

Histopathological Study of Astrocytomas at RIMS, Ranchi

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Abstract: ***Background:** Gliomas are the most common primary brain tumors of CNS which include Astrocytoma, oligodendroglioma and ependymoma. Astrocytomas are classified into four grades depending on clinic-pathological features and molecular parameters and differ significantly in incidence, severity and prognosis from each other. This study compares the different clinic-pathological features of four types of Astrocytomas. **Materials and Methods:** This retrospective and prospective study was done at the Department of Pathology, Rajendra Institute of Medical Sciences, Ranchi between January 2019 to May 2020 including all patients of Astrocytoma of 1-90 years of age. Histopathological examination of all the specimens was done by routine paraffin wax sections and was stained by Haematoxylin and Eosin (H&E). The epidemiological data in terms of age, sex, site, laterality and size of tumor were compared among the four grades of Astrocytoma. **Results:** In the present study all four grades of Astrocytomas were discovered and studied. Among them 18(47%) cases of grade II, 9(24%) cases of grade III, 8(21%) cases of grade IV and 3(8%) cases of grade I Astrocytoma with overall male-female ratio of 13:6 were identified. The adults in 21-40 years of age group were identified as common sufferer and left side of the fronto-parieto-temporal lobe of cerebral hemisphere was more commonly involved. Excised tumor of size 1-3 cm was found in 20 out of 38(53%) cases. **Conclusion:** Grade II Astrocytoma of size 1-3 cm located in left fronto-temporo-parietal lobe of cerebral hemisphere in a male aged 21-40 years is the most common presentation*

Keywords: Glioma, Astrocytoma, Malignant, Anaplastic

1. Introduction

Primary brain tumors comprise 50-75% of all CNS tumors [1]. Gliomas, the most common group of primary brain tumors, include Astrocytomas, Oligodendrogliomas and Ependymomas. It is no longer thought that these tumors derive from their specific, mature cell types (astrocytes, oligodendrocytes, and ependymal), but rather that they arise from a progenitor cell that preferentially differentiates down one of the cellular lineages. Many of the tumors typically occur in certain anatomic regions within the brain, with characteristic age distribution and clinical course [2]. Astrocytomas are the most common type of gliomas. In general, they are found in the late middle life with a peak in 6th decade of life. They occur predominantly in the cerebral hemispheres, and occasionally in the spinal cord[3]. Astrocytomas are among the most fibrillar of CNS neoplasms[4]. Astrocytomas are a heterogeneous group of neoplasms with numerous subtypes. Because some designations of subtypes emphasize grading (low grade, anaplastic and glioblastoma), whereas others emphasize structural differences (pilocytic, gemistocytic, and cystic)[2]. Classically, histological assessment has been used to determine glioma subtype and malignancy grade, which is essential for prognosis and treatment strategies [5]. Astrocytomas are graded to describe their degree of abnormality. The most common grading system uses a scale of I to IV. Tumors also may be grouped by their rate of growth: low-grade (slow growth), mid-grade (moderate) and high-grade (rapid)[6]. As of the 2016 edition of the WHO classification, gliomas are classified based not only on histopathologic appearance but also on well-established molecular parameters.

WHO classification of Astrocytomas [3] –

- 1) WHO Grade I (Pilocytic) Astrocytoma
- 2) WHO Grade II (Well-differentiated) Astrocytoma
- 3) WHO Grade III (Anaplastic) Astrocytoma
- 4) WHO Grade IV Astrocytoma (Glioblastoma Multiforme)

Astrocytoma cure rate, recurrence and mortality varies with different grades. Management of Astrocytomas include early detection and craniotomy with excision of tumor followed by histopathological examination and subsequent chemoradiotherapy. Astrocytomas often show high rates of local invasion that lead to local recurrence of the disease[7].

2. Materials & Methods

This retrospective and prospective study was carried out on patients in Department of Pathology at Rajendra Institute of Medical Sciences, Ranchi, Jharkhand from January 2019 to May 2020. A total 38 subjects (both male and females) of aged 1-80 years were for in this study.

Study Design: Retrospective and prospective observational study.

Study Location: This was a tertiary care teaching hospital based study done in Department of Pathology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand.

Study Duration: January 2019 to May 2020.

Sample size: 38 patients.

Sample size calculation: The sample size was estimated on the basis of cases coming to the hospital in the above-mentioned duration.

Subjects & selection method: The study population was drawn from general population who presented to our

hospital and was subsequently diagnosed with Astrocytoma by routine histopathology technique.

Inclusion Criteria:

- 1) Patients admitted in the department of neurosurgery, RIMS, Ranchi and diagnosed histopathologically as a case of Astrocytoma
- 2) Either sex
- 3) Aged 1-90 years

Exclusion Criteria:

- 1) Patients in the age group <1 year and >90 years.
- 2) Patient suffering from CNS tumors other than Astrocytoma.

3. Observation and Results

Table 1: Showing the incidence of different types of Astrocytoma

Astrocytoma type	Total no. of cases	Percentage (%)
Grade I	3	7.9
Grade II	18	47.4
Grade III	9	23.7
Grade IV	8	21.0
Total	38	100

Above table shows Grade-wise incidence of various Astrocytomas. Grade II Astrocytoma has highest incidence among all types i.e. 47.4% while Grade I Astrocytoma has minimum incidence of 7.9%

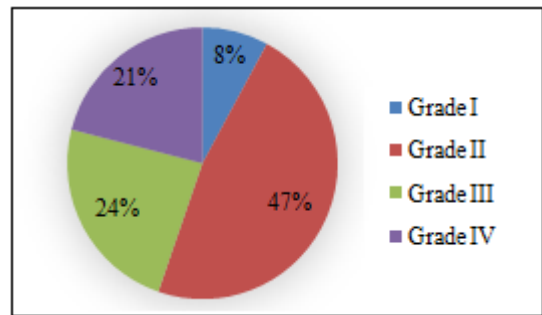


Figure 1: Grade-wise distribution of cases

Table 2: Shows the age-wise incidence of cases

Age group (in years)	Astrocytoma Grade I	Astrocytoma Grade II	Astrocytoma Grade III	Astrocytoma Grade IV	Total no. of cases	Percentage (%)
1-10	0	0	0	0	0	0
11-20	1	2	0	1	4	10.5
21-30	1	4	3	2	10	26.3
31-40	1	4	1	2	8	21.1
41-50	0	3	1	2	6	15.8
51-60	0	4	1	0	5	13.2
61-70	0	1	2	1	4	10.5
71-90	0	0	1	0	1	2.6
Total	3	18	9	8	38	100

Above table shows age-wise incidence of four types of Astrocytoma. Maximum numbers of cases belong to adult age group 21 to 50 years i.e. 63.2%, which is also true for Glioblastoma Multiforme (Grade IV Astrocytoma) where 6 out of 8 cases (75%) occur in 21 to 50 year age group. Incidence below 10 years of age was zero, whereas youngest

age of incidence in our study was 14 years male of Grade IV Astrocytoma. Incidence above 70 years of age was very less i.e. 2.6% whereas oldest case was 71 years old female of Grade III Astrocytoma.

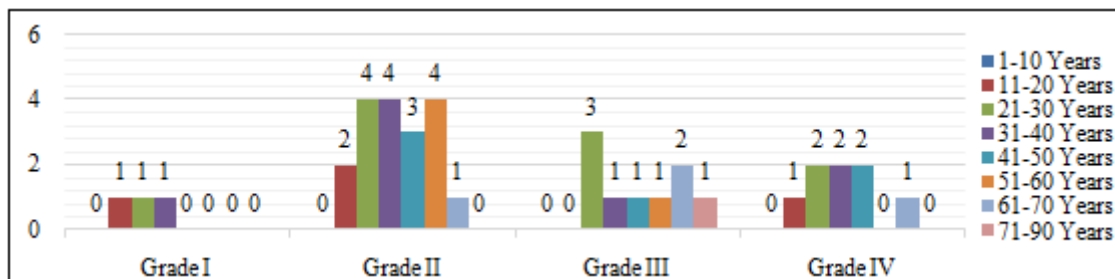


Figure 2: Age-wise distribution of cases

Table 3: Showing the sex-wise incidence of cases

Astrocytoma type	Male	Female	Male : Female ratio
Grade I	2	1	2:1
Grade II	13	5	13:5
Grade III	5	4	5:4
Grade IV	6	2	3:1
Total	26	12	13:6

Above table shows sex-wise distribution of cases. Overall the disease is more common in males i.e. 13:6. Maximum male predilection is 3:1 for grade IV tumors.

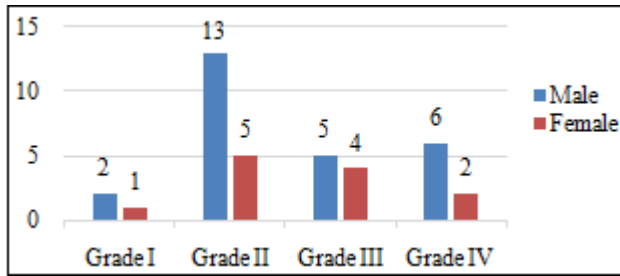


Figure 3: Sex-wise incidence of cases

Table 4: Showing the site-wise incidence of cases

Astrocytoma type	Frontal	Parietal	Temporal	Occipital	Others
Grade I	0	0	2	1	0
Grade II	6	5	3	1	3
Grade III	4.5	3	1	0.5	0
Grade IV	3.5	2	2.5	0	0
Total	14	10	8.5	2.5	3
Percentage	36.8%	26.3%	22.4%	6.6%	7.9%

Above table shows site-wise distribution of cases. Overall the disease is more common in Frontal lobe (36.8%) followed by Parietal lobe (26.3%) and least in Occipital lobe (6.6%). Other areas include 2 cases in Posterior fossa and only 1 Insular cortex.

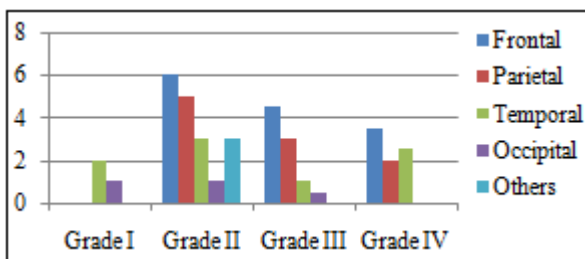


Figure 4: Site-wise incidence of cases

Table 5: Showing the laterality-wise incidence of cases

Astrocytoma type	Right cerebral Hemisphere	Left cerebral Hemisphere	Others
Grade I	1	2	0
Grade II	6	10	2
Grade III	4	5	0
Grade IV	1	7	0
Total	12	24	2

Above table shows laterality of the various types of Astrocytomas. Overall the incidence is twice as common in left cerebral hemisphere as that in right. Other areas include that of 2 cases of Posterior Fossa.

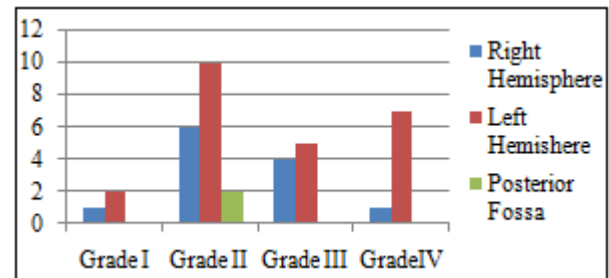


Figure 5: Laterality-wise incidence of cases

Table 6: Showing the size-wise incidence of cases

Size (in cm)	Astrocytoma Grade I	Astrocytoma Grade II	Astrocytoma Grade III	Astrocytoma Grade IV	Total no. of cases
Upto 1	0	1	0	0	1
1.1-2	1	7	2	1	11
2.1-3	1	4	1	3	9
3.1-4	0	2	1	3	6
4.1-5	0	2	3	1	6
>5	1	2	2	0	5
Total	3	18	9	8	38

Above table shows correlation between type of Astrocytoma and size of tumor at the time of excision. Tumor size of 1-3 cm was seen in 20 out of 38 (52.6%) cases and that of 1- 5 cm was seen in 32 out of 38 (84.2%) cases. Mean tumor size of grade I, grade II, grade III and grade IV Astrocytomas were found to be 3.16, 2.95, 4.01 and 3.26 respectively.

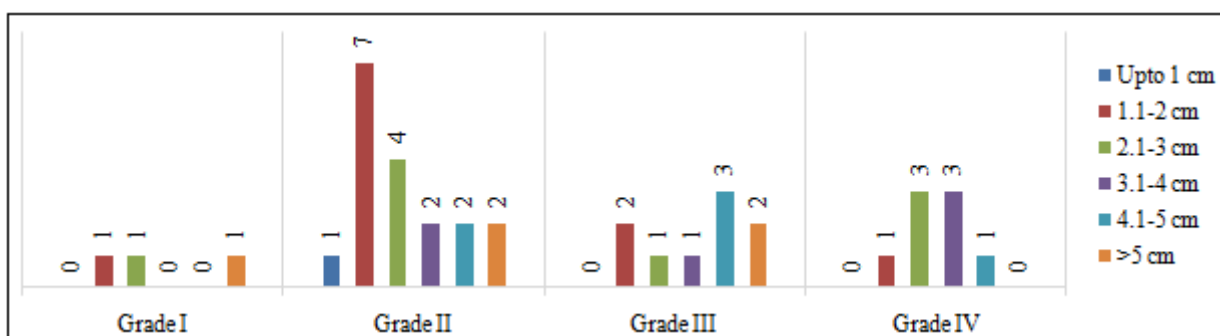


Figure 6: Size-wise incidence of cases

4. Discussion

Astrocytomas are common primary brain tumor seen in all age groups presenting with a variety of clinico-pathological features. They are found most commonly in cerebral hemisphere white matter but may also be found in other

regions of brain as well as spinal cord. Pilocytic Astrocytoma (Grade I Astrocytoma) can arise anywhere in the CNS, although it most frequently occurs in the cerebellum (42 %), followed by the supratentorial compartment (36 %), the optic pathway and hypothalamus (9 %), brainstem (9 %), and the spinal cord (2 %)[8].

Astrocytomas are more commonly seen in adult male while grade I is more common in children and young adults. Pilocytic Astrocytoma makes up approximately 5.1 % of all gliomas and is most common in children. Males are slightly more frequently affected than females[9].

Most cases of low-grade glioma tend to be slow-growing lesions, with an annual growth rate (if left untreated) of 4 to 6 mm per year[10]. Astrocytomas may cause compression of adjacent brain parenchyma, midline shift and obstruction to the ventricular system manifesting as headache, vomiting, seizure, weakness of limb, slurring of speech and diminution of vision etc.

Precise classification and grading are essential due to different therapeutic strategies prompted by diagnoses of pilocytic astrocytoma WHO grade I, diffuse astrocytomas WHO grade II or anaplastic astrocytoma WHO grade III[8].

Pilocytic Astrocytomas are considered to have an excellent prognosis with overall 10-year survival reported to be over 90 %⁹. Malignant astrocytomas (MA) are aggressive brain tumors that affect people of all ages. Current treatments are inadequate, with median survival being 14 months in adults[11]. Our study of 38 case series included 26 male and 12 female aged 1-90 years who has undergone surgery for intracranial glioma later diagnosed histopathologically as Astrocytoma. In our study incidence of Grade II Astrocytoma was highest among the four types (47.4%) followed by Grade III (23.7%), Grade IV (21%) and Grade I Astrocytoma (7.9%). Astrocytomas overall were found to be more common in 21- 30 years age group, while most common age group in Grade I, Grade II, Grade III and Grade IV Astrocytoma were 11-40 years, 21-60 years, 21-30 years and 21-50 years respectively.

Mean age for Grade I, Grade II, Grade III and Grade IV Astrocytoma were found to be 25 years, 38 years, 45 years, 36 years respectively. In our study overall male-female ratio was found to be 13: 6 while male-female ratio in grade I, grade II, grade III, and grade IV Astrocytomas were found to be 2:1, 13:5, 5:4 and 3:1 respectively.

Most cases of tumor were located to the left side of brain (63%) in the cerebral cortex (94.7%). Frontal lobe was most commonly involved (36.8%) followed by parietal lobe (26.3%), temporal lobe (22.4%) and occipital lobe (6.6%). Other areas include 2 cases of posterior fossa tumor and 1 case of insular cortex totaling to 7.9% and none from spinal cord.

Size of tumor in single maximum dimension at the time of surgery varied from 0.5 to 7.1 cm. Mean tumor size of Grade I, Grade II, Grade III and Grade IV Astrocytoma were found to be 3.16 cm, 2.95 cm, 4.01 cm, 3.26 cm respectively.

5. Conclusion

In our study, each case was studied with brief clinical features like age and sex of the patient, site and side of the tumor and size of excised tumor. Among the tumors, 18(47%) cases of Grade II Astrocytoma, 9(24%) cases of grade III, 8(21%) cases of grade IV and 3(8%) cases of

grade I Astrocytoma were received and identified in the present series. Thus all grades of Astrocytomas were found in the present study.

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