



NEUROSURGERY AND ITS ROLE IN MODERN MEDICINE

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Annotation. Neurosurgery is one of the most advanced and complex branches of modern medicine that focuses on the diagnosis, surgical treatment, and rehabilitation of disorders affecting the nervous system. This field plays a significant role in treating diseases related to the brain, spinal cord, peripheral nerves, and cerebrovascular system. With the rapid development of medical technologies, neurosurgery has become more precise, minimally invasive, and effective. Modern neurosurgical methods such as robotic surgery, neuronavigation, microsurgery, and artificial intelligence-assisted diagnostics have significantly improved patient outcomes. This article discusses the importance of neurosurgery in medicine, its historical development, modern technologies, major surgical procedures, challenges, and future prospects.

Keywords. Neurosurgery, brain surgery, nervous system, spinal cord, microsurgery, artificial intelligence, neuronavigation.

Annotatsiya. Izoh. Neyroxirurgiya zamonaviy tibbiyotning eng ilg'or va murakkab sohalaridan biri bo'lib, asab tizimiga ta'sir qiluvchi kasalliklarni tashxislash, jarrohlik davolash va reabilitatsiya qilishga qaratilgan. Bu soha miya, orqa miya, periferik nervlar va miya-qon tomir tizimi bilan bog'liq kasalliklarni



davolashda muhim rol o'ynaydi. Tibbiy texnologiyalarning jadal rivojlanishi bilan neyroxirurgiya aniqroq, minimal invaziv va samaraliroq bo'lib qoldi. Robot jarrohlik, neyronavigatsiya, mikroxirurgiya va sun'iy intellekt yordamida diagnostika kabi zamonaviy neyroxirurgik usullar bemorlarning natijalarini sezilarli darajada yaxshiladi. Ushbu maqolada tibbiyotda neyroxirurgiyaning ahamiyati, uning tarixiy rivojlanishi, zamonaviy texnologiyalar, asosiy jarrohlik muolajalari, muammolari va kelajakdagi istiqbollari muhokama qilinadi.

Kalit so'zlar. Neyroxirurgiya, miya xirurgiyasi, asab tizimi, orqa miya, mikroxirurgiya, sun'iy intellekt, neyronavigatsiya.

Аннотация. Нейрохирургия — одна из наиболее передовых и сложных отраслей современной медицины, которая занимается диагностикой, хирургическим лечением и реабилитацией заболеваний нервной системы. Эта область играет важную роль в лечении заболеваний головного мозга, спинного мозга, периферических нервов и цереброваскулярной системы. Благодаря быстрому развитию медицинских технологий нейрохирургия стала более точной, малоинвазивной и эффективной. Современные нейрохирургические методы, такие как роботизированная хирургия, нейронавигация, микрохирургия и диагностика с использованием искусственного интеллекта, значительно улучшили результаты лечения пациентов. В данной статье рассматривается значение нейрохирургии в медицине, ее историческое развитие, современные технологии, основные хирургические вмешательства, проблемы и перспективы на будущее.

Ключевые слова. нейрохирургия, хирургия головного мозга, нервная система, спинной мозг, микрохирургия, искусственный интеллект, нейронавигация.

Neurosurgery is a specialized field of medicine that deals with surgical interventions involving the nervous system. The nervous system is one of the most vital systems of the human body because it controls movement, sensation, cognition,



and coordination of internal organs. Diseases affecting the nervous system can seriously threaten human life and reduce the quality of life. Therefore, neurosurgery has become an essential discipline in healthcare systems around the world.

The importance of neurosurgery has increased due to the growing prevalence of neurological disorders, traumatic brain injuries, spinal diseases, and tumors. Advances in diagnostic imaging technologies such as Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) scans have improved the accuracy of diagnosis and surgical planning.

The history of neurosurgery dates back thousands of years. Ancient civilizations performed primitive skull surgeries known as trepanation to treat head injuries and neurological conditions. However, modern neurosurgery began developing in the late nineteenth and early twentieth centuries with improvements in anesthesia, antiseptics, and surgical instruments.

One of the pioneers of neurosurgery was Harvey Cushing, often referred to as the father of modern neurosurgery. He introduced advanced surgical techniques and reduced mortality rates during brain operations. Since then, neurosurgery has evolved rapidly with the integration of technology and scientific research.

Brain surgery is performed to treat tumors, aneurysms, epilepsy, traumatic injuries, and brain hemorrhages. Brain tumors can be either benign or malignant, and surgical removal is often necessary to save the patient's life.

Spinal neurosurgery focuses on disorders of the spinal cord and vertebral column. Common conditions include herniated discs, spinal tumors, scoliosis, and spinal trauma. Minimally invasive spinal surgery has become increasingly popular because it reduces recovery time and surgical complications.

Pediatric neurosurgery deals with neurological disorders in children, including congenital abnormalities such as hydrocephalus and spina bifida. Early surgical intervention is critical for improving long-term outcomes in pediatric patients.



Functional neurosurgery is used to treat movement disorders and chronic pain. Deep Brain Stimulation (DBS) is an important technique used for patients with Parkinson's disease, epilepsy, and tremors.

Modern neurosurgery heavily depends on advanced technologies that improve surgical precision and patient safety.

Microsurgery uses high-powered microscopes and specialized instruments to perform delicate operations on the brain and nerves. This technique minimizes damage to surrounding tissues.

Neuronavigation functions similarly to a GPS system for the brain. It helps surgeons identify exact surgical locations and avoid critical structures during operations.

Robotic systems allow surgeons to perform highly accurate procedures with minimal invasiveness. These technologies improve surgical outcomes and reduce human error.

Artificial Intelligence (AI) is becoming increasingly important in neurosurgery. AI assists in medical imaging analysis, surgical planning, disease prediction, and robotic control systems. Machine learning algorithms can help identify tumors and neurological abnormalities more efficiently.

Neurosurgery has a crucial role in reducing mortality and disability associated with neurological diseases. It contributes significantly to emergency medicine, trauma care, oncology, and rehabilitation. Neurosurgical interventions can restore lost neurological functions, improve mobility, and extend patient survival.

In emergency situations such as traumatic brain injuries or intracranial bleeding, immediate neurosurgical intervention may save lives. Neurosurgery also improves the quality of life for patients suffering from chronic neurological disorders.

Despite major advances, neurosurgery still faces several challenges. Brain and spinal surgeries are highly complex and require extensive training and expertise.



Surgical risks include infection, bleeding, neurological deficits, and postoperative complications.

Another challenge is the high cost of neurosurgical equipment and treatment, especially in developing countries where access to advanced healthcare technologies may be limited.

Furthermore, ethical concerns related to brain surgery, artificial intelligence, and neurotechnology continue to be discussed in the medical community.

The future of neurosurgery is closely connected with technological innovation. Researchers are developing more advanced robotic systems, neuroprosthetics, brain-computer interfaces, and AI-assisted surgical techniques.

Minimally invasive procedures are expected to become even safer and more effective. Personalized medicine and genetic research may also contribute to improved treatment strategies for neurological diseases.

In the coming decades, neurosurgery will likely continue transforming healthcare by offering new solutions for previously untreatable neurological conditions.

Neurosurgery is an essential and rapidly evolving branch of medicine that plays a vital role in diagnosing and treating disorders of the nervous system. Technological progress has significantly improved surgical accuracy, patient safety, and treatment outcomes. Despite existing challenges, the future of neurosurgery remains promising due to advancements in artificial intelligence, robotics, and minimally invasive techniques. As medical science continues to progress, neurosurgery will remain one of the most important disciplines in modern healthcare.

References

1. Журакулова Н. Х., Ихтиярова Г. А. СОВЕРШЕНСТВОВАНИЕ МЕТОДИКИ ПРЕПОДАВАНИЯ ПО ТЕМЕ «НУКЛЕИНОВЫЕ КИСЛОТЫ» ИНТЕРАКТИВНЫМИ СРЕДСТВАМИ //SCIENCE AND WORLD. – 2013. – С. 30.



2. Jurakulova N. K. Opportunities of e-learning environment to improve the quality of education //European Journal of Research and Reflection in Educational Sciences Vol. – 2019. – Т. 7. – №. 12.

3. Xolmurodova L., Ibragimova Y. UMUMIY VA NOORGANIK KIMYO KURSINING PEDAGOGIK YO'NALTIRILGANLIGI VA TUZILMAVIY TARKIBINING TAMOYILLARI //International Scientific and Practical Conference on Algorithms and Current Problems of Programming. – 2023.

4. Rakhimkulov S. et al. Synthesis and application of zinc oxide nanoparticles //Synthesis. – 2024. – Т. 25. – №. 01.

5. Якубов Э. Ш. и др. Комплексные соединения кобальта (II), меди (II) и цинка с хиначолоном-4 //Universum: химия и биология. – 2019. – №. 3 (57). – С. 72-76.

6. Якубов Э. Ш. и др. Комплексные соединения кобальта (II), меди (II) и цинка с 2-Метоксикарбониламинохиначолоном-4 //Наука, техника и образование. – 2019. – №. 6 (59). – С. 8-12.

7. Якубов Э. Ш. и др. Комплексные соединения кобальта (II), меди (II) и цинка с 2-тиоксо-и 2-алкилтиохиначолоном-4 //Universum: химия и биология. – 2017. – №. 7 (37). – С. 25-29.

8. Якубов Э. Ш. и др. КООРДИНАЦИОННЫЕ СОЕДИНЕНИЯ КОБАЛЬТА (II), МЕДИ (II) И ЦИНКА С 2-АМИНОХИНАЗОЛОНОМ-4 //Universum: химия и биология. – 2022. – №. 5-2 (95). – С. 66-70.

9. Мусаев З. М. и др. Изучение комплексообразования хиначолона-4 с солями кобальта (II) фотометрическим методом //Узб. хим. журн. – 1993. – №. 6. – С. 18-22.

10. Kamolov L. et al. Stachyibotrus toxic microscopic fungus low molecular metabolites //Plant Cell Biotechnology and Molecular Biology. – 2021. – Т. 22. – №. 35-36. – С. 50-61.



11. Jumanov D. T., Tojiyeva S. O., Ubaydullayeva S. H. FŪZA ҲОСИЛДОРЛИГИ ВА СИФАТИНИ ОШИРИШДА УЙҒУНЛАШГАН ТЕХНОЛОГИК ОМИЛЛАРНИ ЎРНИ //International scientific journal of Biruni. – 2024. – Т. 3. – №. 1. – С. 273-279.

12. Ubaydullayeva S. H., Tojiyeva S. O. INGICHKA TOLALI G ‘O ‘ZANING TERMIZ-202 NAVINING HOSILDORLIGIGA TUP QALINLIGI VA CHILPISHNING TA’SIRI //Interpretation and researches. – 2024. – Т. 2. – №. 15. – С. 4-12.

13. Jumanov D. T., Ubaydullayeva S. H., Tojiyeva S. O. SUG ‘ORISH VA O ‘G ‘ITNI G ‘O ‘ZA HOSILDORLIGIGA TA’SIRI //Oriental renaissance: Innovative, educational, natural and social sciences. – 2024. – Т. 4. – №. 6. – С. 435-439.

14. Tojiyeva S., Kamolov L., Naxatov I. STACHYBOTRYS CHARTARUM ZAMBURUG ‘IDAN BA’ZI ALKALOIDLARINI AJRATISH VA ULARNI TUZILISHINI O ‘RGANISH //Theoretical and experimental chemistry and modern problems of chemical technology. – 2023. – Т. 1. – №. 01.

15. Kamolov L. et al. Low molecular metabolites of fungi. 13, 22-Dimethoxystachibotrin from *Stachybotrys chartarum*. – 2022.

16. Алланов А. Б., Таджиев С. М. Сульфат и азотнокислотное разложение фосфоритов //Universum: технические науки. – 2021. – №. 12-4 (93). – С. 37-39.

17. Абдуллаева К. Т. ИННОВАЦИОННАЯ СТРАТЕГИЯ-ЦЕНТРАЛЬНОЕ ЗВЕНО СТРАТЕГИЧЕСКОГО УПРАВЛЕНИЯ ИННОВАЦИОННОЙ ДЕЯТЕЛЬНОСТЬЮ СОВРЕМЕННОЙ ОРГАНИЗАЦИИ //Социально-экономическое развитие России: проблемы, тенденции, перспективы. – 2023. – С. 9-11.



18. Абдуллаева К. Т. и др. ЦЕЛЕНАПРАВЛЕННЫЙ ВОСПИТАНИЕ И ОРГАНИЗОВАННЫЙ ПРОЦЕСС ФОРМИРОВАНИЯ ЛИЧНОСТИ //Academic research in educational sciences. – 2022. – Т. 3. – №. 1. – С. 142-149.

19. Abdullayeva K. T. TECHNOLOGICAL EDUCATION IN THE PROCESSES OF DIRECTING STUDENTS TO THE PROFESSION AND BUSINESS ACTIVITIES //Экономика и социум. – 2024. – №. 11-1 (126). – С. 11-20.

20. Tursunovna A. K. et al. Methods of the Educational System of Science and the Relation of Pedagogy with Other Sciences //Galaxy International Interdisciplinary Research Journal. – Т. 10. – №. 1. – С. 152-155.