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Study of Glioblastomas According to Clinicopathological Parameters

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ABSTRACT

Background: Glioblastomas are the most common tumors of the central nervous system. The incidence of brain tumors is higher in developed countries and is constantly increasing. **Aim of the study:** The purpose of this study was to analyze the clinicopathological data of patients diagnosed with glioblastomas from a selected case series. **Material and methods:** This retrospective, single-center study was conducted on glioblastoma cases diagnosed between 2014 and 2018 at the Department of Pathology of the County Emergency Clinical Hospital of Târgu Mureș, Romania. The information was centralized from histopathology reports and focused on the location of glioblastomas and demographic parameters (gender and age of patients). **Results:** In the studied period, there were 154 patients diagnosed with glioblastoma, of which 50.65% were men. The most affected age group was 61–70 years (31.17% of cases). In most cases (49.35%), the glioblastoma was located in the left cerebral hemisphere, and the most affected lobes were the frontal (29.87%), temporal (26.62%), and parietal (14.94%). We could not find a statistically significant association between the distribution of cases by years, gender, and location of the tumor. **Conclusions:** Glioblastoma is a tumor that involves the left cerebral hemisphere most often and affects both genders over the age of sixty.

Keywords: glioblastoma, age, gender, localization

INTRODUCTION

Gliomas are the most aggressive tumors of the central nervous system. According to the classification of the WHO, diffuse gliomas are subdivided into astrocytomas, oligodendrogliomas, and glioblastomas.[1,2] Among diffuse gliomas, glioblastoma is the most malignant type (grade IV), displaying a diffuse growth and resistance to chemotherapeutic agents. Most cases are primary malignant and do not display mutations for the isocitrate dehydrogenase 1 gene (IDH-wildtype glioblastomas). Secondary glioblastomas are IDH-mutant cases and occur as a result of dedifferentiation from diffuse grade II or III gliomas.[1] Tumor cell proliferation is also influenced by genetic and environmental factors.

The incidence of brain tumors is higher in developed countries, with differences between ethnic and racial groups. The annual incidence is between 0.59–5/100,000 people, with high numbers of cases reported in South America, South and Eastern Europe, and low numbers reported in East Asia. In terms of age, the most affected age groups are over 55 years, and the male to female ratio ranges from 1:1 to 2.7:1. Overall, the median survival of glioblastoma patients is between 16 and 22 months, in favor of female patients.[1,3–5]

Glioblastomas are located especially in the supratentorial region of the central nervous system. Primary glioblastomas occur more frequently in the temporal, parietal, and frontal lobes. Considering the accelerated expansion of the tumor, it usually invades several lobes with a tendency to proliferate towards the deep areas and to the contralateral hemisphere. Secondary glioblastomas are located mainly in the frontal lobe, frequently in the right cerebral hemisphere, uncommon in central cerebral areas.[6]

The therapeutic management consists in surgical resection, followed by chemotherapy with temozolomide-based or other agents in combination with radiotherapy.[7–9] There is currently no second line of treatment, although bevacizumab, an anti-VEGF chemotherapeutic, has been used alone or in combination but has not yet been approved in Europe for the treatment of glioblastomas.[10]

Despite improving therapy, the incidence of glioblastomas is increasing constantly, and it remains an important cause of cancer death in adults.

The aim of this study was to perform an initial assessment of the clinicopathological parameters of consecutive cases of glioblastomas, as a starting point for further studies.

MATERIAL AND METHODS

This retrospective, single-center study was conducted at the Department of Pathology of the County Emergency Clinical Hospital of Târgu Mureș, Romania. The study included all consecutive patients diagnosed with glioblastoma between 2014 and 2018 who underwent surgery.

For a preliminary database, demographic and tumor parameters were centralized from the histopathology reports. Analyzed tumor parameters included localization (frontal lobe, temporal lobe, parietal lobe) and orientation for the cerebral hemisphere (left, right, or central localization). Statistical analysis of the data was carried out using GraphPad InStat 3, version 3.06 (GraphPad Software Inc, San Diego, USA). The statistical significance was set for a value of $p < 0.05$ (95% confidence interval). This research was approved by the Ethics Committee of the Emergency Clinical County Hospital of Târgu Mureș, Romania.

TABLE 1. Demographic, clinical and metabolic characteristics of patients with T2DM without and with DRD

	2014		2015		2016		2017		2018	
	M	F	M	F	M	F	M	F	M	F
Age (years)										
1–10	0	0	0	0	0	1	0	1	0	0
21–30	0	0	0	0	1	0	1	1	0	0
31–40	1	2	2	0	1	3	2	1	0	1
41–50	5	0	1	0	5	2	3	1	2	5
51–60	9	3	2	5	3	9	2	3	4	4
61–70	6	4	3	4	3	4	7	6	3	8
71–80	3	1	1	1	4	2	2	2	2	1
>80	0	0	0	0	0	1	0	0	0	0
Orientation										
Left hemisphere	10	4	5	5	9	6	11	8	6	12
Right hemisphere	12	4	4	5	8	14	6	7	4	5
Central area	0	0	0	0	0	2	0	0	1	0
Left hemisphere/right hemisphere	0.83	1	1.25	1	1.12	0.42	1.83	0.87	1.5	2
Localization										
Frontal lobe	5	5	2	3	4	7	6	2	3	9
Temporal lobe	4	1	2	2	7	7	6	8	1	3
Parietal lobe	5	1	3	3	2	2	2	1	2	2

F – female; M – male

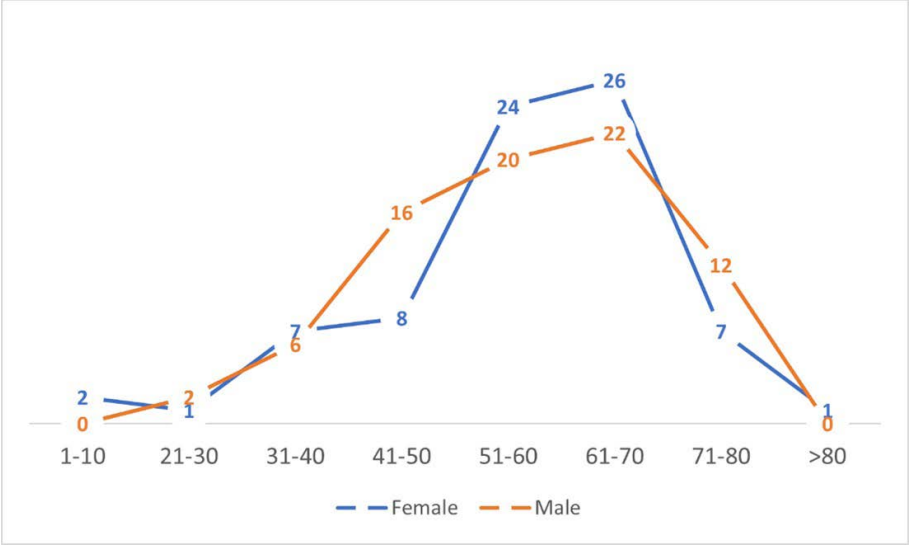

FIGURE 1. Incidence of glioblastomas according to age groups and gender

RESULTS

Between 2014 and 2018, a total of 154 patients have been diagnosed with glioblastoma at the Department of Pathology of the County Emergency Clinical Hospital of Târgu Mureș, Romania. The mean age was 57 years (range 8–81 years). A relatively equal distribution was seen between genders, 50.65% of cases (78/154) being male and 49.35% (76/154) female. The male to female ratio was 1.02:1.

Regarding age distribution, glioblastomas were more frequent in patients aged 61–70 years (31.17%, 48/154), followed by patients aged 51–60 years (28.57%, 44/154). An extremely low number of cases were found in patients aged 1–20 years and >80 years (1.95%, 3/154) (Table 1).

The male to female ratio was 1:1.18 in the 51–60 years and 1:1.2 in the 61–70 years age group, with more females than males, while in the 41–50 years and 71–80 years age groups it was 1.7:1 and 2:1, respectively, with more males than females. We could not demonstrate a statistically significant association between age and gender ($p = 0.32$) (Figure 1).

Regarding the orientation of glioblastomas, most of the tumors involve a single hemisphere. In most of the analyzed cases (49.35%, 76/154) the tumor was located in the left cerebral hemisphere, and in 44.81% (69/154) in the right cerebral hemisphere (Table 1).

Regarding the anatomical location within the cerebral hemisphere, most of the cases were located in the frontal

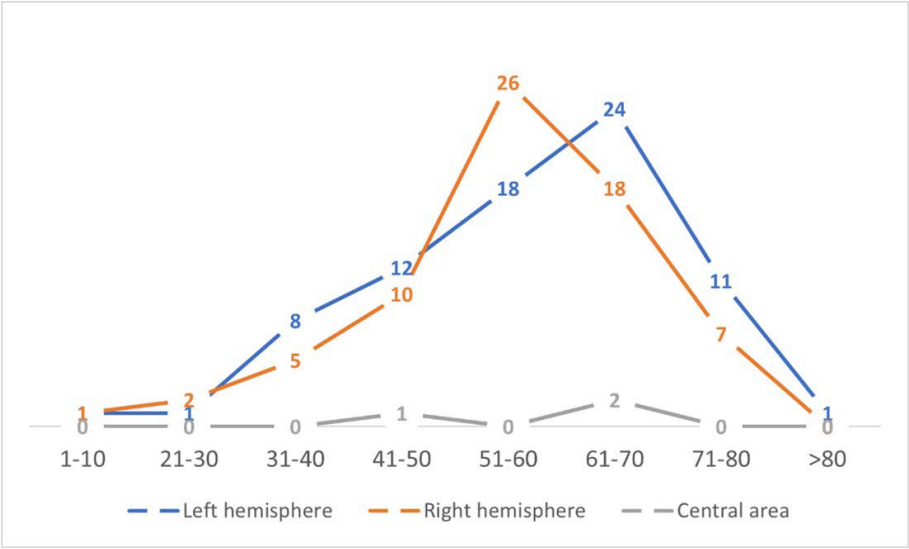

FIGURE 2. Incidence of glioblastomas according to age group and tumor orientation

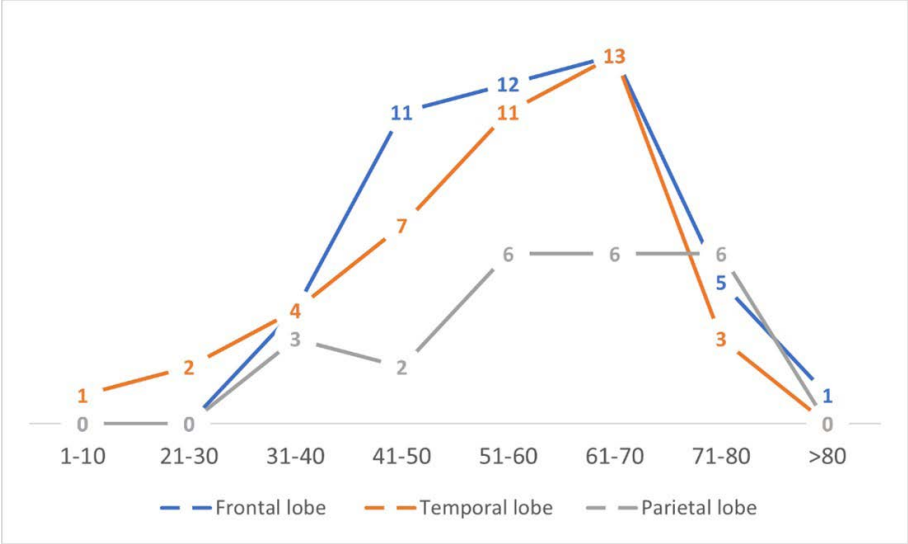

FIGURE 3. Incidence of glioblastomas according to age group and tumor location

(29.87%, 46/154), temporal (26.62%, 41/154), and parietal (14.94%, 23/154) lobes. Corpus callosum, thalamus, or intraventricular localization were uncommon, with 2–3 cases each. Glioblastomas located in the temporal and frontal lobes were more frequent in females, while those located in the parietal lobe were more frequent in males, but the difference was not significant (p = 0.16) (Table 1).

Considering the orientation and localization of glioblastomas, the ratio between left hemisphere/right hemisphere orientation was 1.875 in the frontal lobe, 0.952 in the temporal lobe, and 0.916 in the parietal lobe. As far as the relation between tumor localization and the patients' gender is concerned, the male to female ratio over the entire analyzed period was 1:1.3 in case of tumors located in the frontal lobe, 1:1.05 for tumors located in the temporal lobe, and 1.55:1 for tumors located in the parietal lobe.

We did find a statistically significant association between tumor localization and orientation (p = 0.32). Most of the age groups showed left predominance, except patients between 51 and 60 years, where the tumors were more frequent in the right hemisphere (p = 0.83) (Figure 2). In the majority of the age groups, the most affected region was the frontal lobe, followed by the temporal and parietal lobes (p = 0.51) (Figure 3).

The highest number of glioblastomas were diagnosed in 2016 (25.32%, 39/154) and 2014 (22.08%, 34/154). In contrast, very few cases were diagnosed in 2015 (12.34%, 19/154). Most of the patients diagnosed in 2014 (30.76%, 24/78) were males, with a male to female ratio of 2.4:1.

TABLE 2. Distribution of glioblastomas by gender – results from the current analysis and comparison of data with similar studies

	Years	Total no. of cases	Male	Female	Male to female ratio
Present study	2014–2018	154	78	76	1.02
Grech *et al.*[5]	2008–2017	100	61	39	1.56
Shah *et al.*[9]	1999–2010	6,039	3,153	2,886	1.09
Eriksson *et al.*[10]	1995–2015	571	352	219	1.60
Yang *et al.*[11]	Unavailable	371	227	144	1.57
Tian *et al.*[12]	2000–2008	6586	4,049	2,537	1.59
Hansen *et al.*[13]	2009–2014	1,364	828	536	1.54
Behzadnia *et al.*[14]	1999–2015	58	35	23	1.52
Korja *et al.*[15]	2000–2013	2,045	1,191	854	1.39
Nizamutdinov *et al.*[16]	1976–2013	645	345	300	1.15
Liang et al.[17]	2015–2018	335	190	145	1.31

TABLE 2. Distribution of glioblastomas by gender – results from the current analysis and comparison of data with similar studies

	Years	Total no. of cases	Frontal lobe	Temporal lobe	Parietal lobe
Present study	2014–2018	154	46	41	23
Grech *et al.*[5]	2008–2017	100	25	21	23
Tian *et al.*[12]	2000–2008	6,586	1,663	1,556	1,097
Hansen *et al.*[13]	2009–2014	1364	415	437	258
Behzadnia *et al.*[14]	1999–2015	58	10	6	9
Nizamutdinov *et al.*[16]	1976–2013	645	184	134	136

In 2015, both males and females were diagnosed relatively equally (male to female ratio of 0.9:1). Most female cases were diagnosed in 2016 (28.95%, 22/76), while the least number of cases were recorded in 2014 and 2015 (26.32%, 20/76).

The analysis did not reveal a statistically significant association between case distribution over the years and the gender of patients ($p = 0.06$), tumor orientation ($p = 0.33$), and localization ($p = 0.08$). The most frequently involved hemisphere was the left one; the left hemisphere/right hemisphere ratio ranged between 0.68 and 2 (0.68 in 2016, 0.87 in 2014, 1.11 in 2015, 1.46 in 2017, and 2 in 2018). Most of the cases with central localization were diagnosed in 2016 (2/3).

DISCUSSIONS

Current data show that glioblastomas develop more frequently in the right cerebral hemisphere. In contrast with these data, we found a predominance of tumor location in the left cerebral hemisphere.[6] We also found infrequent central or intraventricular tumors.

Current epidemiological data show differences between males and females regarding the incidence of glioblastomas, with a male to female ratio ranging between 1.09:1 and 1.6:1 (Table 2).[5,9–17] In contrast with these data, we found a relatively equal distribution between genders.

Similarly to other reports (Table 3),[5,12–14,16] we found glioblastomas in the frontal, temporal, and parietal lobes. In a cohort of patients from Denmark, Hansen *et al.* found glioblastomas located predominantly in the temporal lobe.[13]

In Europe, the estimated mean age at the time of diagnosis of astrocyte-derived tumors is 53 years, which is similar to the age distribution found in our analysis.

CONCLUSIONS

Glioblastomas are tumors that affect both genders and develop more frequently in the left cerebral hemisphere and in the frontal lobe. In our geographical area, they appear predominantly in patients aged between 50 and 80 years.

CONFLICT OF INTEREST

Nothing to declare.

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