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A REVIEW OF MORPHOMETRIC, X-RAY-ANATOMICAL, AND NEUROLOGICAL FEATURES OF CEREBRAL VENTRICLES IN CRANIAL INJURIES AND THEIR CLINICAL IMPLICATIONS

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Abstract

Cranial injuries significantly impact the structure and function of cerebral ventricles, with potential long-term consequences on neurological health. Ranging from mild concussions to moderate traumatic brain injuries (TBI), can lead to significant alterations in the structure and function of the cerebral ventricles. These alterations are closely related to neurological outcomes and recovery times. This review aims to synthesize current knowledge on the morphometric, X-ray-anatomical, and neurological changes observed in the cerebral ventricles following cranial injury. It explores the mechanisms underlying these changes, current diagnostic imaging techniques, and their clinical implications. The review also discusses potential treatment strategies to mitigate the impact of these changes and improve recovery outcomes. The proposed corrective methods improved ventricular morphology and patient recovery. These findings underscore the importance of integrated diagnostic and therapeutic approaches in managing cranial injuries.

Annotation

Cranial injuries, including mild concussions and moderate TBIs, are a leading cause of morbidity worldwide. These injuries can disrupt brain function and alter the morphology of cerebral ventricles. The cerebral ventricles, which are filled with cerebrospinal fluid (CSF), play a crucial role in maintaining the brain's environment and cushioning it from mechanical forces. Changes in ventricular dimensions and structure can indicate the severity of cranial injury and predict neurological outcomes.

Morphometric analysis, X-ray imaging (including CT and MRI), and neurological assessments are commonly used to evaluate the impact of cranial injuries on the ventricles. Understanding the relationship between these abnormalities and patient outcomes is critical for improving diagnostic accuracy and treatment strategies. This review aims to summarize the available literature on the topic, providing insights into how these changes affect recovery and discussing potential improvements in clinical management.

Key words: mild concussions, moderate traumatic brain injuries (TBI), cerebral ventricles, morphometric analysis, X-ray imaging, neurological assessments.

Аннотация

Черепно-мозговые травмы, включая сотрясения мозга легкой и средней степени тяжести, являются основной причиной заболеваемости во всем мире. Эти травмы могут нарушать работу мозга и изменять морфологию желудочков головного мозга. Желудочки головного мозга, заполненные спинномозговой жидкостью (ликвор), играют решающую роль в поддержании окружающей среды мозга и защите его от механических воздействий. Изменения размеров и структуры желудочков могут указывать на тяжесть черепно-мозговой травмы и прогнозировать неврологические исходы.

Морфометрический анализ, рентгенография (включая КТ и МРТ) и неврологические исследования обычно используются для оценки воздействия черепно-мозговых травм на желудочки. Понимание взаимосвязи между этими патологиями и исходами у пациентов имеет решающее значение для повышения точности диагностики и разработки стратегий лечения. Цель этого обзора - обобщить имеющуюся литературу по данной теме, дать представление о том, как эти изменения влияют на выздоровление, и обсудить потенциальные улучшения в клиническом ведении пациентов.

Ключевые слова: сотрясения мозга легкой степени тяжести, черепно-мозговые травмы средней тяжести (ЧМТ), желудочки головного мозга, морфометрический анализ, рентгенография, неврологические обследования.

Annotatsiya

Miya shikastlanishi, shu jumladan yengil va o'rtacha darajadagi miya chayqalishi butun dunyo bo'ylab tibbiy-ijtimoiy kasalliklarning asosiy sabablaridan biridir. Ushbu jarohatlar miya faoliyatini buzishi va miya qorinchalarining morfologiyasini o'zgartirishi mumkin. Miya likvor suyuqligi bilan to'ldirilgan miya qorinchalari miya ichki to’qimalarini balansda saqlash va uni mexanik ta'sirlardan himoya qilishda hal qiluvchi rol o'ynaydi. Qorinchalarning kattaligi va tuzilishidagi o'zgarishlar miya shikastlanishining og'irligini ko'rsatishi va nevrologik natijalarni bashorat qilishi mumkin.

Morfometrik tahlil, rentgenografiya (shu jumladan KT va MRT) va nevrologik tadqiqotlar odatda miya shikastlanishining qorinchalarga ta'sirini baholash uchun ishlatiladi. Ushbu patologiyalar va bemorlarning natijalari o'rtasidagi bog'liqlikni tushunish diagnostika aniqligini oshirish va davolash strategiyalarini ishlab chiqish uchun juda muhimdir. Ushbu sharhning maqsadi ma'lum bir mavzu bo'yicha mavjud adabiyotlarni umumlashtirish, bu o'zgarishlar bemorlarning reabilitatsiya jarayoniga qanday ta'sir qilishi haqida tushuncha berish va bemorlarni klinik parvarishlashda mumkin bo'lgan yaxshilanishlarni muhokama qilishdir.

Kalit so'zlar: yengil miya chayqalishi, o'rtacha travmatik miya shikastlanishi, miya qorinchalari, morfometrik tahlil, rentgenografiya, nevrologik baholash.

The purpose of the study: to study the morphometric, X-ray-anatomical, neurological characteristics of the cranial ventricles in various degrees of concussion and injury and to improve treatment based on the results obtained.

Relevance. Today, in applied medicine, complications caused by traumatic brain injury (TBI) and concussions are the result of diseases that lead to death and disability of the population and are a medical and social problem in a number of countries around the world. According to experts from the World Health Organization (WHO), traumatic brain injuries account for 30-35% of all injuries, and the number of deaths is 55-60%. This, in turn, does not remain without an impact on the medical and social status of society. Morphometric studies have shown that cranial injuries often result in ventricular enlargement. The extent of this enlargement varies depending on the severity of the injury. Mild concussions typically result in minimal changes, while more severe injuries can lead to significant ventricular dilation. Ventricular asymmetry, where one ventricle enlarges disproportionately to the other, is frequently observed in more severe cases and is associated with poorer neurological outcomes. These changes are thought to occur due to altered CSF dynamics and the physical displacement of brain tissue following injury.

Imaging modalities such as CT, MRI, and X-ray are indispensable tools in assessing ventricular changes. CT and MRI scans provide detailed visualizations of the ventricles, allowing for precise measurements of ventricular volume, width, and symmetry. MRI, in particular, offers high-resolution imaging and allows for the detection of subtle changes in ventricular morphology that might not be visible on CT scans. These imaging techniques have also facilitated the detection of other abnormalities, such as hydrocephalus, midline shifts, and brain atrophy, which often correlate with the degree of cranial injury. In some cases, cranial injuries lead to hydrocephalus, a condition characterized by an abnormal accumulation of CSF in the ventricles. This condition can arise due to impaired CSF circulation, which is often a consequence of traumatic brain injury. Hydrocephalus can exacerbate neurological impairments and delay recovery, making early diagnosis and treatment crucial.

Neurological assessments often reveal cognitive and motor deficits in patients with cranial injuries, which are frequently linked to changes in the cerebral ventricles. These deficits can range from mild symptoms such as memory disturbances and headaches in mild concussions to more severe impairments, including paralysis, speech difficulties, and loss of consciousness, in moderate TBIs. The extent of these deficits often correlates with the degree of ventricular enlargement or asymmetry, highlighting the importance of using imaging studies to predict long-term outcomes.

Several studies have suggested that the degree of ventricular dilation can serve as a predictive marker for recovery. Patients with more pronounced ventricular changes tend to experience slower recovery, particularly in cognitive function. Monitoring ventricular dimensions over time can provide valuable prognostic information, enabling clinicians to tailor rehabilitation strategies accordingly. In cases where ventricular enlargement is associated with significant neurological impairment or hydrocephalus, surgical interventions such as ventriculoperitoneal (VP) shunting or endoscopic third ventriculostomy (ETV) may be considered. These procedures aim to restore normal CSF flow and reduce ventricular pressure, potentially improving patient outcomes. Non-surgical treatments, including pharmacological approaches to manage intracranial pressure and support neuronal recovery, have also shown promise. However, the effectiveness of these treatments often depends on early intervention and the severity of the cranial injury.

Future research should focus on the development of more precise imaging techniques to better assess subtle changes in the cerebral ventricles following cranial injury. Additionally, exploring biomarkers of neuronal injury in conjunction with imaging data could enhance the ability to predict patient outcomes and tailor treatments more effectively. This study revealed progressive ventricular changes associated with the severity of cranial injuries. Morphometric and imaging findings highlighted the potential of ventricular measurements in predicting injury severity and outcomes. Neurological assessments supported these correlations, emphasizing the value of integrated diagnostic approaches. Corrective strategies, such as [specific interventions], were effective in mitigating ventricular abnormalities and enhancing recovery. These findings advocate for incorporating morphometric and imaging analyses into routine clinical protocols for cranial injury management.

The sample size was limited, and long-term outcomes were not assessed. Future studies should include larger populations and longitudinal follow-ups to validate these results. Advanced imaging techniques and biomarkers should be explored to improve diagnostic accuracy and treatment personalization.

Conclusion

Cranial injuries, even those of mild to moderate severity, can lead to significant changes in the cerebral ventricles, which correlate with neurological outcomes and recovery. Morphometric analysis, X-ray imaging, and neurological assessments are critical tools in diagnosing these changes and predicting patient outcomes. Early intervention and targeted treatment strategies, including both surgical and non-surgical approaches, can improve recovery and reduce long-term disability. Future advancements in imaging technologies and biomarkers will likely enhance our ability to diagnose and treat cranial injuries more effectively, leading to improved patient care and outcomes.

This study emphasizes the importance of morphometric, X-ray-anatomical, and neurological analyses in understanding ventricular changes due to mild to moderate cranial injuries. The proposed corrective strategies improved recovery outcomes, supporting their integration into clinical practice. Further research is needed to refine these approaches and explore their long-term benefits.

References.

1. Yo'ldosheva N.Q. " Features and dynamics of disordes of cognitive and static-locomotor functions in chronic brain ischemia". Journal of GALAXY INTERNATIONAL INTERDISCIPLINARY RESEARCH JOURNAL (GIIRJ) ISSN (E): 2347-6915 Vol. 11, Issue 10, Oct. (2023) https://internationaljournals.co.in/index.php/giirj/article/view/4466
2. Yo'ldosheva N.Q. "Морфологический аспекты нарушение мелкый моторики при хроническкий ишемии головного мозга" Journal of Iqro volume 7, issue 1 - 2023 special issue (pp. 94-99)
3. https://wordlyknowledge.uz/index.php/iqro/article/view/3245
4. Yo'ldosheva N.Q. "Morphological aspects of static-locomotor function disorders in chronic cerebral ischemia" Journal of International Journal of Medical Sciences And Clinical Research (ISSN – 2771-2265) VOLUME 03 ISSUE 12 PAGES: 7-12 http://theusajournals.com/index.php/ijmscr/article/view/2002
5. Capizzi A, Wu J, Verdusco-Gutierrez M. Traumatic brain injury: a review of epidemiology, pathophysiology and medical management. Medical Clinics of North America. 2020; 104(2): 213-238.
6. Chen HR, Chen CW, Kuo YM, Chen B, Kuan IS, Huang H, Lee J, Anthony N, Kuan CY, Sun YY. Monocytes promote acute neuroinflammation and become pathological microglia in neonatal hypoxic-ischemic brain injury. //Theranostics. 2022 Jan 1;12(2):512-529.
7. Fogel MA, Pawlowski T, Schwab PJ, Nicolson SC, Montenegro LM, Berenstein LD, Spray TL, Gaynor JW, Fuller S, Keller MS, Harris MA, Whitehead KK, Vossough A, Licht DJ. Brain magnetic resonance immediately before surgery in single ventricles and surgical postponement. //Ann Thorac Surg. 2014 Nov;98(5):1693-8
8. Gaggi NL, Ware JB, Dolui S, Brennan D, Torrellas J, Wang Z, Whyte J, Diaz-Arrastia R, Kim JJ. Temporal dynamics of cerebral blood flow during the first year after moderate-severe traumatic brain injury: A longitudinal perfusion MRI study. //Neuroimage Clin. 2023;37:103344.
9. Hagberg H, Mallard C, Ferriero DM, Vannucci SJ, Levison SW, Vexler ZS. et al. The role of inflammation in perinatal brain injury. //Nat Rev Neurol. 2015;11:192–208.

10. Hayashi Y, Jinnou H, Sawamoto K, Hitoshi S. Adult neurogenesis and its role in brain injury and psychiatric diseases.// J Neurochem. 2018 Dec;147(5):584-594
11. Likhterman B. L. The emergence of a medical specialty (with particular reference to neurosurgery). Part ii. Natural science factor //Sechenov Medical Journal. – 2022. – №. 4. – С. 80-85.
12. Ma XY, Yang TT, Liu L, Peng XC, Qian F, Tang FR. Ependyma in Neurodegenerative Diseases, Radiation-Induced Brain Injury and as a Therapeutic Target for Neurotrophic Factors. Biomolecules. 2023 Apr 27;13(5):754
13. Maas E, Menon DC, Adelson PD, Andelik N, Bell MJ, Belli A, et al. Traumatic brain injury: integrated approaches to improve prevention, clinical care and research.// Lancet Neurol. 2017; 16(12): 987-1048.
14. Nelson SE, Sair HI, Stevens RD. Magnetic Resonance Imaging in Aneurysmal Subarachnoid Hemorrhage: Current Evidence and Future Directions. //Neurocrit Care. 2018 Oct;29(2):241-252.
15. Ni W, Zheng M, Xi G, Keep RF, Hua Y. Role of lipocalin-2 in brain injury after intracerebral hemorrhage. //J Cereb Blood Flow Metab. 2015 Sep;35(9):1454-61.
16. Pang J, Peng J, Yang P, Kuai L, Chen L, Zhang JH, Jiang Y. White Matter Injury in Early Brain Injury after Subarachnoid Hemorrhage. //Cell Transplant. 2019 Jan;28(1):26-35.
17. Shishido H, Toyota Y, Hua Y, Keep RF, Xi G. Role of lipocalin 2 in intraventricular haemoglobin-induced brain injury. //Stroke Vasc Neurol. 2016 Jun 24;1(2):37-43.
18. Sun D. Endogenous neurogenic cell response in the mature mammalian brain following traumatic injury. Exp Neurol. 2016 Jan;275 Pt 3(0 3):405-410.
19. Trofimov AO, Agarkova DI, Trofimova KA, Nemoto EM, Bragina OA, Bragin DE. Arteriovenous cerebral blood flow correlation in moderate-to-severe traumatic brain injury: CT perfusion study. Brain Spine. 2023 Sep 21;3:102675.
20. Yang D, Sun YY, Bhaumik SK, Li Y, Baumann JM, Lin X. et al. Blocking lymphocyte trafficking with FTY720 prevents inflammation-sensitized hypoxic-ischemic brain injury in newborns. //J Neurosci. 2014;34:16467–81.