) complaints.

Whether or not vestibular results regressed after treating idiopathic sudden sensorineural hearing loss (ISSHL) patients with vestibular complaints and whether this affected the hearing test were examined.

Statistical method.

'Chi-square test, Fisher's chi-square test, and Fisher–Freeman–Halton test' were used to compare the two groups' recovery levels and evaluate the prognostic criteria. The 'Mann–Whitney U test was used to calculate the difference between numerical measurements between the two groups and to evaluate prognostic criteria based on numerical measurements. SPSS Version 21.0 computer program was used, and a p-value of <0.05 was considered significant.

Results.

Thirty of the 80 patients examined had exclusion criteria (described in section 2.2) and were excluded from the study, and the study was continued with 50 patients (36 males, 14 females). Twenty-five patients without vestibular complaints were classified as Group 1, whereas the other 25 were Group 2. The mean age was 51 ± 14.2 (range 18–75). Hearing loss was on the right side in 22 (44%) patients and on the left side in 28 (56%) patients. The mean time for hospital admission was 6 (±2) days.

It was found that 22 (44%) patients were admitted to the hospital within seven days after the onset of ISSHL, and 28

(56%) patients after seven days. None of the patients' hearing loss was bilateral. It was learned that 9 (18%) patients had hypertension, 4 (8%) patients had diabetes mellitus, and 2 (4%) patients had coronary artery disease. Of these 50 patients, 13 (26%) patients had cigarette consumption, 9 (18%) patients had alcohol consumption, and 4 (8%) patients had both cigarette and alcohol consumption.

No statistical difference was observed between the groups regarding sex, age, hospital admission, and tinnitus data ($p > 0.05$).

Tinnitus was present in a total of 25 (50%) patients. Only three (6%) patients had both dizziness and tinnitus. In MRI examination, an anterior inferior cerebellar artery (AICA) loop was observed on the side with ISSHL in 25 (50%) patients.

Audiological data.

Table 1 shows the classification of all cases as per the degree of hearing loss. When evaluated as per the hearing level in the audiometry test performed during admission, moderate hearing loss was observed more frequently (32% (8) in Group 1, 44% (11) in Group 2).

Table 1. *Patients' hearing loss levels before and after treatment.*

GENERAL (50 patients)	Before treatment	After treatment
Mild	8 (16%)	32 (64%)
Moderate	19 (38%)	5 (10%)
Moderately Severe	10 (20%)	6 (12%)
Severe	4 (8%)	6 (12%)
Profound	9 (18%)	12)

When audiometry values after treatment were evaluated as per hearing level, mild hearing loss was observed more frequently (68% (17) patients in Group 1 and 60% (15) patients in Group 2. No statistically significant difference was observed between the two groups regarding PTA in audiometry before and after treatment ($p = 0.0928$). Table 2 shows the classification of Group 1 and Group 2 patients as per the level of hearing loss before and after treatment.

Table 2. *Distribution of hearing loss levels between groups before and after treatment.*

	Group 1 (before treatment)	Group 1 (after treatment)	Group 2 (before treatment)	Group 2 (after treatment)
Mild	6	17	2	15
Moderate	8	4	11	1
Moderately Severe	5	3	5	3
Severe	3	1	1	5
Profound	3	0	6	1

Audiometric configuration: At the time of admission, hearing loss involved high frequencies (descending curve audiogram) in 14 patients, all frequencies (flat type audiogram) in 23 patients, low frequencies (ascending curve audiogram) in 5 patients, and there was a total hearing loss in 8 patients (Table 3A).

It was observed that 33 (66%) patients had a complete recovery. When evaluated on a group basis, 14 patients in Group 1 and 19 patients in Group 2 showed complete recovery (Table 3B). There was no statistically significant difference between the groups regarding recovery ($p = 0.0782$).

Table 3. *Distribution.*

A. Audiometry curve types among groups at the time of admission			
Configuration	**Total**	**Group 1**	**Group 2**
Descending audiogram	14	4 (19%)	10 (71%)
Flat audiogram	23	15 (65%)	8 (35%)
Ascending audiogram	5	4 (80%)	1 (20%)
Total loss	8	2 (25%)	6 (75%)
B. Post-treatment recovery levels by groups			
	p	**Group 1**	**Group 2**
Complete recovery	0.0782	14	19
Partial recovery	0.0834	10	6
Slight improvement	0.102	1	0
No improvement		0	0

Frequency-specific hearing thresholds.

Improvement was observed at all frequencies and was statistically significant. No frequency-specific predominance was detected at 250, 500, 1000, 2000, 4000, or 8000 Hz before and after treatment. The hearing threshold in Group 2 at 8 kHz was significantly higher than in Group 1 ($p = 0.00384$) (Table 4A). The hearing thresholds of patients in Group 2 were higher at 4000 and 8000 Hz than in Group 1 ($p < 0.05$). In Table 4B shows the post-treatment frequency-specific hearing thresholds. There was no statistical difference between PTA and SDS between Groups 1 and 2 before and after treatment ($p > 0.05$).

Table 4. *Frequency-specific hearing thresholds.*

A. Between groups at the time of admission						
	250 Hz	**500 Hz**	**1000 Hz**	**2000 Hz**	**4000 Hz**	**8000 Hz**
Group 2 (avg)	49,4	56,4	62	62,2	70,6	76,6
Group 1 (avg)	50	54,6	57,8	52,6	60,4	58,8
p	0.946	0.831	0,612	0,184	0,102	0.008
B. Between groups after treatment						
	250 Hz	**500 HZ**	**1000 Hz**	**2000 Hz**	**4000 Hz**	**8000 Hz**
Group 2 (avg)	35,2	38,125	43,4	45,2	54,4	60,2
Group 1 (avg)	28,8	31	35,6	33,6	39,8	41,4
p	0,298	0,365	0,325	0,109	0.024	0.014

Vestibular data: Skew deviation, spontaneous and venous nystagmus, dysmetria, and dysdiadokokinesis were not observed in the general vestibular examination on the day of hospitalization and in the third month of discharge for all patients. Both Romberg and Fukuda tests were performed.

At the time of admission, the number of patients in Group 1 with UW above 25% on the side with ISSHL was 1 (4%), while it was 18 (72%) in Group 2. This difference between the

groups was reported to be statistically significant (p = 0.0032). In the examination performed in the third month after treatment, the UW value was reported to be >25% in one patient in both groups (Table 5A)

In the analysis of the effect of the hearing loss severity on the caloric test, unilateral weakness, and directional predominance was observed in all six patients with severe hearing loss in Group 2 (UW> 25%), and it was considered to have a strong statistical significance compared to Group 1 (p = 0.000431).

Table 5B shows the effect of the severity of hearing loss before and after treatment on the caloric test in patients with vestibular complaints. No statistically significant difference was reported between the unilateral directional predominance values between the groups before and after treatment (Table 5C).

Table 5. *Vestibular data.*

A. Unilateral weakness values before and after treatment between groups			
	UW > 25% (before treatment)	**UW > 25% (after treatment)**	***p***
Group 1	1	1	0,998
Group 2	18	1	0.00325 *
B. Distribution of unilateral weakness values before and after treatment as per the severity of hearing loss in ISSHL patients with vestibular complaints			
Hearing loss	**UW> 25% (before treatment)**	**UW> 25% (after treatment)**	**Total**
Mild (26-39)	2	0	2
Moderate (40-54)	5	0	11
Moderately severe (55-69)	4	0	5
Severe (70-89)	1	0	1
Profound (over 90)	6	1	6
C. Directional predominance values between groups before and after treatment			
	Before treatment DP > 30%	**After treatment DP > 30%**	***p***
Group 1	13	15	p> 0.05
Group 2	10	13	p> 0.05

** Statistically significant*

Discussion.

Idiopathic sudden sensorineural hearing loss (ISSHL) is one of the subjects on which important discussions take place in terms of both diagnosis and treatment. It has been reported that various factors affect its prognosis. These factors include vestibular complaints, tinnitus, patient age, hearing level at admission, time until admission, and audiogram configuration [9-11].

There is no consensus in the literature defining improvement in sudden hearing loss. In our study, we reported it appropriate to use Siegel's criteria because it includes both hearing gain and residual hearing [12]. Vestibular involvement in SSHL was first reported in 1949, and then the effect of vestibular complaints on clinical findings and the prognosis was studied in [10]. In certain studies, vestibular complaints have been reported to indicate a poor prognosis [10-15]. However, in other studies, vestibular complaints do not affect prognosis [11,16-17].

In a series of 80 patients with sudden hearing loss, Psifidis et al. reported the rate of persistent tinnitus as 36% and the rate of vestibular complaints as 8.7% and stated that the presence of vestibular complaints, in addition to severe hearing loss, is a poor prognostic factor [18].

In their large series of 541 patients, Cvorovic et al. reported that the presence of vertigo and the degree of hearing loss at the time of admission, time until treatment, and audiogram configuration are poor prognostic factors [19]. They reported a weak but significant relationship between vertigo and recovery rate.

In their series of 576 patients with profound hearing loss, Wen et al. reported that the rate of vertigo was 52.1% and tinnitus was 77.4%, as well as stated that the presence of vertigo did not have a significant effect on recovery [17].

Our study detected 44% right-sided and 56% left-sided sudden hearing loss. The patients' hearing loss was on the right side in 22 (44%) patients and on the left side in 28 (56%) patients. The absence of side dominance in the studies by Shaia and Sheehy, and Van Dishoeck and Bierman are consistent with the data in our study [20].

One of the most important factors affecting the prognosis is the level of initial hearing loss. The amount of studies investigating the effect of the degree of hearing loss on the prognosis is quite limited in the literature [7-10]. In the study conducted by Wilson et al., no complete recovery was achieved in patients with a hearing loss ≥90 dB; the authors concluded that patients with severe hearing loss had a low probability of recovery independent of treatment [20].

Previous studies reported that an advanced hearing level at baseline negatively affects the prognosis [21]. In our study, 7 of 8 (16%) patients with mild hearing loss at the time of hospital admission had improvement, but the improvement was not achieved in 9 (18%) patients with severe hearing loss. According to the data we obtained, if the initial hearing loss of the patient is severe, the response rate to treatment can be expected to be low.

Moreover, the duration before hospital admission of the patient affects the prognosis. The generally accepted view is that recovery symptoms are better in patients who start treatment within the first 3-7 days from the onset of sudden hearing loss. Plaza et al. reported the duration of treatment initiation longer than seven days as a poor prognostic criterion [22]. We included patients admitted to the hospital within the first seven days after the emergence of symptoms in our study. The average duration of admission of the patients is six days. In our study, when the patients who started treatment before seven days and those who started treatment after seven days were compared, no statistically significant difference was reported between the

recovery rates, the difference between the frequencies, and the caloric test responses.

Choi et al. detected nystagmus in 22 patients (67%) in their SSHL series of 38 patients without vestibular complaints [23]. This study reported a good prognosis in 39% of patients with nystagmus and indicated a good prognosis in 72% of patients without nystagmus. In our study, neither spontaneous nor position-induced nystagmus was reported in the examination performed with videonystagmmography.

Liu et al. examined vestibular test changes in patients with SSHL [24]. In this study, which included 35 patients, it was reported that 21 patients (46%) had vertigo. All patients were examined by sensory organization test, caloric test, cervical vestibular evoked myogenic potentials (c-VEMP), and ocular VEMP (o-VEMP). There was a significant relationship between vertigo and the severity of hearing loss. It was emphasized that abnormal o-VEMP result was the most frequently obtained in patients with or without vertigo, followed by abnormalities in caloric test and c-VEMP results. Liu et al. used a limit of >25% as a one-sided weakness criterion in the caloric test. In this study, in which air caloric stimulus was used, unilateral weakness was detected in 66.7% of patients with vertigo; however, it was reported that 35.7% of patients without vertigo had a unilateral weakness. In our study, unilateral weakness was detected in 72% of patients with vestibular complaints, while unilateral weakness was reported in only one (4%) of patients without vestibular complaints [24].

Fujimoto et al. performed vestibular evaluation in patients with SSHL using a caloric test, c-VEMP, and o-VEMP, and 25 patients with vestibular complaints were evaluated [25]. They used a water stimulus in the caloric test, and a 25% limit was used for unilateral weakness. The authors reported that 13 patients (52%) had caloric test abnormalities and stated that the hearing thresholds were significantly higher in these patients.

In our study, vestibular complaints were detected in 18 (95%) of 19 patients who were reported to have pathology in the caloric test (UW > 25%), and tinnitus was reported in 10 (53%) patients. In the presence of vestibular complaint, significant unilateral weakness in the affected ear is considered an important result, indicating that both cochlear and vestibular function are affected by sudden hearing loss.

Studies report that the vestibular nerve is not affected by sudden hearing loss. The histopathological study by Khetarpal showed that vestibular organ damage in patients with SSHL does not correlate with vertigo [26]. This temporal bone study published in 1991 examined whether there is a morphological equivalent of vertigo accompanying SSHL. It was reported that there was no difference between both groups in terms of hair cells and neuronal degeneration.

In our study, hearing thresholds were reported higher in all frequencies except 250 Hz and PTA in patients with vestibular complaints at the time of admission, but only the hearing threshold at 8000 Hz showed a significant difference. Both caloric test response and high-frequency hearing threshold showed a significant difference in patients with vestibular complaints. Regarding the treatment-related values, hearing thresholds were reported to be higher at all frequencies in patients with vestibular complaints, but statistical significance was obtained at frequencies of 4000 and 8000 Hz. However, no significant difference was reported between groups regarding recovery rates based on recovery criteria. The fact that high-frequency hearing loss is observed more frequently in patients with vestibular complaints and that there is less improvement in these frequencies does not reflect improvement rates. The reason for this can be attributed to the use of PTA value rather than frequency-specific information in the recovery criteria.

In our study, 18 (72%) of the patients with vertigo and 1 (4%) of the patients without vertigo had a unilateral weakness (UW > 25%) on the side of SSHL. After treatment, unilateral predominance was observed in one patient (4%) in both groups. Profound hearing loss was detected in one patient who did not have vestibular complaints and had unilateral weakness at the time of application, and there was no improvement in the follow-up of this patient. However, unilateral weakness was not detected in 17 out of 18 patients with vestibular complaints and unilateral weakness after treatment, while unilateral weakness continued in one patient. There were no patients with vestibular complaints after treatment in both groups, indicating that caloric test data are not always compatible with the complaint.

In a meta-analysis published by Yu et al., it was reported that the utricle and superior vestibular nerve were most frequently affected in SSHL patients with vestibular complaints; moreover, the recovery rate was reported to be lower than in patients without vestibular complaints. The authors emphasized that vestibular damage accompanied by SSHL is an important parameter affecting healing [27].

The weakness of our study is that cVEMP-in, which is used to determine saccular function, autolytic organ, and inferior vestibular nerve dysfunction to evaluate the vestibular complaints of patients more comprehensively and to determine the connection with hearing and vestibular centers, was not used in our study.

Conclusion.

In conclusion, it was found that high frequencies (especially 8000 Hz) were more affected in SSHL patients with vestibular complaints. In SSHL patients with vertigo, the caloric response in the ear with hearing loss was lower, and the canal paresis was higher. In our study, it can be suggested that as the severity of hearing loss increases, the possibility of obtaining unilateral weakness increases.

Consent for publication.

The patients consented to the publication of this research.

Competing interests.

The authors declare that they have no competing interests.

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Authors' contributions.

A.A: Study design, examination of patients, data collection

and analysis, manuscript development, review of the final manuscript.

D.T.E: Study design, examination of patients, data collection and analysis, manuscript development, review of the final manuscript.

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Main Points:

1. High frequencies (especially 8000 Hz) were more affected in SSHL patients with vestibular complaints
2. In these patients, a statistically significant presence of total hearing loss and descending audiogram curve were observed
3. Post-treatment hearing thresholds were examined, the improvement in the frequencies of 4000 and 8000 Hz was lower in patients with vertigo, and this result was statistically significant
4. In SSHL patients with vertigo, the caloric response in the ear with hearing loss was lower, and the canal paresis was higher.
5. As the severity of hearing loss increases, the possibility of obtaining unilateral weakness increases.
6. In patients with SSHL with severe to profound hearing loss, the vestibular function of the cochlea is considered to be affected and the auditory function of the cochlea.