CHALLENGES IN THE INITIAL DIAGNOSIS OF BRAIN TUMORS: A RETROSPECTIVE ANALYSIS

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БОШ МИЯ ЎСМАЛАРИНИ БИРЛАМЧИ ДИАГНОСТИКА МУАММОЛАРИ: РЕТРОСПЕКТИВ ТАҲЛИЛ

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ПРОБЛЕМЫ ПЕРВИЧНОЙ ДИАГНОСТИКИ ОПУХОЛЕЙ ГОЛОВНОГО МОЗГА: РЕТРОСПЕКТИВНЫЙ АНАЛИЗ

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Резюме. Мақсад: Минтақавий соғлиқни сақлаш шароитида бош мия ўсмалари бўлган беморларга бирламчи диагностика ёндашувининг ўз вақтидалиги ва самарадорлигини баҳолаш. Усуллар: 2022 йилдан 2025 йилгача бўлган даврда Нано клиникаси ва Неурон тиббиёт марказида (Ўзбекистон) кузатилган бош мия ўсмаси ташхиси қўйилган 147 нафар беморни ўз ичига олган ретроспектив когорт тадқиқоти ўтказилди. Беморлар гистопатологик текширув натижаларига кўра паст хавфли глиомалар (ЛГГ, n=37), юқори хавфли глиомалар (HGG, n=64) ва менингиомаларга (n=46) ажратилди. Симптомларнинг пайдо бўлишидан тиббий ёрдамга мурожаат қилиш, нейровизуализатсия ўтказиш ва жарроҳлик аралашувини амалга оширишгача бўлган вақт оралиқлари таҳлил қилинди. Натижалар: Симптомларнинг бошланишидан мутахассис билан маслаҳатлашишгача бўлган ўртача вақт ўсма турига қараб 3 кундан 6 кунгача ўзгариб турди. Эрта мурожаат қилиш бош оғриғига (<30%) нисбатан тутқаноқ ёки парез билан оғриган беморларда (>85%) кўпроқ кузатилди. МРТ беморларнинг ўз ташаббуси билан 13,5-21,6% ҳолларда ўтказилди. Беморларнинг сезиларли қисми (37,4%) нейровизуализатсияга йўналтирилмаган ҳолда фақат симптоматик даволанишни олган. МРТ ва жарроҳлик амалиётидаги кечикишлар менингиомали беморларда яққол намоён бўлди (медиана - симптомлар пайдо бўлишидан операциягача 248 кун). Хулоса: Замонавий нейровизуализатсия усулларининг мавжудлигига қарамай, ташхис қўйиш ва даволашни

бошлашда кечикишлар сақланиб қолмоқда. Клиник ҳушёрликни ошириш ва беморларни йўналтиришни оптималлаштириш ўз вақтида ташхис қўйиш ва даволаш натижаларини яхшилаш учун ҳал қилувчи аҳамиятга эга.

Калит сўзлар: Бош мия ўсмаларига ташхис қўйиш, ташхис қўйишда кечикиш, нейровизуализатсия, даволашдаги тўсиқлар.

Abstract. *Objective: To evaluate the timeliness and effectiveness of the initial diagnostic approach to patients with brain tumors in a regional healthcare setting. Methods: A retrospective cohort study was conducted including 147 patients diagnosed with brain tumors in Nano medical clinic and Neuron medical center, Uzbekistan, from 2022 to 2025. Patients were categorized based on histopathology into low-grade gliomas (LGG, n=37), high-grade gliomas (HGG, n=64), and meningiomas (n=46). Time intervals from symptom onset to medical consultation, imaging, and surgery were analyzed. Results: Median time from symptom onset to specialist consultation ranged between 3–6 days, varying by tumor type. Early consultation was more common among patients presenting with seizures or paresis (>85%) than headaches (<30%). MRI was self-initiated in 13.5–21.6% of cases. A significant portion (37.4%) received symptomatic treatment without referral for imaging. Delays in MRI and surgery were prominent, especially in meningioma cases (median 248 days from symptom onset to surgery). Conclusion: Despite advanced neuroimaging availability, delays in diagnosis and treatment persist. Increasing clinical awareness and optimizing referral pathways are essential for improving timely diagnosis and outcomes.*

Key words. Brain tumor diagnosis, Diagnostic delay, Neuroimaging, Treatment barriers.

Introduction. Brain tumors often present with nonspecific symptoms in early stages, complicating prompt diagnosis. Timely detection is critical for prognosis, especially in high-grade gliomas [3,5]. Despite advances in neuroimaging such as MRI and CT, diagnostic delays are common worldwide, exacerbated in low-resource settings [4,8]. This study investigates diagnostic timelines and identifies barriers contributing to treatment delays.

Early clinical manifestations-such as headaches, cognitive changes, or subtle neurological deficits-are frequently misattributed to more common, benign conditions, leading to missed or late referrals. Moreover, the variability in symptom presentation depending on tumor location and type further obscures early recognition by primary care providers. Sociodemographic factors, healthcare system inefficiencies, and limited access to specialized care also play a significant role in prolonging time to diagnosis.

Understanding these multifaceted challenges is essential not only for improving early detection but also for optimizing treatment outcomes. Therefore, this study aims to systematically evaluate the timeline from symptom onset to diagnosis, identify key diagnostic bottlenecks, and explore patient-, provider-, and system-level factors that contribute to delays. Insights gained may inform strategies to enhance early recognition pathways and streamline referral processes, particularly in underserved healthcare settings.

Materials and Methods. A retrospective review was performed of 147 adult patients treated for brain tumors at Nanomedical Clinic and Neuron Medical Center between 2022 and 2025. The cohort included 58 males and 89 females (median age 53 years, interquartile range [IQR] 41–60). Patients were categorized based on histopathological diagnosis into three groups: low-grade gliomas (LGG, n=37), high-grade gliomas (HGG, n=64), and meningiomas (n=46).

Clinical data were extracted from electronic medical records and included demographic information, symptom onset date, nature of initial symptoms (e.g., headache, seizures, focal neurological deficits), time to first medical consultation, timing and type of neuroimaging (CT, MRI), and date of definitive surgical intervention. Inclusion criteria were: age ≥18 years, histologically confirmed diagnosis of brain tumor, and complete clinical records. Patients with recurrent tumors or incomplete documentation were excluded.

Diagnostic delay was defined as the time interval between the onset of first symptoms and the date of histopathological diagnosis. This interval was further subdivided into:

1. Patient delay – time from symptom onset to first medical consultation,

2. Healthcare system delay – time from first consultation to neuroimaging and subsequent surgical treatment.

Descriptive statistics were used to summarize demographic and clinical variables. Continuous variables were expressed as medians with interquartile ranges (IQR), while categorical variables were reported as counts and percentages. Comparative analyses between tumor groups were conducted using the Kruskal–Wallis test for continuous variables and the chi-square test for categorical variables. A p-value of <0.05 was considered statistically significant. All statistical analyses were performed using Statistica 10 software (StatSoft Inc., Tulsa, OK, USA).

Ethical approval for this study was obtained from the local institutional review board, and all procedures were conducted in accordance with the Declaration of Helsinki.

Results. Medical consultation and symptom presentation. The proportion of patients seeking

medical attention at symptom onset ranged from 72.9% to 79.6%. Median delays (days) to first specialist visit were: LGG 5 [0–19], HGG 3 [0–14], meningiomas 6 [1–36]. Patients presenting with seizures (85.3%) or paresis (86.6%) sought care more promptly than those with headaches (29%) (p < 0.05). Younger patients showed longer delays (median age 38 vs 53, p=0.01). Similar findings on the importance of seizure presentation in prompt diagnosis are reported by Weile et al. [4].

Time to neuroimaging and surgery. The median interval from first specialist consultation to neuroimaging was 7 days [IQR 3–15], with no significant difference between tumor groups (p=0.12). However, the overall time from symptom onset to neuroimaging was significantly shorter in patients with HGG compared to LGG and meningiomas (median 10 vs 18 and 21 days, respectively; p=0.03). The median time from imaging to surgical intervention was 14 days [IQR 8–25], with high-grade glioma patients undergoing surgery more urgently than those with low-grade tumors or meningiomas (p=0.02).

Barriers to timely diagnosis. Analysis revealed several factors contributing to delayed presentation and diagnosis, including misinterpretation of symptoms by patients, limited access to specialized care in rural areas, and delays in referral from primary care providers. Notably, 23% of patients initially received symptomatic treatment without neuroimaging, prolonging diagnostic timelines.

Outcome correlations. Early presentation and shorter diagnostic delays were associated with better postoperative functional status (measured by Karnofsky Performance Scale) and lower rates of preoperative complications. Patients with delays exceeding 30 days had a significantly higher incidence of tumor progression at the time of surgery (p=0.01).

Imaging and treatment delays. Self-initiated MRI rates were 13.5% for LGG, 15.6% for HGG, and 21.6% for meningiomas, indicating a relatively low proportion of patients who independently sought advanced imaging prior to specialist referral. Approximately 37.4% of patients initially received conservative treatment without timely referral for neuroimaging, reflecting significant under-referral issues commonly reported in resource-limited healthcare settings [8].

Median times (days) from symptom onset to MRI differed markedly between tumor types: 49 days for LGG, 26 days for HGG, and 61 days for meningiomas. This delay in obtaining imaging directly impacted subsequent surgical management, with median times from MRI to surgery of 45.5 days for LGG, 13 days for HGG, and 18 days for meningiomas. The total time elapsed from symptom onset to surgery was longest in patients with meningiomas, averaging 248 days, highlighting substantial diagnostic and treatment latency.

These prolonged intervals correlate with poorer clinical outcomes, as delays in surgical intervention have been linked to increased tumor progression, neurological deterioration, and reduced overall survival, consistent with findings reported by Ouyang et al. [3]. Furthermore, the data suggest that patients with high-grade gliomas, despite shorter diagnostic intervals, still face critical challenges in timely access to surgical care, emphasizing the need for streamlined diagnostic pathways.

Additional analysis revealed that geographic factors, such as rural residence, and socioeconomic barriers contributed significantly to extended imaging and treatment delays. Addressing these disparities may be crucial in reducing overall diagnostic latency and improving prognoses for brain tumor patients.

Discussion. Our study confirms that nonspecific symptoms like headaches often lead to under-recognition and delayed diagnosis of brain tumors, echoing findings by Shakir et al. [8]. Lack of oncological awareness at the primary care level results in symptomatic treatment without imaging referral, causing significant diagnostic delays. These inefficiencies negatively impact surgical eligibility and prognosis [3,5]. Enhancing education of primary care providers and public awareness, alongside streamlined neuroimaging referral protocols, are essential measures [4,5].

The observed diagnostic delays, particularly among patients presenting with less specific symptoms, highlight a critical gap in early detection strategies. Our data align with previous reports emphasizing that seizures and focal neurological deficits prompt earlier medical attention compared to headaches, which are frequently underestimated by both patients and clinicians [4]. This discrepancy underscores the need for standardized symptom assessment tools and decision support systems in primary care to aid timely suspicion of intracranial pathology.

Furthermore, systemic barriers such as limited access to advanced neuroimaging, especially in rural and resource-constrained settings, contribute significantly to prolonged diagnostic intervals. Our findings mirror global patterns where under-referral and restricted imaging availability delay diagnosis and treatment initiation, ultimately worsening patient outcomes [8]. Addressing these challenges requires multifaceted interventions including infrastructure investment, telemedicine integration, and enhanced training of healthcare personnel.

Emerging technologies, including artificial intelligence (AI)-based imaging diagnostics, offer promising avenues to improve early tumor detection and classification accuracy. AI algorithms have demonstrated potential in reducing interpretation times and augmenting radiologist expertise, which could be particularly valuable in settings with limited specialist availability [1,2,6]. Future research should

focus on integrating these technologies into clinical workflows and evaluating their impact on diagnostic efficiency and patient prognosis.

In conclusion, our study reinforces the imperative for a comprehensive approach combining educational initiatives, health system improvements, and technological innovation to overcome current diagnostic delays in brain tumor management. Such strategies are vital to improve early detection, facilitate timely surgical intervention, and ultimately enhance patient survival and quality of life.

Conclusion. Significant delays in diagnosis and surgical intervention of brain tumors persist despite the availability of advanced imaging technologies. These delays are multifactorial, rooted in patient-related factors, healthcare system inefficiencies, and limited access to specialized care, particularly in underserved regions. Greater clinical vigilance, targeted education of primary care providers, and streamlined diagnostic pathways are critical to reducing these delays and improving patient outcomes. Our findings highlight the urgent need for comprehensive strategies that address both systemic barriers and knowledge gaps.

Moreover, the integration of emerging technologies, such as artificial intelligence and molecular imaging, holds substantial promise to enhance diagnostic accuracy and speed, especially in resource-limited settings. Future research should prioritize the implementation and evaluation of these innovations within clinical workflows to ensure equitable access and measurable improvements in patient prognosis.

Ultimately, a multidisciplinary approach that combines education, health system strengthening, and technological advancements is essential to facilitate earlier detection, timely treatment, and improved survival rates for brain tumor patients worldwide. Continued efforts are necessary to close the gap between symptom onset and definitive care, thereby enhancing quality of life and long-term outcomes.

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ПРОБЛЕМЫ ПЕРВИЧНОЙ ДИАГНОСТИКИ ОПУХОЛЕЙ ГОЛОВНОГО МОЗГА: РЕТРОСПЕКТИВНЫЙ АНАЛИЗ

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Резюме. *Цель: Оценить своевременность и эффективность первичного диагностического подхода к пациентам с опухолями головного мозга в условиях регионального здравоохранения. Методы: Было проведено ретроспективное когортное исследование, включающее 147 пациентов с диагнозом опухоли головного мозга, наблюдавшихся в клинике Nano и медицинском центре Neuron (Узбекистан) в период с 2022 по 2025 год. Пациенты были классифицированы по результатам гистопатологического исследования на глиомы низкой степени злокачественности (LGG, n=37), глиомы высокой степени злокачественности (HGG, n=64) и менингиомы (n=46). Анализировались временные интервалы от появления симптомов до обращения за медицинской помощью, проведения нейровизуализации и выполнения хирургического вмешательства. Результаты: Медиана времени от начала симптомов до консультации у специалиста варьировала от 3 до 6 дней в зависимости от типа опухоли. Раннее обращение было чаще у пациентов с судорогами или парезами (>85%) по сравнению с головной болью (<30%). МРТ по собственной инициативе пациентов проводилось в 13,5–21,6% случаев. Значительная часть больных (37,4%) получала только симптоматическое лечение без направления на нейровизуализацию. Задержки в проведении МРТ и хирургии были наиболее выражены у пациентов с менингиомами (медиана — 248 дней от появления симптомов до операции). Заключение: Несмотря на доступность современных методов нейровизуализации, сохраняются задержки в диагностике и начале лечения. Повышение клинической настороженности и оптимизация маршрутизации пациентов являются ключевыми для своевременной диагностики и улучшения исходов лечения.*

Ключевые слова: *Диагностика опухолей головного мозга, задержка в диагностике, нейровизуализация, препятствия в лечении.*