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Patients operated due to intracranial mass: A 5-year analysis

Veysel Kiyak[a,*], Ozgur Demir[a], Fatih Ersay Deniz[a], Erol Oksuz[a], Osman Demir[b]

[a] *Tokat Gaziosmanapasa University, Faculty of Medicine, Departmant of Neurosurgery, Tokat, Türkiye*
[b] *Tokat Gaziosmanapasa University, Faculty of Medicine, Departmant of Bioistatistic, Tokat, Türkiye*

ARTICLE INFO

Keywords:
Brain tumor
Mortality
Epidemiology

Received: Oct 06, 2022
Accepted: Jan 23, 2023
Available Online: 27.02.2023

DOI:
10.5455/annalsmedres.2022.10.304

Abstract

Aim: In the present study, it was aimed to contribute to the literature in the light of reliable and accurate information by revealing in-hospital mortality rate, tumors' pathology and location and whether they are of primary-metastasis or recurrence, initial admission complaint, type of admission, and demographic characteristics such as sex and age and in patients who were operated due to brain tumor.

Materials and Methods: This retrospective study was designed with the inclusion of patients over the age of 18 years who applied to Tokat Gaziosmanpaşa University Neurosurgery clinic from the emergency department or outpatient clinic between January 01, 2017 and December 31, 2021, and who were hospitalized with a pre-diagnosis of intracranial mass and operated.

Results: The most frequently seen tumors according to pathology results were metastasis with 27 (28.4%) patients. It was observed that the admission GCS (Glasgow Coma Scale) score of the deceased patients were significantly lower than that of the survivors ($p = 0.042$). Similarly, clouding of consciousness ($p = 0.003$) and GCS ($p < 0.001$) values were statistically significantly lower in the patients who were hospitalized from the emergency department. The length of hospital stay was longer in the deceased patients than in the survivors ($p < 0.001$). It was also observed that the patients with tumors located in the parietal lobe had longer hospital stay than the others ($p < 0.001$).

Conclusion: The etiology of the patients indicated that the majority of metastases were originated from lung cancer (LC). We assumed that these patients would not have brain metastases in the absence of LC cancer. Eliminating the preventable factors that are in the etiology of LC cancer such as smoking would reduce the occurrence of mortality and neurological sequelae, and also economic-arse losses due to complex treatments of those conditions.

Introduction

Intracranial pressure (ICP) is constant since cranium is in rigid structure [1]. One of the causes for the elevation in ICP is brain tumors [2]. Brain tumors, which can be seen all age groups in the population [3], may be primarily benign or malignant, as well as they appear as metastasis [4]. Benign tumors cannot always be cured by treatment [5]. Edema that may develop as a consequence of the tumor being large and in crucial places including the pons and herniation that occurs accordingly may result in life-threatening consequences [6]. It is rare for primary brain tumors metastasing out of central nervous system [7]. Primary malignant brain tumors are cancers that are difficult to treat and whose 5-year survival rate does not exceed 35% [8].

The incidence of brain tumors, like other cancers, has been significantly increasing worldwide. Although its prevalence is not very high, brain tumors are a significant public health issue due to poor prognosis and difficulties in postoperative follow-up and treatment. Therefore, for the purpose of finding optimum method in the treatment and follow-up of brain tumors, accurate and reliable data are required.

The aim of the present study is to contribute the literature by revealing in-hospital mortality rate, pathology and location of tumors and whether they are of primary-metastasis or recurrence, initial admission complaint, type of admission, and patient characteristics of sex and age in patients operated due to brain tumor. In line with the results obtained, we believe that this study would make an important contribution in developing health policies.

*Corresponding author:
Email address: vyslkyk86@gmail.com (Veysel Kiyak)

Epidemiology

Although the incidence of primary brain tumors can show variation depending on various factors for example sex and age, they constitute an average of 2% of all cancers and their annual incidence is about 22 per 100,000 people [9]. Brain tumor incidence increases with advancing age [10]. Metastases are most frequently observed brain tumors [11]. The most common cause of metastasis to the brain is LC and breast cancer [12]. Meningiomas are most frequently seen benign primary brain tumors [13], whereas gliomas are the most common primary malignant brain tumors in adults [14]. Gliomas, lymphomas and germ cell tumors are observed more in males [8].

Clinical presentation

Brain tumors can cause different symptoms with respect to their location and size. Sometimes they manifest themselves with symptoms that last a long time, but that patients do not need to apply to the hospital because they are nonspecific symptoms (such as headache). Some other times, the diagnosis can be made on imaging performed for a different reason, such as after trauma. On average, 50-80% of patients present with seizures, 30% with headache complaints [15, 16], 10% with nausea and vomiting, 30% with blurred vision or different visual symptoms [3]. Personality changes may occur in patients with tumors located in the frontal lobe [3]. Tumors specifically located in the Broca's area of the frontal lobe, the dominant side, may cause speech loss [17]. In tumors located in the temporal lobe, on the other hand, seizures and changes in consciousness may be seen [18]. Visual defects may occur in occupital lobe tumors [19]. Cerebellar tumors may cause dysmetria, ataxic gait and nystagmus [20]. Respiratory distress and accordingly sudden death may be seen in tumors located close to the brain stem [21].

Materials and Methods

The study received ethical approval from the local ethics committee (Tokat Gaziosmanpaşa University Clinical Research Ethics Committee, number: 22-KAEK-192). This retrospective study was designed by including patients with the age of over 18 years who applied to Tokat Gaziosmanpaşa University Neurosurgery clinic from the emergency department or outpatient clinic between January 01, 2017 and December 31, 2021, and who were hospitalized with a pre-diagnosis of intracranial mass and operated. The inclusion criteria were the diagnosis of patients operated due to intracranial mass. The exclusion criteria were those with pituitary adenomas and vascular lesions. The sample group was divided into different groups according to tumor types. There are 2 types of brain tumors. Group 1 Primary brain tumors: They arise from either the brain parenchyma or extraneural structures in the brain. Group 2 Secondary brain tumors (brain metastases): Originate from tissues outside the brain and spread to the brain. The study data were retrieved from patients' medical records by using electronic patient record system (ENLIL, hospital information management system, version v2.19.46 20191118). It was determined that the diagnosis had been made with radiological evaluation. Since the study was designed retrospectively, no informed consent of the patients was obtained. Comorbidities were evaluated based on the Charlson comorbidity index (CCI). The patients with CCI score of 0 were coded as 0; those with CCI score of 1 were coded as 1 and those with CCI score of 2 or above were coded as 2. Various qualitative and quantitative variables are illustrated in detail in the tables.

Statistical analysis

Descriptive analyses were conducted with the aim of providing information about general characteristics of the study group. The data on continuous and categorical variables were given as mean ± standard deviation and n (%), respectively. Independent t test or one-way ANOVA was utilized for between group comparisons of the means of quantitative variables. Contingency tables and chi-square tests were employed to assess whether there exists a relationship between qualitative variables. All p-values calculated to be less than 0.05 were regarded as statistically significant. A commercial software package (SPSS 22.0 Chicago, IL, USA) was utilized in all statistical calculations.

Results

There were 31 females (32.6%) and 64 males (67.4%) who met the study criteria. The mean age of the patients was determined to be 57.83 ± 15.73 years with a range of 19 to 88 years. Of the patients, 45 (47.4%) were hospitalized from the outpatient clinic and 50 (52.6%) after applying to the emergency department. According to the CCI results, 18 patients (18.9%) had no comorbidities, while 27 (28.4) had one and 50 (52.5%) had two or more comorbidities. The most common comorbidities in the patients were hypertension, coronary artery disease and diabetes mellitus, respectively. Hemiparesis observed in 42 (44.2%) patients and headache in 31 (32.8%) patients were the most frequent symptoms among all patients. Considering the location of the lesions, it was seen that the tumors most commonly located in the frontal region (35 patients, 36.8%), followed by temporal (28 patients, 29.5%) and parietal regions (28 patients, 29.5%). On the other side, the tumors were detected in the pineal and pontocerebellar angles in only one patient each. According to the pathology results, it was determined that 56 (58.9%) patients had primary brain tumors, whereas 26 (27.4%)

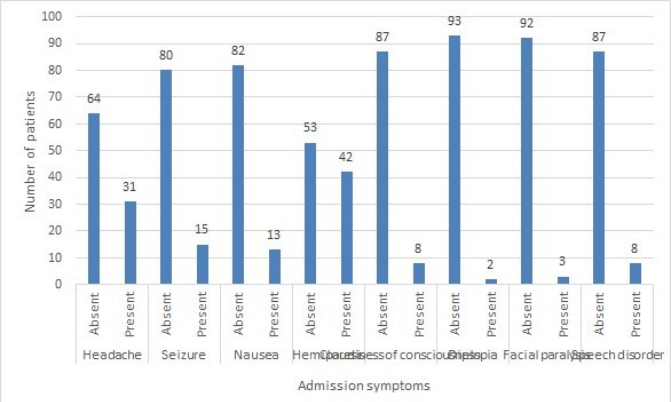

Figure 1. Distribution of the brain tumors by location.

Table 1. Results of qualitative variables.

			n (%)
Mortality		Alive	81(85.3)
		Exitus	14(14.7)
Disease status		Primary	56(58.9)
		Metastasis	27(27.4)
		Recurrent	12(13.7)
CCI score		0	18(18.9)
		1	27(28.4)
		2	50(52.6)
ASA (American Society of Anesthesiologists) score		2	15(15.8)
		3	68(71.6)
		4	12(12.6)
Cancer type		Primary	56(58.9)
		Recurrent	12(12.6)
	Metastasis	Lung	22(23.2)
		Colon	2(2.1)
		Breast	2(2.1)
		Gastric	1(1.1)
Sex		Female	31(32.6)
		Male	64(67.4)
Pathology		Astrocytoma	14(14.7)
		Meningioma	19(20)
		Metastasis	26(27.4)
		Lymphoma	4(4.2)
		Other	9(9.5)
		High-grade glial	23(24.2)
Hospitalization type		Outpatient clinic	45(47.4)
		Emergency department	50(52.6)
Tumor Location	Frontal	Absent	60(63.2)
		Present	35(36.8)
	Temporal	Absent	67(70.5)
		Present	28(29.5)
	Parietal	Absent	67(70.5)
		Present	28(29.5)
	Occipital	Absent	78(82.1)
		Present	17(17.9)
	Cerebellum	Absent	85(89.5)
		Present	10(10.5)
	Pineal	Absent	94(98.9)
		Present	1(1.1)
	Pontocerebellar angle	Absent	94(98.9)
		Present	1(1.1)
Symptoms	Headache	Absent	64(67.4)
		Present	31(32.6)
	Seizure	Absent	80(84.2)
		Present	15(15.8)
	Nausea	Absent	82(86.3)
		Present	13(13.7)
	Hemiparesis	Absent	53(55.8)
		Present	42(44.2)
	Clouding of consciousness	Absent	87(91.6)
		Present	8(8.4)
	Diplopia	Absent	93(97.9)
		Present	2(2.1)
	Facial paralysis	Absent	92(96.8)
		Present	3(3.2)
	Speech disorder	Absent	87(91.6)
		Present	8(8.4)
Comorbidities	Hypertension	Absent	41(43.2)
		Present	54(56.8)
	Coronary artery disease	Absent	62(65.3)
		Present	33(34.7)
	Heart failure	Absent	84(88.4)
		Present	11(11.6)
	Diabetes mellitus	Absent	70(73.7)
		Present	25(26.3)
	Chronic obstructive pulmonary disease	Absent	78(82.1)
		Present	17(17.9)
	Alzheimer	Absent	76(80)
		Present	19(20)
	Chronic renal failure	Absent	81(85.3)
		Present	14(14.7)
	Cerebrovascular event	Absent	77(81.1)
		Present	18(18.9)
	Arrhythmia	Absent	85(89.5)
		Present	10(10.5)
	Thyroid dysfunction	Absent	89(93.7)
		Present	6(6.3)
	Parkinson	Absent	94(98.9)
		Present	1(1.1)

Table 2. Distribution of quantitative variables.

	Mean	Minimum	Maximum
Glasgow coma scale (GCS)	14.09 ± 1.76	7.00	15.00
Length of hospital stay (days)	22.61 ± 16.55	5.00	97.00
Age (years)	57.83 ± 15.73	19.00	88.00
Weight (kg)	73.41 ± 6.53	57.00	88.00
Height (m)	1.67 ± 0.05	1.60	1.87
Body mass index (kg/m^2)	26.42 ± 2.37	20.05	31.99

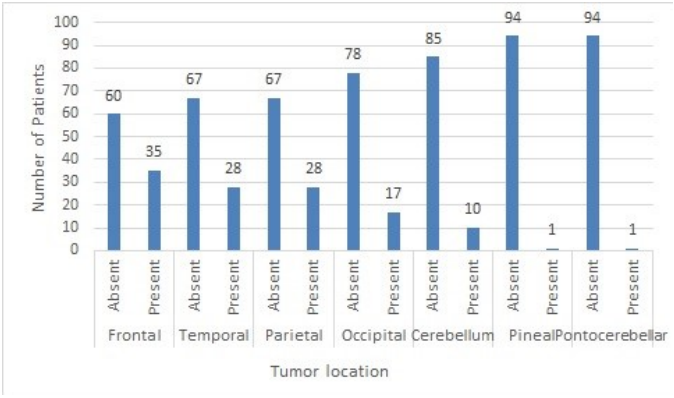

Figure 2. Distribution of the admission symptoms of the patients.

had metastasis and 13 (13.7%) had recurrent mass. The results obtained from the pathological evaluation of the tumors indicated that metastasis (26 patients, 27.4%) was the most common tumors, followed by high grade glial tumors (23 patients, 24.2%). The primary focus of the patients who have metastasis was mostly originated from lung cancer (LC). Of the study population, 14 (14.7) died, while 81 (85.3%) were discharged home or to a care facility. The distributions of qualitative and quantitative variables are respectively given in Tables 1 and 2.

No statistically significant difference was detected between sexes regarding the GCS scores of the patients ($p > 0.05$). On the other hand, the GCS score at the admission were observed to be significantly lower in the deceased patients than in the survivors ($p = 0.042$). In a similar vein, clouding of consciousness ($p = 0.003$) and GCS ($p < 0.001$) scores of the patients who were hospitalized from the emergency department were statistically significantly lower. The distribution of GCS scores based on qualitative variables is shown in Table 3.

It was observed that the tumors were mostly located mostly in the frontal region. Figure 1 demonstrates the distribution of the regions where the tumors were located. The distribution of the admission symptoms of the patients is as shown in Figure 2.

The length of stay of the deceased patients was longer compared to that of the survivors ($p < 0.001$). It was also observed that the patients with tumor located in the parietal lobe stayed longer in the hospital than the other patients ($p < 0.001$). While the mean age in the patients with nausea complaint was lower than that of the other patients ($p = 0.036$), it was higher in the patients with hemiparesis ($p = 0.003$).

Discussion

In the present study, a total of 95 patients, 64 males and 31 females, who underwent surgery in our clinic with a preliminary diagnosis of intracranial mass in a 5-year period were evaluated. According to the pathology results obtained, metastases, which were detected in 27 (28.4%) patients, were most commonly seen tumors. When looking at the primary origin of the metastases, it was determined that LC was in the first place with 22 (23.2%) patients. In the study group, there were 56 (58.9%) patients who received the first time diagnosis, whereas 12 (12.7%) patients were operated due to recurrence. It was observed that in the patients who had primary brain tumor, high-grade glial tumors were the most common with 23 patients (24.2%).

In the literature, there are a lot of studies indicating that brain tumors are more frequently seen in males [22-24]. As seen in our results, the ratio of males was 67.4% in the study, and this coincides with the literature data. Similarly, numerous studies have indicated that the incidence of brain tumor increases with age [25]. In our patient group, the patients' mean age was 57.83 ± 15.73 years.

The pattern of headache, which was long lasting, accompanied with nausea and vomiting and resistant to medication, depending on the increase in ICP caused by the tumor, suggested the presence of brain tumor in the patients. Seizures are a common symptom in brain tumors that can be seen in 20% to 85% of patients, depending on the pathology of the tumor [26]. According to the literature results, seizure is the most common admission complaint in brain tumor patients (over 50%), however, in our study, seizure was seen only 15.8% of the patients, and the most common admission complaints were determined to be hemiparesis (44.2%) and headache (32.6%). Lower rate of seizure complaint in our study may be attributed to the insufficient information in the anamnesis, such as the patient's loss of consciousness at the time of the seizure and the absence of someone nearby who can witness the incident.

Brain tumors in adults are seen to be located in the order of frequency in the frontal (25%), temporal (20.1%) and parietal lobe (14.6%) [27]. In the present study, the rate of frontal, temporal and parietal lobe tumors were 36.8%, 29.5% and 29.5%, respectively. The length of stay in the deceased patients was longer than in the survivors ($p < 0.001$). Although the most common location of tumors in the patients was frontal region, the length of hospital stay was found to be longer in the patients with parietal lobe tumors than in the others ($p < 0.001$).

Of the total of 14 deceased patients, 12 were hospitalized from the emergency department. The patients' admission GCS scores were determined to be statistically significantly lower in the deceased patients ($p = 0.042$). The GCS scores were also detected to be significantly lower in the patients who were hospitalized from the emergency department than those hospitalized from the outpatient clinic ($p < 0.001$). When the relationship between the GCS scores of the patients and the symptoms observed were examined, the GCS scores were identified to be significantly lower in the patients with clouding of consciousness ($p = 0.003$) and speech disorder ($p = 0.007$) compared to those

Table 3. Distribution of GCS scores based on qualitative variables.

			GCS		p
			n	Mean ± SD	
Mortality		Alive	81	14.25 ± 1.62	**0.042**
		Exitus	14	13.21 ± 2.29	
Disease status		Primary	56	14.25 ± 1.63	0.079
		Metastasis	27	14.27 ± 1.61	
		Recurrent	12	13.08 ± 2.29	
CCI score		0	18	13.72 ± 1.87	0.395
		1	27	13.93 ± 1.73	
		2	50	14.32 ± 1.73	
ASA (American Society of Anesthesiologists) score		2	15	14.13 ± 1.77	0.572
		3	68	14 ± 1.84	
		4	12	14.58 ± 1.16	
Cancer type		Primary	56	14.01 ± 1.82	-
		Recurrent	12	13.08 ± 2.29	
		Metastasis: Lung	22	14.27 ± 1.67	
		Metastasis: Colon	2	13.5 ± 2.12	
		Metastasis: Breast	2	15 ±	
		Metastasis: Gastric	1	15 ±	
Sex		Female	31	14.26 ± 1.55	0.531
		Male	64	14.02 ± 1.86	
Pathology		Astrocytoma	14	13.71 ± 1.54	0.710
		Meningioma	19	14.47 ± 1.43	
		Metastasis	26	14.27 ± 1.61	
		Lymphoma	4	14.5 ± 1	
		Other	9	13.56 ± 2.79	
		High-grade glial	23	13.96 ± 1.94	
Hospitalization type		Outpatient clinic	45	14.82 ± 0.58	**< 0.001**
		Emergency department	50	13.44 ± 2.17	
Tumor Location	Frontal	Absent	60	14.1 ± 1.74	0.970
		Present	35	14.09 ± 1.8	
	Temporal	Absent	67	14.18 ± 1.79	0.472
		Present	28	13.89 ± 1.69	
	Parietal	Absent	67	14.09 ± 1.67	0.965
		Present	28	14.11 ± 1.99	
	Occipital	Absent	78	14.1 ± 1.67	0.926
		Present	17	14.06 ± 2.16	
	Cerebellum	Absent	85	14.11 ± 1.75	0.858
		Present	10	14 ± 1.89	
	Pineal	Absent	94	14.09 ± 1.76	-
		Present	1	15 ±	
	Pontocerebellar angle	Absent	94	14.09 ± 1.76	-
		Present	1	15 ±	
Symptoms	Headache	Absent	64	13.94 ± 1.9	0.212
		Present	31	14.42 ± 1.39	
	Seizure	Absent	80	14.13 ± 1.75	0.700
		Present	15	13.93 ± 1.87	
	Nausea	Absent	82	14.16 ± 1.76	0.377
		Present	13	13.69 ± 1.75	
	Hemiparesis	Absent	53	14.09 ± 1.72	0.998
		Present	42	14.1 ± 1.82	
	Clouding of consciousness	Absent	87	14.25 ± 1.56	**0.003**
		Present	8	12.38 ± 2.83	
	Diplopia	Absent	93	14.08 ± 1.77	-
		Present	2	15 ± 0	
	Facial paralysis	Absent	92	14.07 ± 1.78	-
		Present	3(	15 ± 0	
	Speech disorder	Absent	87	14.24 ± 1.64	**0.007**
		Present	8	12.5 ± 2.27	
Comorbidities	Hypertension	Absent	41	14.15 ± 1.68	0.805
		Present	54	14.06 ± 1.83	
	Coronary artery disease	Absent	62	14.1 ± 1.61	0.988
		Present	33	14.09 ± 2.04	
	Heart failure	Absent	84	14.05 ± 1.76	0.473
		Present	11	14.45 ± 1.81	
	Diabetes mellitus	Absent	70	14.04 ± 1.82	0.633
		Present	25	14.24 ± 1.59	
	Chronic obstructive pulmonary disease	Absent	78	14.12 ± 1.67	0.808
		Present	17	14 ± 2.15	
	Alzheimer	Absent	76	14.07 ± 1.82	0.750
		Present	19	14.21 ± 1.51	
	Chronic renal failure	Absent	81	14.02 ± 1.78	0.353
		Present	14	14.5 ± 1.61	
	Cerebrovascular event	Absent	77	14.01 ± 1.85	0.351
		Present	18	14.44 ± 1.29	
	Arrhythmia	Absent	85	14.04 ± 1.8	0.339
		Present	10	14.6 ± 1.26	
	Thyroid dysfunction	Absent	89	14.07 ± 1.79	0.562
		Present	6	14.5 ± 1.22	
	Parkinson	Absent	94	14.09 ± 1.76	-
		Present	1	15 ±	

without. No significant difference was detected in terms of GCS scores for other qualitative variables. The pathological results of the deceased patients revealed that the tumors were metastasis in five patients and high-grade glial mass in four patients. Considering that most of the patients were hospitalized from the emergency department, it can be said that it would be possible to detect the lesion early by screening those who carry certain criteria such as family history or the presence of another tumor in terms of brain tumor and thus to provide more effective treatment with early intervention.

The mortality rate was found to be 14.75% (14 patients) in our study. Apart from tumors, the causes of mortality and morbidity include treatments such as surgery, radiotherapy and chemotherapy. Being able to remove tumor tissue at a maximum level will ensure the reduction in mortality and morbidity rates. Therefore, the use of intraoperative aids such as fluorescent molecules, intraoperative magnetic resonance imaging, and ECS can be recommended to be able to perform wider and safer tumor resection and to facilitate easy differentiation between the tumor and normal tissue.

Considering the etiology of the patients, the majority of metastases were detected to originate from LC. When assumed that no brain metastasis will occur if patients do not have LC, the elimination of preventable factors present in LC etiology would probably reduce the occurrence of mortality and neurological sequelae, and also economic-social losses due to complex treatments of those conditions.

We acknowledge the limitations of our retrospective analysis. As with any retrospective cohort, there are limitations in the validity of the data because of the nature of the data collection, but these were mitigated by querying a well-maintained prospective database of all brain tumor patients at our institution. Classification bias in medical record review was limited by adherence to a strict, predefined abstraction format. Selection bias was excluded by including all patients with newly diagnosed brain tumor who were from a broad referral network, making the results externally generalizable. A major limitation of this study is the imbalance between groups after randomization.

Conclusion

Although the frequency of brain tumors increases with changing lifestyles such as elevated exposure to radiation and by means of advancing technology that facilitates successful detection of tumors, more effective and earlier intervention would be possible with accurate and reliable records. Thus, this would contribute to the increase in survival and decrease in injuries and economic losses.

Ethics approval

The study for received ethical approval from the Tokat Gaziosmanpaşa University Clinical Research Ethics Committee (number: 22-KAEK-192).

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