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ORIGINAL ARTICLE

Evaluation of Outcomes in Patients Undergoing Surgery for Brain Tumors A Prospective Clinical Study

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ABSTRACT

Background: Local data are still needed to optimize surgical practices, despite surgical resection being the first line of treatment for many brain tumors, as outcome variability dictates.

Aim: To evaluate postoperative outcomes including neurological function, survival and quality of life in a cohort of 25 patients undergoing brain tumor surgery in a tertiary center.

Methodology: It was a prospective observational study of 25 adult patients who underwent elective craniotomy for brain tumor removal during 6 months. Clinical presentation, imaging, histopathology, extent of resection, complications and 3 month functional outcomes were collected.

Results: Fifteen patients were male and 10 female (mean age: 47.6 ± 11.2 years, out of 25 patients). The most common tumor types were meningioma (9 cases) and glioblastoma multiform (7 cases). Patients achieved gross total resection (GTR) in 64%. Sixty percent improved, 24 percent were stable, and 20 percent deteriorated postoperatively. In benign tumor cases, three month survival was 100%, and in malignant cases, the survival was 71.4%. Complications occurred in 4 patients (16%).

Conclusion: Postoperatively, this cohort showed significant improvement in neurological function in benign tumors. Repetition of the need for surgical precision and early intervention is supported by the finding that extent of resection remains a critical determinant of outcome.

Key words: Postoperative, Benign Tumor Cases, Malignant Cases, Glioblastoma Multiform, Postoperatively

INTRODUCTION

Brain tumors are a complex group of neoplasms with a wide diversity of histological type, anatomical location, growth pattern, and clinical behavior. Benign or malignant, they may arise either primarily from the brain tissue itself or secondarily following metastasis from systemic malignancies[5]. Global epidemiological studies indicate that the incidence of primary brain tumors is usually between 10 and 20 per 100,000 individuals, with gliomas and meningiomas being the most frequently seen histological subtypes[2]. Although brain tumors constitute a relatively small fraction of all cancers, they are nevertheless characterized by an exceptionally elevated morbidity and mortality for such molecularly defined neoplasms because of the critical nature of central nervous system structures targeted by them[4].

Surgical resection is the mainstay of treatment for most of the brain tumors and serves several purposes including debulking the tumor mass, reducing the intracranial pressure, facilitating the diagnosis by histopathology and improving the survival and neurological outcome[3]. With advances in imaging (MRI, DTI), intraoperative navigation, neurophysiological monitoring and minimally invasive techniques, neurosurgical procedures have become safer and more effective[1]. But the decision about how much resection to perform in order to achieve oncological goals must be

made in such a way as to preserve vital brain functions particularly in eloquent areas[6].

However, in developing countries like Pakistan, such as advanced neurosurgical care, postoperative rehabilitation, and adjuvant therapies are not always accessible. Additionally, there have been no prospective data regarding the outcomes of surgery in South Asian clinical settings[9]. There are gaps in localized treatment protocols and surgical benchmarking in most studies that are either retrospective or lack long term follow up[7].Because brain tumors can affect cognition, mobility and other aspects of quality of life, they pose a big health care challenge. Lack of prospective data is available for surgical outcomes in developing countries. Imaging and histopathological analysis are used to direct diagnosis, however, surgical resection continues to be the most definitive treatment for tumor debulking and diagnosis[8].

The goal of this study is to prospectively evaluate surgical outcome in 25 patients, and to give a focused view of real world data from a tertiary care setting[6]. The aim of this study was to assess functional outcomes, survival and complications of brain tumor surgery. Secondary aims included assessment of perioperative complications and predictors of outcome including tumor type and resection extent. This focused study aims to create useful insights into the safety and effectiveness neurosurgical interventions for brain tumors within a regional context.

MATERIALS AND METHODS

Study Design:
Current study was conducted from June 2024 to December 2024, a prospective and observational study was carried out at the Department of Neurosurgery, Aziz Fatimah Hospital Faisalabad, Pakistan.

Inclusion Criteria:
- ✓ Patients aged 18–75 years
- ✓ Undergoing elective brain tumor surgery
- ✓ Radiological evidence of intra or extra-axial tumor.

Exclusion Criteria:
- ✓ Emergency surgeries
- ✓ Recurrent tumors
- ✓ Severe comorbid conditions

Data Collection:
Demographic details, clinical presentation, radiology (MRI), tumor features, surgical details, extent of resection, histopathology, intraoperative and postoperative complications were recorded. KPS was assessed preoperatively and at 3 months.

Statistical Analysis:
SPSS version 26 was used to analyze all data descriptively. Continuous variables were reported by means and standard deviations; categorical variables by frequencies and percentages. Where applicable Fisher's exact test was applied.

RESULTS

A total of 25 patients with a mean age of 47.6 ± 11.2 years, 15 (60%) males and 10 (40%) females were included. Focal neurological deficits (44%), headache (76%) and seizures (28%) were the most common presenting symptoms in 19 patients (76%), 11 patients (44%), and 7 patients (28%), respectively. Visual disturbances, gait instability and cognitive changes were other symptoms.Histopathological examination revealed that 9 patients (36%) had meningioma, 7 (28%) had glioblastoma multiforme (GBM), and the other patients had a range of tumor types. Low grade glioma (3 patients, 12%), brain metastasis (3 patients, 12%), schwannoma (2 patients, 8%) and ependymoma (1 patient, 4%) were other tumor types (Table 1).

In 16 patients (64%) a gross total resection (GTR) was achieved, in 7 patients (28%) a subtotal resection (STR) was performed and in 2 patients (8%) biopsy only were done because of tumor inaccessibility or proximity to eloquent areas (Table 2).

The Karnofsky Performance Status (KPS) was used to assess postoperative neurological function at baseline and at 3 month follow up. A total of 14 out of 25 patients (56%) improved, 6 remained functionally stable (24%) and 5 deteriorated in KPS in particular due to high grade gliomas or surgeries involving eloquent brain regions (Table 3).

Postoperative complications occurred in 4 patients (16%). Included were wound infection (1 case), CSF leak (1 case), postoperative hematoma requiring reoperation (1 case), and transient hemiparesis (1 case). Success was reached in managing all complications without permanent deficits (Table 4).

At the 3 month follow up all benign tumor patients (n = 12), including meningiomas, schwannomas and low grade gliomas, were alive, recurrent or without significant disability. Among patients with malignant tumors (n = 13) consisting of GBMs and metastases, survival was 69.2% (9/13) and 4 patients (30.8%) died of tumor progression or perioperative complications (Table 5).

Table 1: Tumor Types Identified on Histopathology (n = 25)

Tumor Type	No. of Patients	Percentage (%)
Meningioma	9	36%
Glioblastoma Multiforme	7	28%
Low-Grade Glioma	3	12%
Metastatic Tumor	3	12%
Schwannoma	2	8%
Ependymoma	1	4%

Table 2: Extent of Tumor Resection

Type of Resection	No. of Patients	Percentage (%)
Gross Total Resection	16	64%
Subtotal Resection	7	28%
Biopsy Only	2	8%

Table 3: Functional Outcome Based on KPS at 3 Months

Outcome Category	No. of Patients	Percentage (%)
Improved Function	14	56%
No Change in Function	6	24%
Decline in Function	5	20%
Decline in Function	5	20%

Table 4: Postoperative Complications

Complication Type	No. of Patients	Percentage (%)
Wound Infection	1	4%
CSF Leak	1	4%
Postoperative Hematoma	1	4%
Transient Hemiparesis	1	4%
Total Complications	4	16%

Table 5: 3-Month Survival Outcome by Tumor Type

Tumor Type	No. of Patients	Survivors	Mortality	Survival Rate (%)
Benign Tumors	12	12	0	100%
Malignant Tumors	13	9	4	69.2%
Total	25	21	4	84%

DISCUSSION

An analysis of short term outcomes in 25 patients undergoing surgical resection for brain tumors focusing on functional recovery, survival, and surgical morbidity is presented in this prospective clinical study. These findings show that neurosurgical intervention, when undertaken with proper preoperative planning, and intraoperative precision, is a significant therapeutic benefit, especially for benign lesions[15]. Our cohort had an overall gross total resection (GTR) rate of 64%, which is consistent with previously published literature on GTR rates of 55% to 75% depending on tumor size, location and neurosurgical expertise. Extra-axial tumors like meningiomas and schwannomas were most often associated with GTR, as the anatomical discernible boundary between tumor and brain parenchyma enables safer resection. Of note, patients with benign tumors had marked improvement in functional scores and a 100% survival rate at three months, consistent with the known fact that early surgical removal of non-infiltrative tumors is associated with excellent prognosis[11.]

Glioblastoma multiforme (GBM) malignant tumors had a more challenging surgical profile. While aggressive surgical debulking was attempted in those cases where possible, the infiltrative nature of GBM generally precludes complete resection[12]. Amongst 7 GBM patients, 4 of them died within 3 months of follow up period despite optimal resection strategies in our study. These findings are in agreement with global GBM survival data, and highlight the need for integrated postoperative strategies including radiotherapy and temozolomide based chemotherapy[13]. The role of these adjuvant therapies in improving long term outcomes was not evaluated in our study, which was surgery focused, but it is acknowledged. Out of 56% of patients, 24% were stable and 20% deteriorated while 56% had improvement in Karnofsky Performance Scores[14]. Preoperative

neurological status and tumor location were significantly associated with functional recovery[17]. Transient or permanent deficits were more likely in patients who were undergoing surgery in or near eloquent areas (such as motor cortex, speech centers)[16].

This suggests how the combination of functional MRI, awake craniotomy, and intraoperative cortical mapping are necessary for use in high risk cases, which were not available in our study environment[19]. Complication rate seen is 16%, which include wound infection, CSF leak, hematoma and transient neurological deficits. The rates are similar to international benchmarks. In addition, there were no intraoperative mortalities indicating satisfactory level of perioperative surgical safety at our center[20]. Although complications in 1 of 6 patients is common, poor infection control practices and perioperative monitoring still need improvement.The strength and limitations of neurosurgical services in such settings are reflected in this study by providing meaningful clinical data from a developing country setting. Limitations include a small sample size, short duration of follow up, and lack of molecular tumor profiling. Additionally, long term progression free and overall survival were not analyzed that is important for understanding tumor behavior after surgery.

CONCLUSION

This prospective clinical study in 25 patients undergoing surgical intervention for brain tumor emphasizes the importance of neurosurgical resection in improving short term functional and survival outcomes, especially in the case of benign and accessible tumors. Better postoperative recovery and fewer complications were associated with gross total resection. Despite intense efforts to surgically remove these tumors, malignant tumors, such as glioblastoma multiforme, showed no survival beyond a short time. Taken together, the findings suggest that brain tumor surgery, when performed at the patient level, with appropriate medical accompaniment, can yield favorable clinical outcomes even in resource constrained environments.

DECLARATION

Acknowledgement:
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Authors contribution
Each author of this article fulfilled following Criteria of Authorship:

1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.

All authors agree to be responsible for all aspects of their research work.

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Data availability:
The data that support the fndings of this study are available from the corresponding author, upon reasonable request.

Ethics approval:
This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Aziz Fatimah Hospital Faisalabad.

Consent to participate:
Informed consent was obtained from all individual participants included in the study.

Competing interests: The authors declare that the research was conducted in the absence of any commercial or fnancial relationships that could be construed as a potential confict of interest.

Conflict of interest:
The authors declared no conflict of interest.

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