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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 ВИНТИ 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 ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებშიდან.

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. Корректур авторам не высылаются, 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 computer-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 საყურადღებო!

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, შემავსებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრაფიის ფოტოსურათები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგების 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 ფხიხლებში 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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FORMATION AND DISTRIBUTION PATTERNS OF FUNCTIONAL INTERHEMISPHERIC BRAIN ASYMMETRY IN CHILDREN WITH INTELLECTUAL DISABILITIES

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Abstract.

The study of the dynamics of interhemispheric relations during adaptation to changing environmental conditions, as well as during brain lesions or functional disorders in the activity of any structures, has revealed a predominant increase in the activation of the right hemisphere.

Studies by different authors also show that many pathological brain states are characterized by a deviation of the functional brain asymmetry profile from that recorded in a normally functioning CNS.

In our research we tried to trace the peculiarities of the formation of individual asymmetry profile under the influence of sensory deprivation in children with hearing pathology.

Key words. Interhemispheric brain asymmetry, interhemispheric, functional brain asymmetry, pathology.

Introduction.

Modern ideas about the functioning of the whole brain define it as a dynamic system capable of functional rearrangements of its current activity. Functional rearrangements set priority levels and weights of connections between brain structures involved in the current activity in such a way that the current activity is implemented in the most efficient way, in terms of motivation, and in the most minimized way, in terms of energy expenditure. The possibilities for this are inherent in the properties of the brain to combine rigidly fixed and plastic forms of structural organization and functional activity [1-3]. As a result, a certain type of intracerebral and interhemispheric interactions is formed during normal development of the organism in the process of interaction with the outside world, which, in turn, forms a certain type of functional brain asymmetry (FBA). Such a normal type of FBA (genetically predetermined) is characterized in humans by the formation of dominance of the right hand, right eye, dominance of the left hemisphere in the perception of verbal information, and the right hemisphere - in the service of reasoning activity, etc. Such a species-specific (for humans) profile of FBA has been studied in sufficient detail [4-7].

The normal formation of the nervous system in ontogenesis determines the formation of the brain and its interhemispheric and intersensory interactions under conditions of normally incoming efferent influences. At deprivation of any afferentations conditions of non-standard functioning arise and as a result adaptive-compensatory mechanisms of the nervous system can be triggered to restore the equilibrium interaction of the organism with the environment. The result of such adaptive restructuring is the organization of intersensory and interhemispheric interactions at a different level, which is reflected in the formation of the individual asymmetry profile.

The study of the dynamics of interhemispheric relations during adaptation to changing environmental conditions, as well as

during brain lesions or functional disorders in the activity of any structures, has revealed a predominant increase in the activation of the right hemisphere [8-12].

Studies by different authors also show that many pathological brain states are characterized by a deviation of the FBA profile from that recorded in a normally functioning CNS [13-15].

In our research we tried to trace the peculiarities of the formation of individual asymmetry profile under the influence of sensory deprivation in children with hearing pathology.

Finally, the main aim of this research was to examine the impact of auditory sensory deprivation on the development of the individual functional brain asymmetry profile in children with hearing pathology, with a particular focus on the reorganization of interhemispheric and intersensory interactions during ontogenetic development.

Materials and Methods.

The individual asymmetry profile of each participant was determined through an integrated evaluation of motor, sensory, and psychosensory components of lateralization. The assessment included analysis of:

- motor asymmetry (dominance of the hand and foot);
- sensory asymmetry (dominance of the eye and ear);
- psychosensory asymmetry (hemispheric activation patterns associated with cognitive processing and eye-movement responses).

The study involved school-aged children between 8 and 11 years old, including both typically developing children and children diagnosed with mild intellectual disability. The clinical group consisted of 36 children with mild intellectual disabilities, while the control group included 42 typically developing children matched by age. From the perspective of analytical purposes, both groups were subdivided into two age categories: 8–9 years and 10–11 years. The research was conducted within a comparative cross-sectional design aimed at identifying age-related and developmental differences in the formation of functional interhemispheric brain asymmetry.

The individual asymmetry profile (IAP) of each participant was determined based on the integrated assessment of motor, sensory, and psychosensory asymmetries, including hand, foot, eye, and ear dominance. The classification of asymmetry patterns was based on the conceptual framework proposed by Adrianov (1976) representing a cornerstone in both theoretical research and practical applications, guiding scholars and professionals in organizing ideas, identifying relationships, and formulating strategies. This approach considers the combination of lateralized functional systems as a marker of interhemispheric organization.

Within the scope of motor and sensory asymmetries, a set of standardized neuropsychological and behavioral tests

were evaluated mainly procedures developed by A.R. Luria and Gurova (1973), as well as the handedness inventory questionnaire proposed by M. Annett (1967). In combination, the Luria and Gurova methods provide an integrated assessment of the individual asymmetry profile (IAP) by analyzing the interaction of motor, sensory, and cognitive components. They are particularly useful in developmental neuropsychology because they allow comparison of functional brain organization in children with typical development and those with neurological, sensory, or cognitive impairments. These methods allowed for the identification of dominant functional systems in motor coordination and sensory perception.

The Annett Hand Preference Questionnaire (AHPQ) was administered to a sample of 352 randomly selected individuals from the general community to examine the reproducibility of its handedness classification and to evaluate its model-based reliability and convergent validity. Latent class analysis showed that the eight categories of hand preferences could not be justified on statistical grounds. Instead, three broad handedness classes adequately accommodated the variety of handedness patterns: 'consistent right' (66.0%), 'consistent left' (9.8%) and 'inconsistent or mixed' (24.2%). Confirmatory factor analysis not only showed that the AHPQ is reliable and has solid convergent validity, but also the measurement properties of the AHPQ could be further improved by eliminating a few items from the scale. The implications of these findings are discussed, and it is suggested that questionnaire requires modification, possibly by replacing obsolete items such as 'sweeping' and 'shovelling' with modern manual activities, such as 'typing SMS messages' and 'using a remote control'.

When determining the individual asymmetry profile (IAP) of the brain, the combination of motor (hand, foot) and sensory (vision, hearing) asymmetries - symmetries inherent in each person was taken into account, and the peculiarities of psychosensory asymmetry were considered (Adrianov, 1976). Motor and sensory asymmetries were evaluated by the well-known tests of Luria, Gurova (1973), questionnaire M. Annett (1967) and others.

Motor asymmetry was examined through a series of tasks assessing:

- Preferred hand use in unimanual activities (e.g., writing, drawing, object manipulation);
- Precision and coordination in fine motor tasks;
- Cross-lateral motor performance (e.g., reaching, throwing, and bimanual coordination tasks);
- Spontaneous hand preference during unstructured activities.

Foot dominance was determined using tasks such as:

- Preferred leg for kicking a ball;
- Leg used for stepping onto a platform or initiating gait;
- Stability and balance tasks involving unilateral support.

Sensory asymmetry was evaluated through:

- Visual dominance tasks (e.g., sighting through a tube or monocular alignment tasks);
- Auditory preference tests based on dichotic listening-like situations or directional hearing responses;
- Response accuracy and reaction time differences depending on sensory input side.

These procedures allow the identification of functional hemispheric specialization by analyzing consistent behavioral preferences across multiple motor and sensory domains.

The analysis of psychosensory asymmetry was based on the Kinsbourne hypothesis [16,17], according to which the direction of eye deviation elicited by a speech stimulus is associated with asymmetric activation of the cerebral hemispheres. The hypothesis assumes that during the performance of a particular mental operation, the hemisphere predominantly responsible for this function becomes activated, and the resulting imbalance in interhemispheric activity is reflected in the direction of eye movements. Thus, eye movement patterns can be considered an indirect behavioral marker of functional hemispheric specialization. In the study of psychosensory asymmetry, we adopted the Kinsbourne hypothesis.

Table 1 presents the distribution of leading eye dominance and the stability of visual lateralization in children with mild intellectual disabilities and typically developing children aged 8–9 and 10–11 years. The leading eye was classified as right (D), left (S), or ambidextrous (A). In children with mild intellectual disabilities aged 8–9 years, left-eye dominance was predominant (61%), with a higher stability coefficient compared with right-eye dominance. In typically developing children of the same age, right-eye dominance was more frequent (56%), and ambidextrous eye preference was observed in 6% of cases.

At the age of 10–11 years, children with mild intellectual disabilities demonstrated a decrease in left-eye dominance and an increase in right-eye dominance, indicating gradual reorganization of visual lateralization. In typically developing children, right-eye dominance became more pronounced (67%), reflecting greater stabilization of visual asymmetry.

Overall, the findings suggest that visual lateralization develops differently in the two groups, with children with mild intellectual disabilities showing a slower maturation and less stable organization of visual functional asymmetry compared with typically developing peers.

Table 2 presents the distribution of leading ear dominance and the left-ear coefficient (CLE) in children with mild intellectual disabilities and typically developing children aged 8–11 years.

In children with mild intellectual disabilities, left-ear dominance was predominant in both age groups, although it decreased with age, while right-ear dominance gradually increased. In typically developing children, auditory lateralization changed with age: right-ear dominance became more pronounced in the 10–11-year-old group, indicating stronger left-hemisphere specialization.

Overall, the results suggest delayed maturation of auditory functional asymmetry in children with mild intellectual disabilities compared with typically developing peers.

Table 3 presents the distribution of hand dominance and the right-handedness coefficient (Rhc) in children with mild intellectual disabilities and typically developing children aged 8–11 years.

In both groups, right-hand dominance was predominant. Among children with mild intellectual disabilities, right-handedness increased from 77% to 84% with age, while the Rhc remained relatively stable. In typically developing children, right-handedness was more pronounced, increasing from 90% to 95%, accompanied by a higher Rhc value.

Overall, the results indicate that children with mild intellectual disabilities demonstrate a lower degree of stable right-hand lateralization compared with typically developing children, suggesting slower maturation of motor asymmetry.

The basis for the choice of specific research methods was the possibility of their application both in the group of healthy children and in the group of children with hearing pathology. This made it possible to conduct the research according to a unified program, which allows us to perform a comparative analysis of the obtained results.

When identifying characteristic trends in the formation of the individual asymmetry profile in these children and their normal peers, the relative coefficients of stability of dominance of each of the motor, sensory, and psychosensory functions (the ratio of the number of samples with stable lateralization to the total number of samples, in %) for each type of IAP were calculated. On the basis of these values, the average stability of dominance of a given asymmetry profile was calculated. Formation was considered stable with a ratio of more than 75%.

Due to the fact that not all possible types of FBA profile distributions were encountered in our sample, we focused on the analysis of the most frequently encountered ones, there were four of them:

I - right-lateral and II - left-lateral types, including profiles in which all four features or three out of four are unilateral (i.e. one hemisphere dominates in the organization of motor and sensory functions);

III - ambidextrous type, including profiles in which four or three traits are ambidextrous (i.e., there is no clear hemispheric dominance in the organization of motor and sensory functions);

IV - partial type, when motor and sensory functions are dispersed in different hemispheres.

Results and Discussion.

Quantitative data on the study of sensory and motor asymmetries, peculiarities of psychosensory asymmetry of children with intellectual disabilities and their normal peers are summarized in Tables 1-5.

The obtained results show that in children with intellectual disabilities aged 8 to 9 years the left eye dominates, the coefficient of stability of dominance of this eye is high, despite the absence of pure ambidextrous children, the coefficient of ambidextrous manifestation is rather high (Table 1).

In normally developing children, the distribution of subjects is different: the leading eye of a part of the subjects is the right eye, in 6% of cases pure ambidextrous eyes were identified, and the ambidextrous coefficient in the whole group decreased.

In the next age group from 10 to 11 years old, there was a smoothing of visual asymmetry in subjects with mild mental retardation (see Table 1), but its increase in normally developing children. At this age, the right eye is the leading eye in the majority of subjects.

As follows from Table 2, the left ear functionally predominates in children with mild mental retardation in both age groups (8 to 9 and 10 to 11 years). However, with age, the frequency of children with left ear dominance decreases slightly (from 53.8% to 46.1%), while the frequency of children with right ear dominance increases twofold (from 15.4 to 30.8). At the same

time, the number of children with no predominance of one or the other ear is decreasing (from 30.8% to 23.1%). The left ear dominance rate in children with mental retardation decreases significantly with age (from 33.3% to 11.5%). In normally developing schoolchildren, initially between the ages of 8 and 9, a slight left ear dominance over the right ear is found, but with age, the number of children with left ear dominance and the number of children with functional ambidextrous hearing decreases, and the number of schoolchildren with right ear dominance increases significantly (from 25 to 63.64%). The left ear coefficient in normal developmental children changes from 6.25 to - 43.2%, i.e. the insignificant predominance of the left ear at the age of 8 to 9 years is replaced by the functional dominance of the right ear.

The distribution shows that there are a higher percentage of left-handed children with pathology (Table 3). In both age groups of children with mild mental retardation and children with normal development, the right hand dominates (the number of trials performed by the right hand is greater than the number of trials performed by the left hand), and the predominance of the right-hand increases with age. However, while in children with mild mental retardation the right handedness ratio in the two age groups is below average (according to Fedoruk's classification [5]), in the group of normally developing children it is average for schoolchildren aged 8 to 9 years and above average in the group of children aged 10 to 11 years.

The study of functional asymmetry of legs in the majority of children in both groups also revealed the predominance of the right leg over the left one (Table 4). In addition, ambidextrous is also found here and the percentage of such children increases with age. As can be seen from Table 4, the coefficient of right leg dominance is not very high both in children with mild mental retardation and in healthy preschoolers, and it decreases with age.

Table 5 shows the percentage of visually registered clear lateral eye movements. The data in Table 5 show that all subjects at the age of 8-9 years have a dominance of the right hemisphere in eye movements to the left when actualizing images of auditory and visual-spatial perception. No statistically significant differences are found in the asymmetry of normally developing children and children with a mild degree of mental retardation (8-9 years old) in this form of psychosensory asymmetry. At the age of 9-11 years the dominance of the right hemisphere in actualizing images of visual-spatial and auditory perception is observed only in normally developing children. Among subjects with a mild degree of mental retardation of 10-11 years of age, equal distribution in the participation of brain hemispheres in the realization of visual-spatial perception is noted.

When determining the brain IPA, all four asymmetry profiles were found in hearing-impaired preschoolers, while in healthy children - only two (Table 6). The left-lateral and ambidextral profiles were absent.

Children with right-lateral type of IPA (42.5% children with intellectual disabilities and 67.7% normally developing) made up a large group. Among them, only 11% of subjects with pathology and 23% of healthy children are full right-handed.

Left-lateral and ambidextral asymmetry profiles were detected in only 9% of children with mild mental retardation.

Table 1. Percentage of normally developing children and children with intellectual Disabilities by leading eye.

Age	Pathology						Normal					
In years	Leading eye			Pre-dominance stability coefficient		Am-bidec-stria coefficient	Leading eye			Pre-dominance stability coefficient		Am-bidec-stria coefficient
	D	S	A	D	S		D	S	A	D	S	
8 to 9	39	61	-	1,26	1,97	1,1	56	38	6	0,75	0,51	0,22
10 to 11	49	42	9	1,02	0,88	0,99	67	33	-	1	0,49	0,25

Symbols: D - right eye; S - left eye; A – ambidextrous.

Table 2. Age distribution (in %) of normally developing children and children with intellectual disabilities (quantitative index and estimated coefficient of the leading ear).

Age	Pathology				Normal			
In years	S	D	A	CLE	S	D	A	CLE
8 to 9	53,8	15,4	30,8	33,3	37,5	25	37,5	6,25
10 to 11	46,1	30,8	23,1	11,5	13,64	63,64	22,72	-43,2

Notation: D, right ear; S, left ear; A, ambidextrous; CLE - left ear coefficient

Table 3. Age distribution (in %) of children by leading hand and right-hand ratio (Normally developing children and children with intellectual disabilities).

Age	Pathology				Normal			
In years	right-handed	left-handed	ambidextria	Rhc	right-handed	left-handed	ambidextria	Rhc
8 to 9	77	23	-	36,5	90	-	10	42,5
10 to 11	84	16	-	37	95	5	-	57

Notation: Rhc - right-handedness coefficient

Table 4. Percentage distribution of subjects by leading leg and right leg dominance ratio.

Age	Pathology				Normal			
In years	D	S	A	Rlc	D	S	A	Rlc
8 to 9	85	15	-	31,6	80	10	10	40
10 to 11	44	36	20	10,7	66,5	2,5	31	24,6

Symbols: D - right leg; S - left leg; A - ambidextrous; Rlc - coefficient of dominance of the right leg

Table 5. Age distribution of the subjects (in %) by psychosensory asymmetry of normally developing children and children with mild intellectual disabilities.

Methodology	Age	Pathology		Normal	
	In years	Eye movement		Eye movement	
		to the left	to the right	to the left	to the right
Actualization of the image	8 to 9	38	31	40	19
auditory perception	10 to 11	49	17	55	20
hearing perception	8 to 9	33	26	39	25
visual perception	10 to 11	46	43	59	7
Actualization of the image	8 to 9	33	19	35	24
kinesthetic perception	10 to 11	46	46	62	11

Table 6. Distribution of Laterization Types in Asymmetry Groups of Normally Developing Children and Children with Mild Intellectual Disabilities (in % of the total number of subjects).

Type of laterization	Pathology	Normal
I	42,5	67,7
II	6	-
III	3	-
IV	48,5	32,3

Table 7. Average coefficients of stability of dominance of sensorimotor and psychosensory functions in children with intellectual disabilities and normally developing peers (in %).

FIA profile	Lateralization of motor and sensory functions		Lateralization of psychosensory functions	
	pathology	normal	patology	normal
I	80	83	47,5	67
II	79	-	100	-
III	63,5	-	-	-
IV	74	76	41,5	51

The partial type of laterization included significant groups of subjects with pathology and normally developing schoolchildren (48.5% and 32.3%, respectively).

The data of Table 7 show that children with a mild degree of mental retardation are characterized by delayed formation of laterization of interhemispheric asymmetry as compared to similar processes in their normally developing peers.

Moreover, insufficient expression of laterization is noted not so much at the level of individual motor and sensory functions as at the level of psychosensory asymmetry. Thus, the indicators of the right-lateral type of FIA in children with intellectual disabilities are 80% vs. 83% in normally developing children in sensorimotor functions, and in psychosensory asymmetry - 47.5% vs. 67%, respectively.

The conducted studies of children with a mild degree of mental retardation and in normality allow us to evaluate the peculiarities of formation and distribution of the FIA profile in schoolchildren with pathology. The profile of functional interhemispheric asymmetry was determined by the totality of motor (hand, foot), sensory (eye, ear) signs of FA taking into account psychosensory asymmetry.

In the course of analyzing the results obtained in assessing sensory functional asymmetry in children with mild mental retardation and their normally developing peers, a number of differences were revealed.

Thus, among children with intellectual disabilities at the age of 8-9 years the left eye functionally dominates, but in the next age subgroup this dominance decreases. Among the majority of healthy schoolchildren up to the age of 10 years the right eye dominates and this dominance increases with age.

Thus, the dominance of the right hemisphere revealed in the studies, apparently, can be explained by the well-known fact that adaptation processes are predominantly realized by the right hemisphere, where the activity, including autonomic regulation, of the hypothalamus is more pronounced [10]. These differences are especially significant in comparison with normally developing children.

The most significant differences between the studied groups are manifested in the distribution of functional asymmetry of ear dominance, and these differences increase with age. Among children under 10 years of age, the predominance of left-sided asymmetry was revealed in the general subgroups (pathology and norm) (more significant in the group of children with pathology, the left ear remains dominant at the next age stage in the majority of children with pathology - 46.1%, and in hearing children it dominates only in a small part (13.64%) with a significant increase in the dominance of the left hemisphere in the realization of auditory functions.

Thus, the data on the functional asymmetry of the auditory analyzer also show that in children with mild mental retardation the right (adaptation) hemisphere dominates in providing sensory functions compared to the left hemisphere in healthy children.

The study of the dynamics of interhemispheric relations during adaptation to changing environmental conditions, as well as during brain lesions or functional deviations in the activity of any structures from the norm, has revealed a predominant increase in the activation of the right hemisphere [2, 3, 8, 9].

Along with the studies of sensory functions, motor functional asymmetry was analyzed, in the manifestation of which the predominance of the right hand over the left hand and the right leg over the left leg was revealed in the majority of children, with the right hand predominating in more children than the right leg. In the age group of children from 8 to 9 years old, right-hand asymmetry among schoolchildren with intellectual disabilities is observed to a lesser extent than among their normally developing peers. Unlike normally developing children, they have a more significant role of the right hemisphere in the realization of this function. With age (10-11 years) the share of the left hemisphere in the formation of this function increases in the group of healthy children, which is not observed in the other group.

The revealed peculiarities may indicate a general difficulty in the formation of functional interhemispheric brain asymmetry in children with intellectual disabilities.

In the manifestation of psychosensory asymmetry in subjects with pathology in the age period from 10 to 11 years, a tendency to smoothing of psychosensory asymmetry in the function of visual-spatial representations was revealed.

Summarizing the data of the study of functional asymmetries, we note that the number of children with right-hemispheric localization of sensory and motor functions in the groups of children with intellectual disabilities and normally developing on average is respectively 32 and 21%, with left-hemispheric localization - 46 and 63%.

With the undoubtedly leading role of the left hemisphere in children of both categories, we note that the specific weight of the contribution of the hemispheres to sensorimotor activity is different: in children with a mild degree of mental retardation, the contribution of the right hemisphere is more pronounced than in their healthy peers, which is explained by the redistribution of hemispheric functions under the influence of sensory deprivation.

Conclusion.

The study demonstrated that children with mild intellectual disabilities exhibit specific features in the formation of functional interhemispheric brain asymmetry compared with typically developing children. The individual asymmetry profile, based on the integration of motor, sensory, and psychosensory components, revealed differences in the maturation and stabilization of lateralized functions.

Children with mild intellectual disabilities showed a slower and less stable development of functional lateralization. In sensory systems, they demonstrated a prolonged predominance of left-eye and left-ear dominance, whereas typically developing children showed a gradual strengthening of right-sided dominance, reflecting more stable hemispheric specialization. The greatest differences between groups were observed in auditory asymmetry, indicating delayed maturation of auditory functional lateralization in children with mild intellectual disabilities.

Motor asymmetry was less differentiated in children with mild intellectual disabilities, although right-hand and right-leg dominance remained predominant in both groups. Compared with typically developing children, the clinical group

demonstrated lower stability of right-sided motor dominance, suggesting delayed formation of motor lateralization.

The analysis of psychosensory asymmetry showed reduced hemispheric differentiation in children with mild intellectual disabilities, particularly in the organization of visual-spatial and cognitive processes. The higher frequency of partial and mixed asymmetry profiles in this group indicates a less consolidated pattern of interhemispheric organization.

Overall, the findings suggest that mild intellectual disability is associated with delayed maturation and altered organization of functional brain asymmetry, characterized by reduced stability of lateralization and greater involvement of right-hemisphere functional systems. These results highlight the importance of assessing individual asymmetry profiles in developmental neuropsychology for understanding cognitive and functional differences in children with intellectual developmental disorders.

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Թերեզա Յուրիի Ազատյան

Մանկավարժական գիտությունների թեկնածու, ֆիզիկական դաստիարակության տեսության և մեթոդիկայի և աղապարի ֆիզիկական կուլտուրայի ամբիոն , դոցենտ Հայաստանի ֆիզիկական կուլտուրայի և սպորտի պետական ինստիտուտ

ՄՏԱՎՈՐ ՀԵՏԱՄԱՅՈՒԹՅՈՒՆ ՈՒՆԵՑՈՂ ԵՐԵՎԱՆԵՐԻ ԳԼԽՈՒՂԵՂԻ ՓՈԼԵԿՏԵԽՆԻԿԱԿԱՆ ՄԻՋԿԵՆՏՐԱԿԱՆ ԱՆՀԱՏԱԶՓՈԹՅԱՆ ԿԱԶՄԱՎՈՐՄԱՆ ԵՎ ԲԱՇԽՄԱՆ ԱՌԱՋՆԱՀԱՏՎՈՒԹՅՈՒՆՆԵՐԸ.

Հոդվածում ներկայացված են տվյալներ գիտությունների աշխատանքի վերաբերյալ սահմանելու այն որպես դիմադրող համակարգ, որն ընդունակ է ընթացիկ գործունեության ֆունկցիոնալ վերադասավորումների: Բացահայտվել են մտավոր հետամնացություն ունեցող երեխաների գիտությունների ֆունկցիոնալ միջկիսագնդային անհամաչափության պրոֆիլի ձևավորման և բաշխման առանձնահատկությունները: Հաստատվել է, որ թերթի աստիճանի մտավոր հետամնացություն ունեցող երեխաների մոտ, համեմատած նորմալ զարգացող երեխաների հետ, ֆունկցիաների վերաբաշխումը տեղի է ունենում ուղեղի աջ և ձախ կիսագնդերի միջև աջ կիսագնդի դոմինանտության պայմաններում:

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ОСОБЕННОСТИ ФОРМИРОВАНИЯ И РАСПРЕДЕЛЕНИЯ ПРОФИЛЯ ФУНКЦИОНАЛЬНОЙ МЕЖПОЛУШАРНОЙ АСИММЕТРИИ МОЗГА У УМСТВЕННО ОТСТАЛЫХ ДЕТЕЙ

В статье представлены данные о функционировании целостного мозга определяют его как динамическую систему, способную к функциональным перестройкам

текущей деятельности. Выявлены особенности формирования и распределения профиля функциональной межполушарной асимметрии мозга у умственно отсталых детей. Установлено, что у детей с легкой степенью умственной отсталости по сравнению с нормально

развивающимися детьми происходит перераспределение функций между правым и левым полушариями головного мозга при формировании функциональной асимметрии сенсорных систем с повышенным доминированием правого полушария в этих функциях.