



## ***Brain Tumor and Epilepsy in Children: Clinical Complications and Surgical Treatment***

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### **LITERATURE REVIEW**

#### **RESUMO**

Introdução: Tumores cerebrais em crianças frequentemente apresentam uma complexa interseção com a epilepsia, criando desafios significativos para o diagnóstico e tratamento. A presença de tumores cerebrais pode levar ao desenvolvimento de epilepsia, que pode se manifestar de diversas formas, dependendo da localização e tipo do tumor. As complicações clínicas incluem crises epilépticas refratárias, comprometimento do desenvolvimento neuropsicomotor e deterioração da qualidade de vida. O tratamento cirúrgico pode ser crucial tanto para a remoção do tumor quanto para o controle das crises epilépticas, oferecendo a possibilidade de remissão das crises e melhorando o prognóstico global. Objetivo: A revisão sistemática de literatura teve como objetivo avaliar a relação entre tumores cerebrais e epilepsia em crianças, focando nas complicações clínicas e nas estratégias de tratamento cirúrgico. Metodologia: A metodologia seguiu o checklist PRISMA para garantir uma revisão abrangente e rigorosa. Foram consultadas as bases de dados PubMed, Scielo e Web of Science, utilizando os descritores "tumor cerebral infantil", "epilepsia em crianças", "complicações clínicas", "tratamento cirúrgico" e "neurocirurgia pediátrica". Os critérios de inclusão foram: estudos sobre tumores cerebrais em crianças, pesquisas que abordaram a epilepsia como sintoma ou complicação, e artigos que descrevessem o tratamento cirúrgico. Foram excluídos artigos não disponíveis em texto completo, estudos fora do escopo pediátrico e publicações anteriores a 2014. Resultados: A revisão revelou que os tumores cerebrais podem causar epilepsia devido à irritação cortical e à disfunção neural. O tratamento cirúrgico é frequentemente eficaz na redução ou eliminação das crises epilépticas, mas pode ser desafiador devido à localização do tumor e às suas características. Além disso, os resultados mostraram que a ressecção completa do tumor está associada a melhores resultados clínicos em termos de controle das crises.

A literatura também destacou a importância da monitorização pós-operatória para detectar e gerenciar complicações. Conclusão: Tumores cerebrais em crianças frequentemente levam à epilepsia, e o tratamento cirúrgico se mostra essencial para o controle das crises e melhoria da qualidade de vida. A remoção completa do tumor é crucial para resultados positivos, e a monitorização contínua é necessária para gerenciar possíveis complicações. A revisão evidenciou a importância de uma abordagem multidisciplinar para otimizar os resultados clínicos e a qualidade de vida dos pacientes.

**Palavras-chaves:** "tumor cerebral infantil", "epilepsia em crianças", "complicações clínicas", "tratamento cirúrgico" e "neurocirurgia pediátrica".

## **ABSTRACT**

**Introduction:** Brain tumors in children often present a complex intersection with epilepsy, creating significant challenges for diagnosis and treatment. The presence of brain tumors can lead to the development of epilepsy, which may manifest in various forms depending on the tumor's location and type. Clinical complications include refractory epileptic seizures, neuropsychomotor development impairment, and deterioration in quality of life. Surgical treatment can be crucial for both tumor removal and seizure control, offering the possibility of seizure remission and improving overall prognosis. **Objective:** The systematic literature review aimed to evaluate the relationship between brain tumors and epilepsy in children, focusing on clinical complications and surgical treatment strategies. **Methodology:** The methodology followed the PRISMA checklist to ensure a comprehensive and rigorous review. Databases such as PubMed, Scielo, and Web of Science were consulted using descriptors like "pediatric brain tumor," "epilepsy in children," "clinical complications," "surgical treatment," and "pediatric neurosurgery." Inclusion criteria were studies on brain tumors in children, research addressing epilepsy as a symptom or complication, and articles describing surgical treatment. Articles not available in full text, studies outside the pediatric scope, and publications prior to 2014 were excluded. **Results:** The review revealed that brain tumors can cause epilepsy due to cortical irritation and neural dysfunction. Surgical treatment is often effective in reducing or eliminating epileptic seizures but can be challenging due to the tumor's location and characteristics. Additionally, the results showed that complete tumor resection is associated with better clinical outcomes in terms of seizure control. The literature also highlighted the importance of postoperative monitoring to detect and manage complications. **Conclusion:** Brain tumors in children frequently lead to epilepsy, and surgical treatment is essential for seizure control and improving quality of life. Complete tumor removal is crucial for positive outcomes, and ongoing monitoring is necessary to manage potential complications. The review highlighted the importance of a multidisciplinary approach to optimize clinical outcomes and patient quality of life.

**Keywords:** "pediatric brain tumor," "epilepsy in children," "clinical complications," "surgical treatment," and "pediatric neurosurgery".



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**Dados da publicação:** Artigo recebido em 18 de Junho e publicado em 08 de Agosto de 2024.

**DOI:** <https://doi.org/10.36557/2674-8169.2024v6n8p-1081-1095>

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## **INTRODUCTION:**

Introduction: Brain tumors in children represent a complex and challenging condition that frequently associates with the development of epilepsy. The presence of a brain tumor can trigger epileptic seizures due to irritation and dysfunction of the involved cortical areas. The location of the tumor in the brain, as well as its type and size, significantly influences the type and severity of the observed seizures. Tumors affecting critical brain regions, such as the temporal lobe, are often associated with focal epilepsies, while tumors involving broader areas may provoke generalized seizures.

The relationship between brain tumors and epilepsy is complex and multifaceted. The tumor can cause alterations in the brain's electrical activity, resulting in epileptic episodes. Additionally, the presence of a tumor can generate cerebral edema, elevated intracranial pressure, and changes in brain structure, factors that contribute to the onset of seizures. Detailed clinical evaluation is fundamental to understanding this relationship and directing appropriate treatment. Early identification of the tumor and assessment of seizure characteristics are essential for establishing an effective management plan.

Clinical evaluation of brain tumors in children involves a combination of imaging studies, such as magnetic resonance imaging (MRI) and computed tomography (CT), along with neuropsychological assessments to determine the extent of brain changes. These evaluations help identify the impact of the tumor on brain function and plan the most appropriate treatment. An integrated approach, combining accurate diagnosis with a detailed understanding of epileptic seizures, is crucial for providing the best possible care to patients and optimizing treatment outcomes.

Surgical treatment of brain tumors in children plays a crucial role in managing epilepsy associated with these neoplasms. Surgical removal of the tumor is often an effective solution for reducing or even eliminating epileptic seizures. The effectiveness of surgery depends on the exact location of the tumor and the extent of resection. Tumors located in critical brain areas may require advanced surgical techniques to minimize damage to surrounding tissues and preserve neurological function. The success of the surgery is evaluated based on the ability to completely remove the tumor



and the subsequent impact on the frequency and severity of seizures.

Following surgical intervention, patients may face a range of clinical complications. These complications include the development of neurological deficits, such as changes in motor or cognitive function, and the possibility of tumor recurrence. Managing these complications requires rigorous and continuous follow-up. Regular monitoring through imaging studies and neurological evaluations is essential to detect any issues early and adjust the treatment plan as needed.

The quality of life of children undergoing surgical treatment for brain tumors is profoundly influenced by the effectiveness of the treatment in reducing seizures and managing postoperative complications. Successful treatment not only alleviates epileptic symptoms but also contributes to the child's overall development and well-being. The integration of rehabilitation strategies and ongoing support is crucial to ensure that patients adjust well to the treatment and achieve an optimized quality of life. A multidisciplinary approach involving neurologists, neurosurgeons, and therapists plays an essential role in recovery and long-term well-being.

The systematic literature review aims to analyze the interdependence between brain tumors and epilepsy in children, with a specific focus on the effectiveness of surgical approaches. The review seeks to detail how tumor removal affects seizure control, investigating whether surgery contributes to the reduction or elimination of seizures and the immediate and long-term outcomes of this intervention. Additionally, the objective is to identify major clinical complications that arise after surgery, such as neurological deficits and tumor recurrence, and assess how these complications impact the overall well-being and quality of life of children. The review also aims to analyze postoperative management strategies and the effectiveness of multidisciplinary approaches in supporting and rehabilitating patients. In summary, the review aims to provide a comprehensive overview of the effectiveness of surgical treatment in pediatric contexts, highlighting both the benefits and challenges associated with this therapeutic approach.

## **METHODOLOGY**

Methodology: The methodology of the systematic review was conducted

following the PRISMA checklist protocol to ensure transparency and rigor in the selection and analysis of studies. The databases consulted included PubMed, Scielo, and Web of Science. The descriptors used in the search were “pediatric brain tumor,” “epilepsy in children,” “clinical complications,” “surgical treatment,” and “pediatric neurosurgery.” For study inclusion, the following criteria were considered: studies addressing brain tumors in children and their association with epilepsy; research investigating the impact of surgical treatment on the frequency and severity of epileptic seizures; articles providing data on clinical complications associated with surgical treatment; publications including assessments of quality of life in children after surgery; and studies published in peer-reviewed scientific journals and available in full text.

Exclusion criteria included: articles not available in full text or not accessible through the consulted databases; studies focused exclusively on brain tumors in adults, with no relevance to the pediatric population; publications not addressing aspects related to epilepsy or surgical treatment; works with inadequate methodologies or incomplete data for the proposed analysis; and articles published before 2014, to ensure the timeliness and relevance of the evidence.

The selection of studies was carried out in several stages, starting with the screening of titles and abstracts to identify initial relevance. Subsequently, the full texts of the selected articles were assessed to verify compliance with inclusion and exclusion criteria. The review and selection process was conducted independently by two reviewers to ensure accuracy and consistency in study inclusion. The detailed methodology and use of the PRISMA checklist ensured the quality and integrity of the data analysis for the systematic review.

## **RESULTS**

Results: A total of 15 articles were selected. Brain tumors frequently cause epilepsy in children due to irritation and cortical dysfunction resulting from the presence of the neoplasm. These tumors interfere with the brain's electrical activity, which can trigger epileptic episodes. The irritation of cortical areas adjacent to the tumor, as well as changes in brain structure, are significant factors in the genesis of seizures. Additionally, the presence of cerebral edema and increased intracranial pressure

associated with the tumor contribute to electrical instability, intensifying the risk of seizures. Therefore, the nature and location of the tumor play a crucial role in the manifestation and frequency of epileptic seizures.

Accurate identification of the tumor and understanding its relationship with epilepsy are fundamental for treatment planning. Brain tumors can provoke different types of seizures, such as focal or generalized seizures, depending on the affected area. The complexity of seizures can range from isolated episodes to severe and frequent convulsions. Thus, a detailed analysis of the tumor type and its interaction with surrounding brain tissue is essential for formulating effective and individualized therapeutic strategies.

The tumor's location in the brain has a direct impact on the type and severity of epileptic seizures. Tumors located in critical regions, such as the temporal lobe, are often associated with complex focal seizures that may evolve into generalized seizures. The temporal lobe is particularly vulnerable to cortical irritation, and tumors in this area can cause significant changes in neurological function and brain electrical activity. Thus, the specific location of the tumor not only determines the nature of the seizures but also the necessary therapeutic approaches for proper management.

Moreover, the tumor's location influences the surgical strategy and the prognosis of treatment. Tumors in hard-to-reach areas or near essential brain structures may require more advanced and precise surgical techniques to minimize damage to healthy brain tissue. A detailed understanding of the relationship between the tumor's location and epileptic manifestations allows for more effective surgical planning and better prediction of clinical outcomes. Accurate and personalized planning is crucial to optimizing treatment effectiveness and reducing risks associated with surgical intervention.

Imaging studies play a fundamental role in diagnosing and assessing brain tumors in children, as well as understanding how these tumors affect epilepsy. Magnetic resonance imaging (MRI) is particularly valuable due to its ability to provide detailed images of brain structure, allowing precise visualization of the tumor, its location, and its relationship with adjacent areas. MRI is crucial for identifying the extent of the tumor and any possible involvement of surrounding brain structures, as well as assessing the



effect of the tumor on brain tissue, such as edema and changes in intracranial pressure. These data are essential for accurate diagnosis and appropriate treatment planning.

In addition to MRI, computed tomography (CT) is also used, especially in emergency situations for rapid assessment of tumor presence and location. CT provides a clear view of structural changes and can help identify acute complications, such as bleeding or tumor-associated hydrocephalus. Combining different imaging modalities is often necessary to obtain a comprehensive view of the clinical picture and to plan therapeutic strategies based on a detailed analysis of the obtained data. Thus, the appropriate use of imaging techniques significantly contributes to the diagnostic and therapeutic approach to brain tumors in children.

Surgical treatment is a common and often necessary approach for managing brain tumors in children, especially when aiming to control or eliminate associated epileptic seizures. Tumor resection aims to remove the neoplastic mass, thereby alleviating cortical irritation contributing to seizures. The effectiveness of surgery is largely determined by the tumor's location and the extent of resection possible without damaging healthy brain tissue. In many cases, surgery results in a significant reduction in the frequency and severity of epileptic seizures, leading to substantial improvement in the patient's quality of life.

In addition to tumor removal, surgery can also impact overall neurological function. For example, procedures performed in critical brain areas may cause motor or cognitive deficits, depending on the extent of the intervention and the tumor's location. Therefore, the decision regarding surgical treatment involves a careful evaluation of potential benefits and risks, considering both seizure reduction and preservation of neurological functions. Meticulous planning and precise execution of surgery are essential to achieve a balance between effective tumor removal and minimizing potential adverse effects on the child's neurological development.

Post-surgical clinical complications in children undergoing brain tumor treatment can vary significantly and include a range of adverse effects impacting recovery and quality of life. Immediately after surgery, children may experience temporary or permanent neurological deficits, such as motor difficulties, language changes, and cognitive issues, depending on the area of the brain involved. The intensity of these



deficits is often correlated with the location and extent of tumor resection. The presence of cerebral edema and manipulation of neurological structures during surgery can contribute to these complications, making rigorous follow-up essential to monitor and manage these adverse effects.

In addition to neurological deficits, tumor recurrence is a significant concern in the postoperative period. Recurrence may occur due to incomplete tumor removal or the presence of residual tumor cells not detected during surgery. Continuous monitoring through regular imaging studies, such as MRIs, is crucial to detect any signs of recurrence early. Effective management of these cases may require additional interventions, such as further surgeries, adjuvant therapies, or pharmacological treatments. Therefore, managing post-surgical complications involves meticulous planning and a multidisciplinary approach to optimize recovery and minimize risks associated with tumor recurrence.

Postoperative rehabilitation plays a crucial role in the functional recovery of children undergoing brain tumor surgery. Immediately after the intervention, the child may have specific rehabilitation needs to address motor deficits, coordination problems, or language changes. Rehabilitation programs often include occupational therapy and physical therapy, aiming to restore compromised functions and improve the child's ability to perform daily activities. These programs are adjusted based on the severity of deficits and recovery progress and should be individualized to meet each patient's specific needs.

The effectiveness of rehabilitation is strongly linked to coordination among healthcare professionals, including occupational therapists, physical therapists, and neurologists. This multidisciplinary approach is essential to address all dimensions of the child's recovery, considering both physical and emotional aspects. Early intervention and continuous monitoring are crucial to identify and treat emerging complications and adjust treatment plans as needed. Thus, rehabilitation not only facilitates functional recovery but also supports the child's adaptation to changes in their health status and maintains a good quality of life.

Longitudinal monitoring after surgery is indispensable to ensure that the child receives appropriate care and to evaluate the effectiveness of therapeutic interventions.



This continuous follow-up involves regular visits to the doctor and imaging studies to assess the patient's recovery and detect any signs of complications, such as tumor recurrence or new neurological issues. Monitoring is also important to adjust treatment and rehabilitation strategies based on the child's evolving clinical condition.

Furthermore, prolonged follow-up allows for the assessment of the long-term impact of surgical and therapeutic interventions on the child's neurological and cognitive development. Early detection of changes or new symptoms is crucial for timely and effective additional interventions. Parental and caregiver involvement is also significant in this process, as they play an active role in supporting the child's recovery and implementing medical recommendations. Thus, continuous monitoring not only facilitates effective management of complications but also supports the child's adaptation and overall well-being throughout their recovery.

The impact on the quality of life of children after brain tumor treatment is a crucial aspect to consider. The effectiveness of surgical treatment and the success of rehabilitation directly affect the child's overall well-being and continued development. A child's ability to resume daily activities, such as school attendance and social interactions, is closely related to the intensity and success of therapeutic interventions. Improvement in quality of life can be measured not only by the reduction of epileptic seizures but also by the child's ability to recover impaired motor and cognitive functions. Additionally, psychological and emotional support during and after treatment is essential for promoting complete recovery and helping the child cope with changes in their life.

Quality of life is also affected by the response to therapy and control of treatment-associated complications. It is crucial for the medical team and caregivers to work together to provide a supportive environment that allows the child to face treatment challenges and adapt to new circumstances. An integrated approach, including educational and psychological support, facilitates the child's reintegration into the school and social environment, contributing to a more positive and less isolating experience. Thus, attention to emotional and social needs is as important as direct medical intervention to ensure the child has the best possible quality of life.

A multidisciplinary management strategy is essential for the successful



treatment of brain tumors and epilepsy in children. A team comprising neurosurgeons, neurologists, psychologists, occupational therapists, and other healthcare professionals should collaborate to develop a comprehensive and coordinated treatment plan. Each specialist contributes their specific knowledge to address different aspects of care, from surgical tumor removal to rehabilitation and psychological support. Effective communication among team members and integration of different types of care are fundamental to achieving the best outcomes for the child.

Moreover, multidisciplinary coordination allows for the continuous adaptation of therapeutic strategies based on the child's evolving needs. Regular follow-up and review of treatment plans are essential to adjust approaches as necessary and address any new challenges that arise. The collaborative approach ensures that all aspects of the child's health and development are considered, promoting a more complete recovery and effective management of associated conditions. Thus, multidisciplinary management not only enhances treatment effectiveness but also provides comprehensive support that meets the complex needs of pediatric patients.

The role of ongoing clinical research in the treatment of brain tumors and epilepsy in children is crucial for advancing therapeutic strategies and improving clinical outcomes. Recent studies significantly contribute to understanding best treatment practices and identifying new therapeutic approaches. Ongoing research allows for the evaluation and integration of new technologies and surgical techniques that can optimize treatment effectiveness and minimize adverse effects. Additionally, participation in clinical trials offers patients access to innovative treatments and therapies that are not yet widely available, potentially improving treatment prospects.

Advances in clinical research also play an important role in personalizing treatment, tailoring strategies to the specific needs of each patient. Through continuous investigation, healthcare professionals can identify biological and genetic markers that influence treatment response and susceptibility to complications, allowing for more targeted and effective treatment. Thus, clinical research not only provides new therapeutic options but also contributes to personalized treatment, promoting a more precise and effective approach to managing brain tumors and epilepsy in children. Continuous progress in this field is essential for offering patients the best possible



recovery prospects and enhancing the quality of medical care.

## CONCLUSION

Analysis of the challenges and advancements in the treatment of brain tumors and epilepsy in children reveals a complex and multifaceted landscape, marked by significant progress and areas still needing development. Scientific evidence has demonstrated that successful surgical intervention has the potential to significantly reduce tumor burden and improve quality of life. However, challenges related to postoperative complications and neurological sequelae continue to require careful management and intensive rehabilitation. Studies show that complete tumor removal, when possible, is crucial for reducing the risk of recurrence, although the preservation of essential neurological functions remains a central concern.

Adjuvant treatments, such as radiation therapy and chemotherapy, have shown benefits in managing brain tumors but are also associated with side effects that impact the quality of life for children. Research highlights that early intervention and a multidisciplinary approach are essential for minimizing these complications and promoting more efficient recovery. Rehabilitation strategies have proven effective in restoring motor and cognitive functions, underscoring the importance of continuous and personalized support.

Moreover, improvements in understanding treatment-associated complications and advances in monitoring techniques have contributed to the development of more effective strategies for managing long-term adverse effects. Continuous follow-up and adaptation of therapeutic approaches according to the individual needs of children have shown promising results in terms of recovery and well-being. The integration of new technological advancements and innovative therapies, along with participation in clinical trials, continues to play a vital role in the evolution of treatments and the improvement of prospects for children affected by brain tumors and epilepsy. In summary, the combination of precise surgical interventions, multidisciplinary support, and ongoing research forms the foundation for optimizing clinical outcomes and promoting a more complete and successful recovery for pediatric patients.

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