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Case Report On Anaplastic Astrocytoma: Diagnostic And Therapeutic Challenges

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Abstract: Anaplastic astrocytoma (AA) is a rare, aggressive Grade III primary brain tumor arising from astrocytes. It predominantly affects adults aged 30–50 years and is characterized by increased cellular atypia, mitotic activity, and a high risk of progression to glioblastoma. Genetic alterations, including TP53 mutations, ATRX deletions, and IDH1/IDH2 mutations, significantly influence prognosis. Clinically, patients present with progressive neurological deficits, seizures, and cognitive decline. Magnetic resonance imaging (MRI) with contrast serves as the primary diagnostic tool, revealing non-enhancing lesions with variable edema. Histopathological analysis and genetic profiling confirm the diagnosis and guide treatment. Standard management includes maximal surgical resection, followed by radiation therapy and temozolomide-based chemotherapy. Molecular markers and extent of resection impact survival, with IDH-mutant tumors having a better prognosis. Despite advancements, AA remains challenging to treat, necessitating further research into targeted therapies and immunotherapy to improve outcomes.

Key words:
Anaplastic astrocytoma, Grade III glioma, IDH mutation, MRI diagnosis, Glioblastoma.

Introduction:

Anaplastic astrocytoma (AA) is a Grade III glioma, meaning it is a highly infiltrative and malignant brain tumor arising from astrocytes the star-shaped supportive cells in the brain [1]. It is classified as an intermediate tumor that is more aggressive than Grade II diffuse astrocytomas but lacks the necrosis seen in Grade IV glioblastomas (GBM) [2].

It is rare, accounting for only 4% of all brain tumors, yet it carries a high recurrence rate and poor prognosis [3]. Symptoms are often subtle at first, leading to delayed diagnosis until the tumor has progressed. Even with surgery, chemotherapy, and radiation, anaplastic astrocytoma remains challenging to treat, often progressing to glioblastoma, which has a median survival of just 12–15 months. This is illustrated in Figure1, which shows a typical brain tumor and its location in the brain.

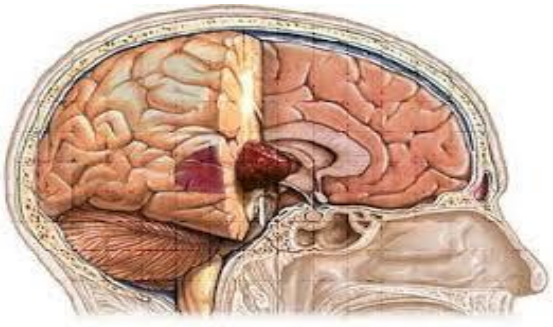

Figure1: A primary brain tumor is a group (mass) of abnormal cells that starts in the brain.
Adopted from the National Cancer Institution, public domain.

Like all gliomas, AA originates from genetic mutations that cause uncontrolled cell growth in the brain. The IDH mutation is a key factor: IDH-mutant tumors respond better to treatment and have a better prognosis [4], IDH-wildtype tumors behave more like glioblastomas and are more aggressive [5].

Other genetic markers like MGMT promoter methylation and 1p/19q co-deletion influence treatment response and survival [6].

The tumor grows silently until it starts affecting surrounding brain structures. Symptoms depend on tumor location, but commonly include: Seizures – Often the first symptom, occurring suddenly, Cognitive decline – Memory loss, personality changes, difficulty concentrating, Neurological deficits – Weakness, speech problems, vision disturbances, Headaches & Increased Intracranial Pressure – Due to tumor growth [7].

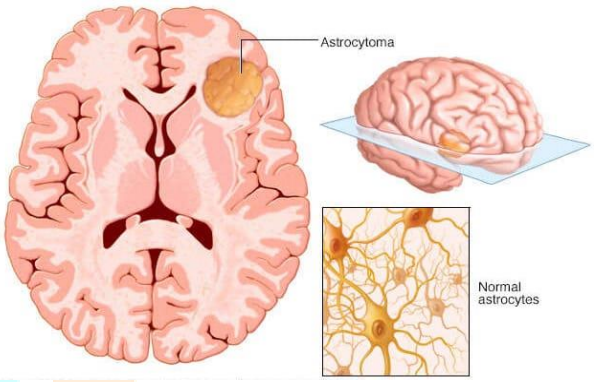

Figure2: Illustration showing brain tumor (astrocytoma) and normal astrocytes
Adopted from the National Cancer Institute (www.cancer.gov), public domine

Since symptoms are non-specific, imaging and pathology play a crucial role, MRI with contrast is the optimal imaging modality for diagnosis and management of AA [8]. Patient with anaplastic astrocytoma shows an irregularly enhancing lesion with surrounding edema, Histopathology – Reveals high cellularity, nuclear atypia, and mitotic activity, and Genetic Testing – Determines IDH mutation status and other prognostic markers [9]. The contrast between normal astrocytes and the abnormal tumor cells in astrocytoma is clearly depicted in Figure2.

There is no single cure, but a multimodal approach offers the best outcome like Surgical Resection – The goal is to remove as much of the tumor as possible without damaging critical brain function [10], Radiotherapy – Standard protocol of 60 Gy in 30 fractions to prevent recurrence [11,12], Chemotherapy (Temozolomide) – Used alongside radiation for 6 weeks [13], followed by maintenance therapy and, Supportive Care – Steroids for swelling, anticonvulsants for seizures.

Despite treatment, most tumors recur, requiring ongoing management and, in some cases, experimental therapies like targeted therapy or immunotherapy [14].

Case Presentation:

A 45 years old women was admitted to the emergency word with Complaints of seizures, progressive neurological deterioration (including dysphasia) and persistent headache for the past one month, On the day of admission, she experienced a generalized seizure, followed by left-sided hemiparesis. Subsequently, she developed recurrent seizures. Her past medical history was significant for hypertension over the past five years, for which she was on Amlodipine 5 mg once daily.

On examination, the patient was febrile (temperature: 101.6ºF /38.7ºC), likely due to tumour-associated inflammatory response. Her blood pressure was elevated (blood pressure 160/100), possibly secondary to increased intracranial pressure.

Laboratory investigations revealed leukocytosis, with a total white blood cell count of 19,000 cells/mm³ and neutrophilia (91%) (Table 1), suggestive of systemic inflammation likely triggered by the tumor.

Table 1: Laboratory investigation during admission

Parameter	Observed Value	Normal Range
Haemoglobin	10.1g/dl	12.5-15.5g/dl
Neutrophils	19,000cells/cumm	4500-11000cells/cumm
WBC	91%	50-70%
Potassium	2.8mEq/L	3.0-5.0mEq/L
Sodium	137mEq/L	135-145mEq/L

As a preliminary diagnostic step, an MRI with contrast was performed, which revealed an ill-defined, T2 hyperintense mass with minimal enhancement (unlike glioblastoma, which shows necrosis and strong contrast enhancement) suggests a diffuse infiltrative tumor.

To confirm the diagnosis histopathological examination was performed. It revealed increased mitotic activity which confirms rapid tumor growth, and nuclear pleomorphism suggests malignant transformation of astrocytes, and high cellularity without necrosis.

By integrating MRI and Histopathology findings, the features were consistent with anaplastic astrocytoma (WHO Grade III). Once the diagnosis was confirmed, clinical management was immediately initiated to address the patient's condition effectively.

The patient, experiencing seizures and signs of increased intracranial pressure, was initially managed symptomatically with Dexamethasone 10 mg IV bolus to reduce cerebral edema and relieve intracranial pressure. Additionally, Levetiracetam 200 mg twice daily was initiated as an antiepileptic to control seizure activity and prevent further episodes.

Once the patient's condition stabilized, a multidisciplinary team including neurosurgeon, oncologist, and radiation specialist formulated a standard treatment plan it consists of surgical resection, In this the patient was scheduled for tumour debulking surgery, aiming to remove tumour as much of the tumour as possible while preserving neurological functions.

Following the surgical resection, the patient underwent post-surgical adjuvant therapy to target remaining tumour cells and prevent progression. Standard fractionated external beam radiation therapy (EBRI) was administered at a total dose of 60 Gray (Gy) over six weeks.

In addition, Chemotherapy with Temozolomide (TMZ) was initiated. the patient received concurrent temozolomide with at a doses of 75mg/m^2 daily during radiotherapy [15], Followed by adjuvant TMZ at 150mg/m^2 for 5 days every 28 days cycle for 6 cycles.

This multimodal approach surgery, radiotherapy and chemotherapy remains the gold standard for treating anaplastic astrocytoma. For long term management the patient was placed under regular follow-ups with MRI scan to assess tumour response and progression.

Discussion:

Anaplastic astrocytoma (AA), though less aggressive than glioblastoma multiforme (GBM), demonstrates a notable potential for malignant transformation. Histologically, AA (WHO Grade III) lacks the necrosis and microvascular proliferation seen in GBM (Grade IV), but displays increased mitotic activity compared to low-grade (Grade II) astrocytomas. The presence of genetic mutations such as IDH1/IDH2, ATRX loss, and TP53 mutations has a significant prognostic and therapeutic implication [16]. This case highlights the importance of early diagnosis, multidisciplinary management, and tailored therapeutic approaches to improve patient outcomes.

Conclusion:

This case underscores the complexity of diagnosing and managing anaplastic astrocytomas, particularly in patients with significant neurological impairment. A combination of surgical intervention, radiotherapy, and chemotherapy remains the cornerstone of management [17]. Further research into molecular profiling may enhance personalized treatment strategies for better prognosis.

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