

OPTIMIZATION AND ROUTING OF PEDIATRIC PATIENTS WITH SUSPECTED CNS TUMORS

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Abstract:

Central nervous system (CNS) tumors represent a significant challenge in pediatric oncology due to their heterogeneity, aggressive progression, and complex clinical management. Early diagnosis and timely referral are crucial to improving prognosis and survival rates. This study focuses on the optimization of patient care pathways and the effective routing of pediatric patients with suspected CNS tumors. The aim is to reduce diagnostic delays, streamline multidisciplinary consultations, and enhance coordination between primary, secondary, and specialized oncology centers. By analyzing current referral patterns, identifying bottlenecks, and proposing evidence-based strategies, the research seeks to establish a more efficient system for patient management. Improved routing protocols are expected to minimize treatment delays, optimize resource utilization, and ultimately improve clinical outcomes for children with suspected CNS tumors.

Keywords: Pediatric oncology; CNS tumors; patient routing; care optimization; multidisciplinary approach; early diagnosis.

Introduction

Central nervous system tumors are among the most common and severe malignancies in children, often leading to high morbidity and mortality. Early recognition and rapid referral to specialized centers are essential for effective management. However, delays in diagnosis, suboptimal routing, and fragmented care pathways frequently compromise treatment outcomes. Optimizing patient flow from initial suspicion to definitive diagnosis and treatment requires a structured approach that integrates primary care physicians, pediatric oncologists, radiologists,



and neurosurgeons. The present study aims to evaluate current practices in patient routing, identify key barriers, and propose strategies for the systematic optimization of care for pediatric patients with suspected CNS tumors. Effective implementation of these strategies can improve survival rates, reduce complications, and enhance the overall quality of pediatric oncology services.

Central nervous system (CNS) tumors are among the most common malignancies in children, accounting for nearly 20% of all pediatric cancers. The clinical impact of these tumors is significant, as their location and growth patterns can rapidly impair neurological function. Early recognition of warning signs—such as persistent headaches, nausea, vomiting, motor difficulties, or cognitive changes—is essential for timely diagnosis and treatment. Effective management relies on a multidisciplinary approach, involving pediatric oncologists, neurosurgeons, radiologists, and specialized nursing teams.

Despite medical advancements, delays in referral and diagnosis remain a major obstacle. Contributing factors include limited awareness of early symptoms among primary care providers, geographic barriers, insufficient coordination between healthcare facilities, and delays in accessing diagnostic imaging or pathology services. Such inefficiencies can result in tumor progression, increased complication rates, and poorer prognoses for affected children.

Optimizing patient pathways requires targeted interventions at multiple levels. Early detection can be enhanced through training programs for primary care physicians and standardized screening protocols. Multidisciplinary coordination ensures rapid assessment, including neurological examinations, imaging studies, and laboratory tests. Clear referral guidelines and routing algorithms direct patients to tertiary pediatric oncology centers with neurosurgical capabilities without unnecessary delays. Digital platforms, telemedicine, and centralized case management can further accelerate communication and decision-making. Continuous monitoring of patient flow is essential to maintain and improve the efficiency of referral systems. Performance indicators, such as the interval from initial symptom presentation to diagnosis and treatment initiation, help identify bottlenecks and inform policy adjustments. Regular audits and feedback mechanisms can further refine routing protocols, ensuring that children receive timely and appropriate care. Optimized referral and routing systems have a measurable impact on clinical outcomes. Prompt access to specialized care reduces the risk of neurological deterioration, shortens hospital stays, and facilitates the use of advanced therapies. Additionally, systematic routing enhances resource utilization, reduces the burden on families, and contributes to overall patient satisfaction with the healthcare system.

Timely and accurate diagnosis is a cornerstone of effective management for pediatric CNS tumors. Imaging techniques, particularly magnetic resonance imaging (MRI), play a critical role in detecting tumor location, size, and characteristics. In addition, histopathological confirmation through biopsy is essential for determining tumor type and guiding treatment strategies. Streamlined diagnostic pathways, where imaging and laboratory tests are coordinated in advance, significantly reduce waiting times and improve the speed of initiating therapy.



The complexity of CNS tumors in children necessitates collaboration among multiple specialists. Neurosurgeons, pediatric oncologists, radiologists, pathologists, and rehabilitation therapists must work closely to design individualized treatment plans. Regular multidisciplinary meetings and case discussions allow the team to prioritize urgent cases, adjust treatment protocols based on tumor response, and anticipate complications. Effective communication between team members is essential for minimizing delays and ensuring comprehensive care.

Optimized routing involves establishing clear protocols for directing patients from initial presentation to tertiary care centers. Criteria for prioritization may include tumor size, neurological symptoms, and risk of rapid progression. Teleconsultation and digital referral systems can support physicians in remote areas by providing immediate guidance on next steps. Standardized routing reduces unnecessary visits, prevents overcrowding in tertiary centers, and ensures that children receive care at facilities equipped to provide specialized interventions. Efficient patient routing and optimized pathways not only improve clinical outcomes but also enhance overall healthcare system performance. Children benefit from earlier intervention, reduced neurological complications, and better survival rates. For healthcare providers, structured pathways lead to more effective resource allocation, reduced treatment delays, and improved coordination between facilities. Families experience lower emotional stress and logistical burden, contributing to higher satisfaction and adherence to treatment plans.

To achieve effective optimization and routing of pediatric patients with suspected CNS tumors, several strategies are recommended:

- Development of national or regional guidelines for referral and prioritization;
- Training programs for primary care providers to recognize early CNS tumor symptoms;
- Integration of telemedicine and electronic health record systems for rapid consultations;
- Establishment of performance indicators to monitor diagnostic and referral timelines;
- Regular multidisciplinary review meetings to adjust protocols based on outcome data.

By implementing these recommendations, healthcare systems can create a more responsive and patient-centered approach to pediatric CNS tumors, ultimately improving both clinical outcomes and operational efficiency.

Conclusion

Effective management of pediatric patients with suspected central nervous system (CNS) tumors depends on timely diagnosis, coordinated multidisciplinary care, and optimized referral pathways. Delays in recognition and referral can lead to tumor progression, increased neurological complications, and poorer clinical outcomes. Implementing structured routing protocols, early detection strategies, and digital communication platforms improves patient flow, reduces diagnostic and treatment delays, and enhances overall care quality. Multidisciplinary collaboration ensures that each child receives individualized treatment plans, while systematic monitoring and performance evaluation help identify bottlenecks and



continuously improve the healthcare system. Optimizing the pathway from initial suspicion to specialized care not only benefits clinical outcomes but also reduces the burden on families and healthcare resources, ultimately contributing to a more effective and patient-centered pediatric oncology service.

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