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Retrospective Observational Study of Clinical Profile, Neurosurgical Management and Outcome of Intracranial Tumors in a Tertiary Care Government Teaching Hospital

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Abstract

Introduction: A brain tumor, known as an intracranial tumor, is an abnormal mass of tissue in which cells grow and multiply uncontrollably, seemingly unchecked by the mechanisms that control normal cells. The two main groups of brain tumors are termed primary and metastatic.

Aim: The aim is to study the different causes, clinical outcome and management of the patient.

Materials and Methods: This study is a retrospective observational study and included all the patient who underwent surgery for intracranial tumor in our hospital from December 2016 to December 2021.

Results: Total 350 patients underwent the surgery for intracranial tumor who was admitted in our hospital from December 2016 to December 2021. In all the patient presented headache and seizures was the commonest symptom.

Conclusion: In our retrospective study conducted in 350 patients, headache was the most common symptom and more frequently associated with males and cerebral convexity is the most common location of occurrence with meningioma being the most common.

Keywords: Intracranial Tumors; Prognosis; Headache; Meningioma; Glial Tumours.

INTRODUCTION

Intracranial tumours may involve the brain or other structures (e.g., cranial nerves, meninges). The tumours usually develop during early or middle adulthood but may develop at any age; they are becoming more common among older people. Brain tumours are found in about 2% of routine autopsies. More than 150 different brain tumours have been documented, but the two main groups of brain tumours are termed primary and metastatic.[1]

- *Primary brain tumours:* Originate in the brain either in the brain parenchyma.
- *Secondary brain tumours (brain metastases):* Originate in tissues outside the brain and spread to the brain. Metastatic tumors to the brain affect nearly one in four patients with cancer. Up to 40 percent of people with lung cancer will develop metastatic brain tumors.[2]

Type of Benign Brain Tumours

- Primary brain tumour is divided into benign and malignant types. Benign brain tumour are Chordomas, Craniopharyngiomas, Gangliocytomas, Glomus jugulare, Meningiomas, Pineocytomas, Schwannomas.
- Malignant brain tumours are Gliomas,

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Astrocytoma, Ependymomas, Glioblastoma multiforme (GBM), Medulloblastomas, Oligodendrogliomas.

- Other types of brain tumours are Hemangioblastomas, Rhabdoid tumours.[3-5]

Brain tumours are thought to arise when certain genes on the chromosomes of a cell are damaged and no longer function properly. These genes normally regulate the rate at which the cell divides (if it divides at all) and repair genes that fix defects of other genes, as well as genes that should cause the cell to self-destruct if the damage is beyond repair. In some cases, an individual may be born with partial defects in one or more of these genes. Environmental factors may then lead to further damage. In other cases, the environmental injury to the genes may be the only cause. It is not known why some people in an "environment" develop brain tumours, while others do not. Once a cell is dividing rapidly and internal mechanisms to check its growth are damaged, the cell can eventually grow into a tumour. Another line of defence may be the body's immune system, which optimally would detect the abnormal cell and kill it. Tumours may produce substances that block the immune system from recognizing the abnormal tumour cells and eventually over power all internal and external deterrents to its growth. A rapidly growing tumour may need more oxygen and nutrients than can be provided by the local blood supply intended for normal tissue. Tumours can produce substances called angiogenesis factors that promote the growth of blood vessels. The new vessels that grow increase the supply of nutrients to the tumour, and, eventually, the tumour becomes dependent on these new vessels. Research is being done in this area, but more extensive research is necessary to translate this knowledge into potential therapies.[6,7]

World Health Organization (WHO) Brain Tumour Grades:[8,9]

	Grade	Characteristics	Tumour Types
Low Grade	WHO Grade I	• Least malignant (benign) • Possibly curable via surgery alone • Non-infiltrative • Long-term survival • Slow growing	• Pilocytic astrocytoma • Craniopharyngioma • Gangliocytoma • Ganglioglioma
	WHO Grade II	• Relatively slow growing • Somewhat infiltrative • May recur as higher grade	• "Diffuse" Astrocytoma • Pineocytoma • Pure oligodendroglioma
High Grade	WHO Grade III	• Malignant • Infiltrative • Tend to recur as higher grade	• Anaplastic astrocytoma • Anaplastic ependymoma • Anaplastic oligodendroglioma
	WHO Grade IV	• Most malignant • Raid growth, aggressive • Widely infiltrative • Rapid recurrence • Necrosisprone	• Glioblastoma multiforme (GBM) • Pineoblastoma • Medulloblastoma • Ependymoblastoma –

Neurologic dysfunction may result from the following:

1) Invasion and destruction of brain tissue by the tumour.

2) Direct compression of adjacent tissue by the tumour.

3) Increased intracranial pressure (because the tumour occupies space within the skull).

4) Bleeding within or outside the tumour 4). Cerebral oedema.

5) Obstruction of dural venous sinuses (especially by bone or extradural metastatic tumours).

6) Obstruction of cerebrospinal fluid (CSF) drainage (occurring early with 3rd-ventricle or posterior fossa tumours).

7) Obstruction of CSF absorption (e.g., when leukaemia or carcinoma involves the meninges).

8) Obstruction of arterial flow.

9) Rarely, paraneoplastic syndromes.[10-12]

Symptoms vary depending on the location of the brain tumour, but the following may accompany different types of brain tumors:[13,14]

- Headaches that may be more severe in the morning or awaken the patient at night.
- Seizures or convulsions.
- Difficulty thinking, speaking or articulating.
- Personality changes.
- Weakness or paralysis in one part or one side of the body.
- Loss of balance or dizziness.
- Vision changes.
- Hearing changes.
- Facial numbness or tingling.
- Nausea or vomiting, swallowing difficulties.
- Confusion and disorientation.

Similar findings can result from other intracranial masses (e.g., abscess, aneurysm, arteriovenous malformation, intracerebral haemorrhage, subdural hematoma, granuloma, parasitic cysts such as neurocysticercosis) or ischemic stroke.

A complete neurologic examination, neuroimaging, and chest x-rays (for a source of metastases) should be done. T1-weighted MRI with gadolinium is the study of choice. CT with contrast agent is an alternative. MRI usually detects low grade astrocytoma and oligodendrogliomas earlier than CT and shows brain structures near bone (e.g., the posterior fossa) more clearly. If whole brain imaging does not show sufficient detail in the target area (e.g., Sella turcica, cerebellopontine angle, optic nerve), closely spaced images or other special views of the area are obtained. If neuroimaging is normal but increased intracranial pressure is suspected, idiopathic intracranial hypertension should be considered and lumbar puncture done.[15,16,17]

Brain tumours (whether primary or metastatic, benign or malignant) usually are treated with surgery, radiation, and/or chemotherapy alone or in various combinations. While it is true that radiation and chemotherapy are used more often for malignant, residual or recurrent tumours, decisions as to what treatment to use are made on a case by case basis and depend on a number of factors. There are risks and side effects associated with each type of therapy. Surgery is generally accepted that complete or nearly complete surgical removal of a brain tumour is beneficial for a patient. Another procedure that is commonly performed, sometimes before a craniotomy, is called a stereotactic biopsy. This smaller operation allows doctors to obtain tissue in order to make an accurate diagnosis. Radiation therapy uses high-energy X-rays to kill cancer cells and abnormal brain cells and to shrink tumours. Radiation therapy may be an option if the tumour cannot be treated effectively through surgery.

1) Standard External Beam Radiotherapy.

2) Proton Beam Treatment.

3) Stereotactic Radiosurgery (such as Gamma Knife, Novalis and Cyberknife). Chemotherapy generally is considered to be effective for specific paediatric tumours, lymphomas and some oligodendrogliomas. Chemotherapy works by inflicting cell damage that is better repaired by normal tissue than tumour tissue. Resistance to chemotherapy might involve survival of tumour tissue that cannot respond to the drug, or the inability of the drug to pass from the blood stream into the brain.[18-22]

METHODS

We retrospectively reviewed all case records from adult and pediatric age group that were observed between December 2017 until December 2021 at the neurosurgery department of B.J. Medical college and Sassoon hospital, Pune; a tertiary care hospital.

The aim of this study is to analyze the different causes, clinical outcome and management of the patient in our center and also study factors influencing complications and the prognosis of patient after surgery.

Inclusion Criteria:

- All age groups.
- Both genders.
- Mandatory diagnosed as brain tumor either primary, secondary; benign or metastatic on pre-op CT or MRI brain.

Exclusion criteria:

- Patients with infectious neurological disease.
- Head trauma.
- Congenital brain disease.
- Previously operated for tumor.

Clinical Data: We conducted a retrospective observational study using administrative data; and detailed history and neurological examination were retrieved from patient files from medical

record book of previously admitted patient including presenting symptoms, age of on set of symptoms, results of ancillary investigations and data on treatment and its response and outcome of treatment. Total of 350 patients were included in the study of which 20 patients were of less than 5 year and 330 patients were of 5 to 80 years of age group. And only patient with diagnosis of intracranial tumor were included in our study. The patients were categorized according to presenting symptoms.

RESULTS

Between December 2017 to December 2021; 350 patients were studied in retrospective observational study manner and included in the study. All patients were diagnosed with intracranial tumors on pre-op CT/MRI imaging by radiologist.

The clinical age at presentation of all the intracranial tumors are most 43% in 40 - 50 years

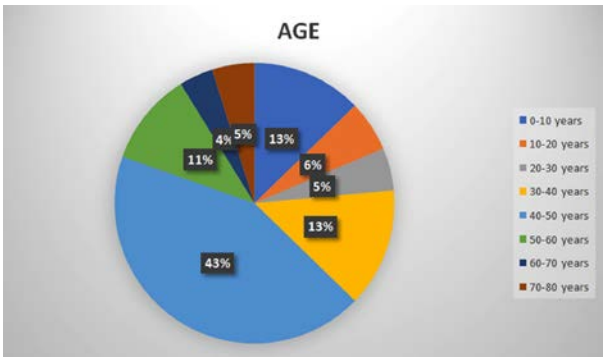


Fig. 1: Showing frequency of intracranial tumors: 43% in 40-50 years followed by 30-40 years and 0-10 years.

followed by 13% at 0-10 years and 30-40 years. 6% in 10-20 years, 5% in 20-30 years, 11% in 50-60 years, 4% in 60-70 years and 5% in 70-80 years.

The most common tumors which encountered in our setup in overall 350 cases were primary brain tumor which constitutes of 88.8% (311) of all cases and 11.2% (39) in metastatic cases. Of all the primary intracranial tumor, meningiomas are encountered in 119 cases (34%) followed by glial cell tumor in 85 cases (24.2%) followed by pituitary tumor in 53 cases (15.1%). Around 1% for medulloblastomas. 2% for lymphomas and hemangioblastomas. 0.3% for PNET, trigeminal Schwannomas, epidermoid, hemangiopericytomas and ependymomas. Vestibular schwannomas constitute of 6% of all cases.

In all the intracranial tumor we encountered male

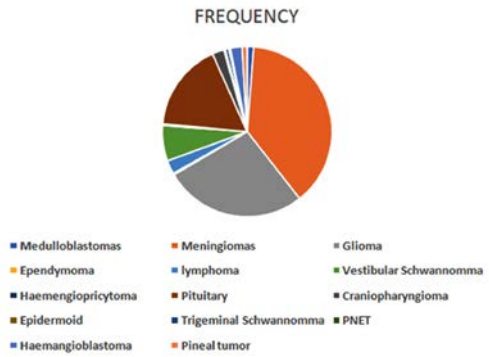


Fig. 2: Showing the frequency of tumor; meningiomas being the most common followed by glial tumor and pituitary tumors

have higher risk of having the tumor as compared to females being 60.5% ratio for males (212 cases) than females 39.5% (138 cases).



Fig. 3: Showing male being the most affected than females

The location of tumor varies according to histological grading. Of all the intracranial tumors encountered the 192 (54.8%) cases reported were of supratentorial and 158 (46.2%) of infratentorial location. Supratentorial tumor are the commonest location of which temporal constitute the 30 of all cases followed by cerebral convexity i.e.; 28 cases. The frontal lobe constitutes 26 cases, parietal constitute 18 cases, occipital constitutes 8 cases. Sellar and suprasellar tumor constitute 60 cases and parasagittal is 10 cases and falcine is 6 cases.

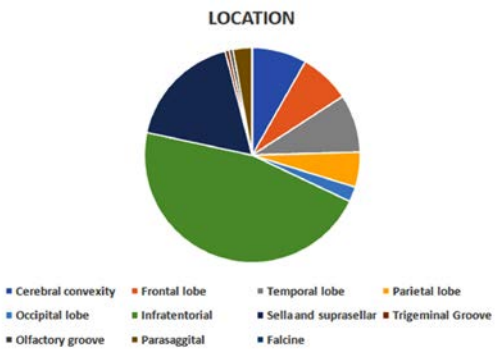


Fig. 4: Showing supratentorial being the most common and in which sellar and suprasellar region being the most common followed by convexity and temporal region.

The symptoms of tumor have larger variation and sometimes present in combined forms. In all the intracranial tumors, headache (162 cases) is the commonest symptoms followed by vomiting in 104 cases. Hearing loss was present in 34 cases and tinnitus in 23 cases. Gait ataxia was present in 89 cases. 47 cases have visual disturbances and seizures were present in 96 cases. Impaired level of consciousness found in 37 cases. 15 cases had facial pain. 22 cases presented with neurological deficits.

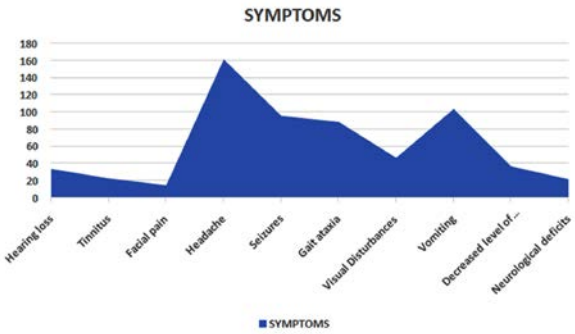


Fig. 5: Showing the presenting features in which headache was the most common symptoms followed by vomiting and gait ataxia

Most of the intracranial tumors are benign in nature and most of the recurrence tumors have malignant transformation. In our study, 277 cases were benign and 73 cases were of malignant in nature.

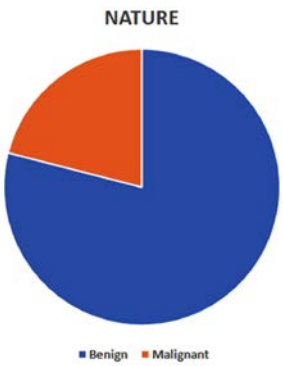


Fig.6: Showing 79% cases were of benign in nature and 21% cases were malignant.

The prognosis of intracranial tumors depends on many factors like histological grading, age at onset, presenting symptoms, family history and level of consciousness. But here in our study we have focused only on 5 years survival rate of the cases. Only 5-year survival rate were studied and only followed up patients were included in the study. In all the 350 cases 164 (46%) cases has less than 5-year survival rate and 186 (54%) cases has more than 5 years survival rate.

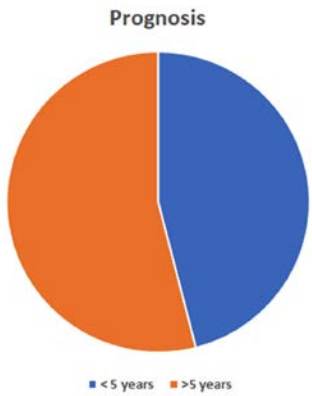


Fig. 7: Showing 164 cases have less than 5 years survival rate.

DISCUSSION

This study is a retrospective observational study conducted in our institute for intracranial tumor who underwent surgery in B.J. Medical College and Sassoon Hospital, Pune and by using administrative data and detailed history with neurological examination retrieved from patient files from medical record book of previously admitted patient including presenting symptoms, age of onset of symptoms, results of ancillary investigations and data on treatment and its response and outcome of treatment from December 2017 to December 2021.

We have observed 350 cases from December 2017 to December 2021 and concluded our study on that basis. The various criteria which are studied are age at presentation, gender predisposition, symptoms on presentation, nature of tumor and prognosis of the tumors.

Ina study by Hoda SA, Cheng E *et al*;[23] the median age of diagnosis was 58 years old, while median age of death was 65 years in united states in the year 2015. In our study the frequency for intracranial tumor is most at 40-50 years age group and the median age is 43 years.

In a study conducted by Vos T, Allen C, Arora M, Barber RM, Bhutta ZA, Brown A, *et al*;[24] GBD 2015 Disease and Injury Incidence and Prevalence Secondary, or metastatic, brain tumors are about four times as common as primary brain tumors. But in our study primary tumor are much more common compromising 88% of all tumors and 12% are secondary or metastatic.

In Baldwin RT, Preston-Martin S *et al*[25]; epidemiology of brain tumor, most common is supratentorial region, 57.0% of the tumors were in

the hemispheric. In infratentorial region, 68% of the tumors were in the midline. In our study conducted in 350 cases 55% of cases were supratentorial in nature and 45% cases were infratentorial. Of all the supratentorial cases, 17% were located in sellar and suprasellar region. 8.5% cases located in temporal region, 8% cases were located in cerebral convexity, 7.4% cases were in frontal lobes and 5.1% cases in parietal lobes and 2.2% in occipital lobes.

Preston-Martin S, Staples M, Ferrugi H, Giles *et al*;[26] the mixed five most common histological diagnoses in patients were astrocytoma (40.4%), followed by medulloblastoma (18.4%), ependymoma (10.5%), craniopharyngioma (8.8%), and meningioma (4.2%). In our case report study, meningiomas are the most common consisting of 34% followed by glial cell tumor 24.2% and pituitary tumors of 15%. The occurrence of vestibular schwannoma is 6%. Followed by lymphomas 2% and medulloblastomas 1%. The PNET, trigeminal schwannomas, ependymomas, epidermoid and hemangioblastoma all constitutes 0.3% respectively.

Lannering B, Marky I, Nordborg C *et al*;[27] males were affected more than females. A significant male predominance was observed in craniopharyngioma and medulloblastoma. Astrocytoma was the first most common brain tumor in all age groups. Certain tumor types show a predilection for the certain period of life. In our study males were affected the most as compared to female population being the 60% predisposition to males and 40% to females.

Gregg N, Arber A, Ashkan K, Brazil L, Bhangoo R, Beaney R, *et al*;[28] the most common symptom was headache followed by seizures. In our study of 350 cases, headache was the most common symptoms occurred in 46% of all cases followed by vomiting 29%. Seizures was associated with 27%, gait ataxia 25%, hearing loss 9.7%, tinnitus 6.5%, facial pain 4.2%, neurological deficits 6.2% and impaired consciousness 10.5%.

This is a vast study and a detail description of each and every type of tumor is not possible. The patient included in our study were the only patient in whom follow up was possible and given the all cases 46% cases had less than 5 years survival rate and 54% has better prognosis.

Summary: In our retrospective observational study, we have observed that male has higher tendency for intracranial tumors compared to female and in population of 40-50 age group is most commonly affected. The most common presenting feature are headache followed by vomiting and seizures which was present in more than 45%. Of all the tumors 88% were primary tumors. The most common location is supratentorial region in which cerebral convexity and suprasellar region are most common. The most common tumor in occurrence was meningioma and glial cell tumors.

CONCLUSION

In our retrospective study conducted in 350 patients, headache was the most common symptom and more frequently associated with males and cerebral convexity is the most common location of occurrence with meningioma being the most common.

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