# Analysis of the relationship between age, gender, site and frequency of different grades of astrocytoma.

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ABSTRACT:

**Objective:** To examined the relationship among age, gender, location, and the frequency of different grades of astrocytoma.

**Methodology:** This cross-sectional study was conducted in the pathology department of Basic Medical Sciences Institute, Jinnah Postgraduate Medical Centre Karachi, Sindh; between 01-01-2019 to 31-12-2022. The study comprised 60 cases of astrocytoma. Biopsy samples of different grades of Astrocytoma were extensively investigated and included in the current research, taking into consideration their patients' age, demographic characteristics, clinical information and histological findings. This study reviewed and approved by Institutional Review Board (IRB) of JPMC. The data was analyzed using IBM-SPSS version 23.0, utilizing the Pearson Chi-Square test of independence. The P-value of 0.05 was set as statistically significant.

**Results:** A total of sixty astrocytic tumour cases were investigated. As per the findings of this investigation, the mean age of study participants was 31.5 years, ranging from 4 to 65 years. Male outnumber (34, 56.6%) female (26, 43.3%). The frontal lobe (31.7%), posterior fossa (16.7), and parietal region (11.7) were among the more frequently afflicted sites.

**Conclusion:** Diffuse astrocytoma was the most frequently observed, while anaplastic astrocytic tumours were the least prevalent. The occurrence of high-grade astrocytic tumors was found to be more common in males compared to females.

**Keywords:** Dentistry practice, Germ Cell and Embryonal Tumours, Neuroectodermal Tumours, Neuroepithelial, Glioma, Astrocytoma.

Introduction: Dentistry Central Nervous System (CNS) tumours are the 20th most common type of cancer globally. According to GLOBOCON, Central Nervous System (CNS) cancers are the 17th and the most prevalent neoplastic lesions in the American population.[1] The Shaukat Khanum cancer registry indicates that, in 2020, central nervous system tumors ranked as the seventh most frequently diagnosed type of cancer among children in the Pakistani population.[2]

Combined brain and spinal cord tumors make up simply 4% of all recently identified malignancies in America.[3] Glial tumors were the most prevalent type of brain and spinal cord malignancies, representing over ninety percent of all cases. Among these, Grade IV astrocytoma is the most frequently diagnosed glioma, comprising 69% of the total.[4] Gliomas are primary Central nervous system cancers that emerge from precursor or neuro-glial stem cell populations. According to their histological appearance, they have generally been classed as astrocytomas, oligodendrogliomas, or ependymomas. The World Health Organization grades these tumors from one to four representing different levels of malignancies.[5]

Astrocytoma are tumors that originate in glial cells known as astrocytes. Astrocytoma primarily affects the brain and may also impact the spinal cord, resulting in a high fatality rate and substantial debility degrees in both kids and elders.[6,7] Astrocytoma, particularly glioblastoma, are the supreme violent among Central Nervous System (CNS) tumours worst consequences.[8,9] Based on the World Health Organization grading System, astrocytic tumors are categorized into 04 grades: grade I pilocytic astrocytoma, grade II diffuse astrocytoma, grade III anaplastic astrocytoma, and grade IV glioblastoma multiforme.[10-12] This research aims to evaluate the relationship between age, gender, site and the frequency of various grades of astrocytoma.

**Objective:**

To examined the relationship among age, gender, location, and the frequency of different grades of astrocytoma.

**Methodology:**

This research was conducted in the Pathology section of BMSI, JPMC Karachi, Sindh Pakistan, from January 1, 2019, to December 31, 2022. It comprised all histopathologically proven Astrocytoma specimens that had been adequately formalin-fixed and paraffin-embedded. Histopathological data, medical information, and the patient's distinguishing characteristics were collected. Every case was classified according to the WHO grading system. The investigation relied on medical records to collect critical data, numbers, and facts. The study excluded biopsy samples with inadequate material, autolyzed biopsy samples, and biopsy samples with unimpressive or differential diagnosis. IBM-SPSS version 23.0 was used for analyzing the collected data. Astrocytoma numbers and proportions were

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provided along with other histological classifications and grades. An examination was conducted to determine if the patient's age, gender, and tumor site corresponded with the WHO grade for Astrocytoma. The Pearson square test determined the significance level for P-values less than 0.05. The JPMC Institutional Review Board granted permission.

**Results:**

Table 1 provides a detailed distribution of patient ages categorized by the morphological grade of astrocytoma. In grade I, there were 16 cases (26.7%), with an average age of 26.2 years (Standard Deviation = ±15.0), and ages ranged from 6 to 56. For grade II, which included 24 cases (40%), the average age was 32.4 years (Standard Deviation = ±13.2), with patients aged between 4 and 60. In grade III, there were 6 cases (10%) with an average age of 22.8 years (Standard Deviation = ±15.3), and the age range was from 8 to 45. Lastly, the fourteen cases (23.3%) in grade IV had an average age of 39.9 years (Standard Deviation = ±19.2), with ages spanning from 11 to 65.

**Table No 1: Grade of Astrocytoma vs age.**

| Morphological Grade | n | % | Mean age | ±SD | Min Age | Max Age |
|---|---|---|---|---|---|---|
| I | 16 | 26.7 | 26.2 | 15.0 | 6.0 | 56.0 |
| II | 24 | 40 | 32.4 | 13.2 | 4.0 | 60.0 |
| III | 6 | 10 | 22.8 | 15.3 | 8.0 | 45.0 |
| IV | 14 | 23.3 | 39.9 | 19.2 | 11.0 | 65.0 |
| Overall | 60 | 100 | 31.5 | 16.0 | 4 | 65 |

Table 2 illustrates the overall prevalence of different grades of astrocytoma categorized by gender. Among the total biopsy samples of astrocytoma, Grade I (G-I) accounted for 16 cases, representing 26.7% of the total. Of these, nine samples (15%) were from females, while seven samples (11.7%) were from males. Grade II (G-II) comprised 24 cases, or 40% of the total, with ten cases (16.7%) from females and 14 cases (23.3%) from males. Grade III (G-III) included six biopsy samples, making up 10% of the total, with three samples (5%) from males and three samples (5%) from females. Additionally, there were 14 biopsy samples of Grade IV (G-IV) astrocytoma, constituting 23.3% of all cases, with ten samples (16.7%) from males and four samples (6.6%) from females. A significant association was identified (p=0.48) between gender and astrocytoma grade using the Pearson chi-square test. The male-to-female ratios for the different grades were as follows: G-I had a ratio of 0.77:1, G-II had 1.4:1, G-III was 1:1, and G-IV was 2.5:1. Overall, the combined male-to-female ratio across all grades was 1.3:1. Table 3 illustrates the distribution of various grades of astrocytoma based on tumor location. In the frontal region, nineteen biopsy samples (31.7%) were identified as grade I, three samples (5%) as grade II, and seven samples (11.7%) as grade IV. The frontoparietal area contained six biopsy samples (10%), which were classified into grade I, grade II, grade III, and grade IV, with one sample (1.7%) as grade I, and three samples (5%) as grade II, grade III, and grade IV, respectively. In the parietal region, seven biopsy samples (11.7%) were recorded, including one sample (1.7%) classified as grade I, five samples (8.3%) as grade II, and one sample (1.7%) as grade III. The temporal area yielded four biopsy samples (6.7%), comprising one sample (1.7%) as grade I and three samples (5%) as grade IV. Additionally, there were ten samples (16.7%) from the posterior fossa, with six samples (10%) classified as grade I, three samples (5%) as grade II, and one sample (1.7%) as grade IV. Although fewer cases were noted in other regions such as the bithalamic, temporoparietal, parasagittal, parietoccipital, and spinal cord, the Pearson chi-square test indicated a significant correlation between tumor location and morphological grades ($p < 0.001$).

**Table No 2. Various Grades of Astrocytic Tumors vs Gender.**

| Morphological grade | n (%) | Male n (%) | Female n (%) | M: F | p value |
|---|---|---|---|---|---|
| I | 16 (26.7) | 7 (11.7) | 9 (15.0) | 0.77: 1 | =0.48 * |
| II | 24 (40) | 14 (23.3) | 10 (16.7) | 1.4:1 | |
| III | 6 (10) | 3 (5.0) | 3(5.0) | 1:1 | |
| IV | 14 (23.3) | 10 (16.7) | 4 (6.6) | 2.5:1 | |
| Total | 60 (100) | 34 (56.6) | 26 (43.4) | 1.3:1 | |
| * Pearson Chi-Square test was used keeping p<0.05 statistically significant. | | | | | |

**Discussion:** Comprehending the frequency of these malignancies in the population is essential for advancing treatment methodologies and expanding our understanding of their management. To achieve this, it is important to examine various factors such as age, gender, tumor grade, and the specific location of the tumors within the brain and spinal cord. Analyzing the prevalence of astrocytic tumours across different age demographics can aid in assessing patient treatment and management strategies. Additionally, investigating gender differences in the incidence of these tumors can yield critical insights into risk factors and genetic predispositions that contribute to their development.

A total of sixty cases of different grades of astrocytoma were evaluated. There were 16 (26.7%) in Grade-I, 24 (40%) in Grade-II, 6 (10%) in Grade-III, and 14 (23.3%) in Grade-IV. The results of current study are in agreement with a study conducted in Iraq [13]. While results of Qaisrani and Schittenhelm reported contradictory findings to current study.[14,15] Additionally, various studies carried out in different nations have revealed a greater incidence of high-grade astrocytic tumors, contrasting with the current research, which identified a predominance of lower-grade astrocytic tumors. Several factors may contribute to this discrepancy, including variations in population age and a higher frequency of autopsies in certain countries compared to others.

The present study revealed that astrocytic tumors are predominantly observed in individuals during their third decade of life, with ages spanning from 4 to 65 years. This data sheds light on the demographic characteristics of those affected by these tumors. While numerous prior studies [13,16,17] have reported comparable findings, it is important to highlight that Hashmi and colleagues[18] identified a higher average age, suggesting that variations in age may exist across different populations. It is reasonable to assert that additional research could be essential to uncover the various factors contributing to these age disparities, as well as to enhance the diagnosis and management of astrocytic tumors.

The results of the present study indicate that men are at a higher risk of developing astrocytoma compared to women. A separate study conducted in Pakistan revealed that 65% of individuals diagnosed with astrocytoma were male, while only 35% were female, resulting in a male-to-female ratio of 1.8:1.14 Similarly, research from Iraq reported comparable findings, with 55% of cases occurring in males and 45% in females, yielding a male-to-female ratio of 1.25:1.13 These results consistently suggest that men experience a higher incidence of astrocytic tumors than women across various countries. This evidence implies that the development of these tumors may be influenced by hormones, highlighting the potential significance of hormonal factors in the differences in susceptibility to these astrocytic tumors.

Further investigation into the relationship between steroid hormones and gliomagenesis would enhance our comprehension of the mechanisms contributing to the gender disparity in astrocytoma incidence.

Based on their findings, Hirtz and associates determined that gliomas, particularly astrocytomas, are tumors that are sensitive to hormones.[19]

Kabat et al. also observed that glial tumours may be more prevalent in men compared to women, with the lowest incidence noted during reproductive years, suggesting a potential protective effect of estrogens. Research has indicated that estradiol and selective estrogen receptor modulators (SERMs) can inhibit the development of gliomas.[20]

The ongoing investigation indicates that the frontal lobe (31.7%) and posterior fossa (16.7%) are the most commonly affected areas. Similar findings have been reported in other studies, which also noted a predominance of cases involving the frontal lobe.[21,22] Conversely, Ibrahim and his team reported different outcomes.[7] Research on astrocytic tumors in Pakistan has been limited. This study offers valuable insights into the correlations among age, gender, tumor location, and the prevalence of astrocytic tumors across various grades.

Table No 3: Association of Astrocytic tumor grade with the location of tumor

| Tumor Location | Grade -I n (%) | Grade -II n (%) | Grade - III n (%) | Grade-IV n (%) | Total n (%) | p value |
|---|---|---|---|---|---|---|
| Frontal Region | 3(5) | 9 (15) | - | 7 (11.7) | 19 (31.7) | p<0.01* |
| Frontoparietal Region | 1 (1.7) | 3 (5) | 1(1.7) | 1(1.7) | 6 (10) | |
| Parietal region | 1 (1.7) | 5 (8.3) | 1(1.7) | - | 7 (11.7) | |
| Temporal area | 1 (1.7) | - | - | 3(5) | 4 (6.7) | |
| Posterior Fossa | 6 (10) | 3 (5) | - | 1(1.7) | 10 (16.7) | |
| Temporoparietal area | 1 (1.7) | - | - | 1(1.7) | 2 (3.4) | |
| Parasagittal area | - | 1 (1.7) | - | - | 1 (1.7) | |
| Bihalamic area | - | - | 2 (3.3) | - | 2 (3.3) | |
| Parietoccipital area | 3 (5) | 1 (1.7) | 1 (1.7) | 1(1.7) | 6 (10) | |
| Spinal Cord | - | 2 (3.3) | 1 (1.7) | | 3 (5) | |
| * Pearson Chi-Square test was used keeping p<0.05 statistically significant. | | | | | | |

## Conclusion:

Diffuse astrocytoma was the most frequently observed, while anaplastic astrocytic tumor was least prevalent. The occurrence of high-grade astrocytic tumors was found to be more common in males compared to females, a finding suggests that hormonal or genetic variables may play a contributing factor. Predilection for site of origin may aid to plan appropriate management.

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**Conflict of interest:** Authors declare none.

**Authors' Contribution**:

Asma Jalbani: conceptualized the idea and authored the manuscript, which received approval from Noshaba Rahat. Additional contributions included editing, statistical analysis, and data collection by other team members.

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