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A Case Report of Recurrent High-Grade Astrocytoma: Surgical Intervention and Postoperative Complications

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Abstract

High-grade astrocytomas, classified as WHO Grades III and IV, are aggressive brain tumors that pose significant management challenges due to their infiltrative nature and high recurrence rates. This report details the case of a 23-year-old male diagnosed with recurrent high-grade astrocytoma after initial surgical intervention. He presented with persistent vomiting, severe headaches, dizziness, and difficulty maintaining body posture, leading to a second surgical exploration and tumor decompression. Upon admission, neurological assessment revealed significant deficits, including complete vision loss in the right eye and left-hand paresis. MRI imaging showed a cystic lesion with transcalvarial brain herniation, complicating the clinical picture. Following right frontal-parietal craniectomy and exogenous duroplasty, the patient experienced a decline in neurological function, highlighting the risks of surgical intervention in recurrent cases. Postoperative management involved an extensive pharmacological regimen, including antibiotics, anticonvulsants, and corticosteroids. Despite these measures, the patient developed complications such as persistent headaches and altered sensory perceptions, necessitating a multidisciplinary rehabilitation approach. This case underscores the critical need for tailored treatment strategies, advanced imaging for ongoing surveillance, and collaboration among healthcare specialists to address the multifaceted challenges of recurrent high-grade astrocytomas. Recommendations include enhanced preoperative assessments, personalized treatment plans, and improved patient education to optimize outcomes. Continued research into novel therapies is essential for improving survival rates and quality of life for patients affected by this challenging diagnosis. By implementing these strategies, healthcare providers can better navigate the complexities associated with high-grade astrocytomas and improve patient care.

Keywords: High-grade astrocytoma, recurrence, surgical intervention, postoperative complications, neurological deficits

Introduction

High-grade astrocytomas are aggressive brain tumors characterized by their rapid proliferation and infiltration into surrounding brain tissue, resulting in significant morbidity and mortality. The World Health Organization (WHO) classifies astrocytomas into several grades, with Grades III and IV being categorized as high-grade due to their anaplastic features, increased cellularity, and poor prognosis **[1]**. These tumors account for a substantial proportion of primary brain neoplasms and are notorious for their aggressive nature and high propensity for recurrence, necessitating effective management strategies. Managing recurrent high-grade astrocytomas presents unique challenges that require a multidisciplinary approach. Following recurrence, patients often experience a decline in neurological function, which necessitates careful reassessment and potentially different therapeutic strategies. Recent studies emphasize the importance of ongoing imaging and monitoring to detect recurrence early, as timely intervention can significantly impact patient outcomes **[2]**. Advancements in imaging techniques, such as functional MRI and PET scans, provide crucial insights into tumor activity, aiding in surgical planning and postoperative management **[3]**. Surgical intervention remains the cornerstone of treatment for high-grade astrocytomas, with the primary goal of maximizing tumor resection while minimizing neurological compromise. Complete resection has been associated with improved survival rates and better quality of life; however, achieving this goal is often complicated by the infiltrative nature of these tumors, which can extend into critical brain regions. Recurrence of high-grade astrocytomas is common, as tumor cells may persist even after aggressive initial treatment, leading to regrowth and necessitating subsequent surgical interventions.

Additionally, the complexities surrounding high-grade astrocytomas extend beyond surgical intervention. Postoperative complications, including neurological deficits, infection, and cerebrospinal fluid (CSF) leaks, are prevalent and can significantly affect recovery and quality of life **[4]**. The rehabilitation of patients following surgery often requires a tailored approach that incorporates physical therapy, occupational therapy, and nutritional support to address the

multifaceted needs of individuals undergoing treatment for these tumors.

This case report highlights a 23-year-old male with a history of high-grade astrocytoma who underwent a second surgical intervention after experiencing a recurrence. The patient's clinical presentation, surgical outcomes, and subsequent complications provide valuable insights into the complexities of treating recurrent brain tumors. By examining this case, we aim to illustrate the importance of comprehensive preoperative assessment, individualized treatment planning, and the integration of multidisciplinary care teams in optimizing outcomes for patients with recurrent high-grade astrocytomas.

As our understanding of high-grade astrocytomas evolves, so too must our approaches to treatment. Improved preoperative evaluations, personalized treatment plans, and enhanced patient education are vital for addressing the unique challenges presented by these tumors. Continued research into novel therapeutic options and strategies will be essential for advancing the care of patients affected by high-grade astrocytomas and ultimately improving survival rates and quality of life.

Case Presentation

The patient, a 23-year-old male weighing 52 kg and standing 165 cm tall, was admitted to the neurology ward with a chief complaint of persistent vomiting for the past 15 days. He also reported severe headaches for 10 days, dizziness for 7 days, and difficulties in maintaining body posture. His medical history included a right frontal craniotomy performed in May 2024, during which a space-occupying lesion was excised, and a diagnosis of high-grade astrocytoma was confirmed. This initial surgery included augmented duroplasty.

Upon admission, physical examination revealed that the patient was conscious and oriented to time, place, and person, although he appeared undernourished. Notably, there was significant swelling on the right side of his head, leading to an asymmetrical appearance. A visual examination indicated complete blindness in the right eye, although the pupils remained reactive to light. The Glasgow Coma Scale (GCS) score was E4 V5 M5, indicating intact cognitive function, while neurological examination revealed complete loss of vision in cranial nerve II, symmetrical facial expressions with no noted deficits in cranial nerve VII, normal hearing but loss of taste sensation in cranial nerve IX, inadequate gait coordination, and abnormal deep tendon reflexes noted in the left brachioradialis, with motor function testing revealing only left-hand impairment. Vital signs were monitored consistently, with temperatures fluctuating between 98.6°F and 100°F, pulse rates averaging around 80-85 beats per minute, and blood pressure readings within normal ranges. A complete blood count (CBC) revealed a normal total leukocyte count of 19,500 cells/mm³, indicating no acute infection. MRI findings with contrast demonstrated a cystic lesion measuring 5.8 x 6.9 x 6.6 cm, with a thin internal septum communicating with the frontal horn of the lateral ventricles. The imaging suggested a postoperative cyst associated with transcalvarial herniation of brain tissue through a previous surgical defect. In September 2024, the patient underwent a second surgical procedure consisting of exploration with right frontal-parietal craniectomy for tumor decompression and exogenous duroplasty. The procedure was performed under general anesthesia. Unfortunately, postoperatively, the patient exhibited significant neurological deterioration, including worsening headaches, left-hand paresis, and altered sensory perception.

Postoperative management included intravenous administration of several medications, including Meropenem, Colistin, Pantoprazole, Ondansetron, Paracetamol, Tranexamic acid, Sodium Valproate, Eptoin, Levetiracetam, Dexamethasone, Mannitol, and Lasix. Despite aggressive management, the patient continued to struggle with complications, raising concerns about the effectiveness of the treatment strategy employed.

Discussion

This case illustrates the multifaceted complexities involved in managing recurrent high-grade astrocytomas. Although initial surgical intervention can provide temporary relief and potential curative intent, the aggressive nature of these tumors often leads to recurrence, as evidenced in this patient. The recurrence underscores the need for a comprehensive understanding of the tumor's biological behavior and the necessity for ongoing vigilance in monitoring and managing potential relapses. The development of postoperative complications, including neurological deficits and increased infection risk, emphasizes the importance of meticulous preoperative planning and surgical technique. A well-coordinated approach can mitigate risks associated with reoperation, such as brain edema, infection, and cerebrospinal fluid (CSF) leaks, which are particularly common in patients undergoing repeat surgeries. The nuances of surgical technique, including intraoperative imaging and neuronavigation, may assist surgeons in maximizing resection while minimizing harm to adjacent healthy brain tissue. Advanced techniques, such as intraoperative MRI, could provide real-time feedback and enhance the accuracy of tumor excision. Postoperative care is critical, especially for young adults who may possess a higher rehabilitation potential. A multidisciplinary approach involving neurology, oncology, rehabilitation, and nutrition is essential for optimizing recovery outcomes. Early involvement of rehabilitation specialists can facilitate better recovery trajectories by addressing motor and cognitive deficits promptly **[2-4]**. Incorporating nutritionists into the care team can also enhance postoperative recovery, as adequate nutritional support has been linked to improved wound healing and reduced infection rates.

Moreover, this case highlights the necessity of regular follow-up imaging to monitor for recurrence. Advanced imaging technologies, such as functional MRI and PET scans, have improved the ability to

assess tumor activity and guide postoperative management. These tools are instrumental in detecting subtle changes that may precede clinical symptoms, enabling timely intervention that could alter the disease trajectory. Additionally, the potential need for adjuvant therapies, such as chemotherapy and radiation, must be carefully considered based on imaging findings and the patient's overall clinical status. Personalized treatment plans that consider the tumor's genetic profile and patient-specific factors are essential. Emerging therapies, including targeted therapies and immunotherapy, have shown promise in improving outcomes for patients with recurrent glioblastoma **[5,6]**. Integrating these novel therapies into a comprehensive treatment strategy could enhance therapeutic efficacy and patient survival. The management of recurrent high-grade astrocytomas is fraught with challenges, particularly in young adults, where aggressive tumor behavior can lead to rapid clinical decline. While surgical resection remains the primary treatment modality, the infiltrative nature of these tumors complicates complete excision, often resulting in residual tumor burden and subsequent recurrence **[7]**.

Furthermore, the significance of preoperative counseling and informed consent cannot be overstated. Patients must be fully apprised of the possible outcomes, complications, and the rationale for the selected treatment pathway. This communication is crucial for building trust and ensuring that patients are active participants in their care decisions. Addressing the nutritional status preoperatively can significantly influence recovery. Malnutrition can adversely affect postoperative outcomes and increase the risk of complications. A proactive approach to patient care that encompasses nutritional assessment and intervention is vital. This case underscores the necessity for a multidisciplinary framework that integrates various specialties to optimize management and care for patients with recurrent high-grade astrocytomas. By continually refining treatment strategies and focusing on holistic patient care, we can better navigate the complexities associated with this challenging diagnosis.

Conclusion

This case report underscores the significant challenges associated with recurrent high-grade astrocytomas, particularly regarding the potential for severe postoperative complications. Effective management requires a multifaceted approach that encompasses careful surgical planning, vigilant postoperative monitoring, and collaborative care among various healthcare specialists. To enhance patient outcomes, we emphasize the need for several key recommendations.

First, enhanced preoperative assessment is crucial. Implementing thorough evaluations, including nutritional assessments and advanced imaging techniques, can provide valuable insights that inform surgical strategies and postoperative care. Second, personalized treatment plans tailored to each patient's unique tumor biology and individual characteristics are essential for addressing the specific needs of those affected. Third, multidisciplinary collaboration among neurosurgeons, oncologists, nutritionists, and rehabilitation specialists can facilitate a comprehensive management plan that optimizes recovery and minimizes complications.

Moreover, patient education and counseling are fundamental. By providing patients with thorough preoperative education regarding the risks, benefits, and potential outcomes of surgery, we empower them to make informed decisions and establish realistic expectations. Lastly, ongoing research into novel therapeutic agents and approaches remains vital. Continued exploration in this area will enhance our understanding of high-grade astrocytomas and lead to improved treatment modalities.

By focusing on these recommendations, we can enhance the management of recurrent high-grade astrocytomas, ultimately aiming to improve both the quality of life and survival rates for affected patients. This integrated approach not only addresses the clinical aspects of treatment but also emphasizes the importance of patient-centered care, fostering a supportive environment that can significantly impact recovery and well-being.

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