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Characteristics of Adult Brain Tumors in Neurology Emergency Unit in Prof. Dr. I.G.N.G. Ngoerah Hospital Bali 2020-2022

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ABSTRACT

Introduction: Brain tumors have a low incidence, with only 77,000 new cases reported annually in the United States, there is limited published data on brain tumor epidemiology in Indonesia, particularly in Bali. Therefore, we conducted this study to provide data that can explain the burden of care for adult brain tumors, particularly in Bali.

Methods: The study collected secondary data from medical records at Prof. Dr. I.G.N.G. Ngoerah, a tertiary hospital in Bali Province. The sample consisted of adult patients aged 18 years or older who were treated in the neurology emergency department for brain tumors between 2020 and 2022, diagnosed through imaging or histopathological examination. The sample was further divided into primary and metastatic brain tumors. Primary brain tumors were categorized based on the major classification according to the type of cell precursor, while metastatic brain tumors were grouped based on the primary source of the tumor. The collected data were presented descriptively as proportions.

Results: A total of 535 subjects were included in the study, out of which 298 (55.7%) had primary brain tumors and the remaining 237 (44.29%) cases were brain metastases. The incidence rate was found to be higher among males (278 cases, 51.96%) than among females (257 cases, 48.03%). The highest incidence rate (31.77%) was observed in the age group of 51 to 60 years. Majority of primary brain tumors were classified as glioma, especially high-grade glioma, accounting for 123 cases (41.27%), followed by meningioma with 94 cases (31.54%) and low-grade glioma with 44 cases (14.76%). The majority of primary brain tumors were located in the supratentorial area, accounting for 259 cases (86.91%). Although rare, the study found a sample of 6 cases (1.76%) with primary brain tumors in both the supratentorial and infratentorial areas, consisting of meningioma, Mesenchymal, non-meningothelial tumors, and hematolymphoid tumors. The majority of patients showed clinical features of headache (68.78%), hemiparesis (51.96%), and cranial nerve palsy (51.96%). Other clinical features noted were seizure (26.72%), loss of consciousness (32.33%), vomiting (11.77%), and visual impairment (8.59%). The study revealed that lung cancer was responsible for 43.88% of brain metastasis cases, making it the most common cancer to metastasize to the brain.

Conclusions: Discovering the most common type of brain tumor in emergency departments can be a vital step in understanding the characteristics of brain tumor patients. This study has revealed that primary brain tumors, particularly high-grade gliomas, are the most frequently

occurring type of brain tumor in emergency departments. Not only this, but the study also found that metastatic brain tumors most often resulted from lung cancer. These findings are unique to the Indonesian context and thus provide valuable insights into the epidemiology of brain tumors in emergency settings. It is hoped that this study will encourage further research in this area, and ultimately lead to improved care for brain tumor patients in emergency departments

Key Words: Brain Tumor, Primary Brain Tumor, Metastatic Brain Tumor.

INTRODUCTION

Brain tumors are a rare type of cancer that affects the central nervous system. They account for only 1.6% of all cancer cases worldwide, with a total of 296,851 cases reported. In the United States alone, there are approximately 77,000 new cases of primary brain tumors each year, out of which 25,000 are malignant. The incidence rate of primary brain tumors is 22 per 100,000 people per year. The most common types of brain tumors are meningioma, which accounts for 36.4% of cases, followed by pituitary tumors at 15.5%, neural tumors such as vestibular schwannomas at 15.5%, and glioblastomas at 15.1%.[1,2,3]

Brain metastases are a type of brain tumor that occurs when cancer cells from other parts of the body spread to the brain. They are estimated to be ten times more frequent than primary brain tumors, making them the most common type of brain tumor. Unfortunately, brain metastases are a common complication of cancer, with up to 40% of cancer patients expected to develop them. While the incidence rates of brain metastases are reported to be up to 11 per 100,000 population per year, the actual incidence rate could be much higher due to underdiagnosis and inaccurate reporting. Brain metastase incidence rates vary in adults depending on the primary tumor type, with the highest risk being observed in lung, breast, melanoma, and kidney cancers. Therefore, cancer patients must receive proper screening and treatment to detect and manage brain metastases if they occur.[1,2,4,5,6,7]

Brain tumors can cause a range of physical and behavioral symptoms, depending on where they are located. However, there is limited and sometimes conflicting information available on the specific symptoms that brain tumors can cause. For instance, in a study of 124 patients who had been diagnosed with brain tumors, the most commonly reported symptoms were fatigue, sleep disturbance, drowsiness, distress, and dry mouth. In contrast, a sample of patients with glioma reported six symptoms - fatigue, uncertainty about the future, motor difficulties, drowsiness, communication difficulties, and headaches - in more than 50% of cases, which had a significant negative impact on their quality of life. Another study of 92 patients with brain tumors showed that weakness and headaches were the two most commonly reported symptoms.[8,9,10,11,12,13]

A considerable number of patients, who were not previously diagnosed with brain tumors, come to the Emergency Department (ED) with new symptoms. While information exists on the prevalence of signs and symptoms among the general population of patients with brain tumors, little is known about the clinical presentation in the ED. To the best of our knowledge, only two retrospective studies have been published, that describe the presenting signs and symptoms of patients with primary brain tumors diagnosed in the ED. One of these studies was conducted on a mixed pediatric and adult population. [8,9]

Until now, there is no available data about the epidemiology of adult brain tumors in Emergency units, especially in Indonesia. As such, this paper aims to present an overview of the epidemiology of adult brain tumors in the emergency unit, with a strong focus on the Bali region. Its findings are expected to contribute significantly to the current understanding of the topic at hand.

METHODS

The study collected secondary data from medical records at Prof. Dr. I.G.N.G. Ngoerah, a tertiary hospital in Bali Province. The sample consisted of adult patients aged 18 years or older who were treated in the neurology emergency department for brain tumors between 2020 and 2022, diagnosed through imaging or histopathological examination. The sample was further divided into primary and metastatic brain tumors. Primary brain tumors were categorized based on the major classification according to the type of cell precursor, while metastatic brain tumors were grouped based on the primary source of the tumor. The collected data were presented descriptively as proportions.

RESULT

A total of 535 participants were enrolled in this study, with male participants comprising the majority (51.96%) and the age group of 51-60 accounting for 170 (31.77%) of the total. The study participants were classified into two groups: primary brain tumors (55,7%) and metastatic brain tumors (44,29%).

Table 1. Subjects Characteristics of Primary and Metastasis Brain Tumor

Variable	Klasifikasi	N	%
Gender	Men	278	51.96
	Woman	257	48.03
Age Group	18-30	45	8.41
	31-40	71	13.27
	41-50	127	23.73
	51-60	170	31.77
	61-70	86	16.07
	>70	36	6.72
Tumor Location	Supratentorial	321	60
	Infratentorial	50	9.34
	Both Supratentorial and Infratentorial	164	30.65
	Total	535	
Clinical Features	Headache	368	68.78
	Hemiparesis	278	51.96
	Seizure	143	26.72
	cranial nerve palsy	277	51.77
	loss of consciousness	173	32.33
	Vomiting	63	11.77
	Visual impairment	46	8.59

It was found that the incidence rate of tumors was higher among males (278 cases, 51.96%) than among females (257 cases, 48.03%). The age group with the highest incidence rate (31.77%) was between 51 and 60 years. The majority of tumor locations for both primary and metastatic tumors were in the supratentorial area, accounting for 321 cases (60%). The next most common locations were both supratentorial and infratentorial, with 164 cases (30.65%), and infratentorial, with 50 cases (9.34%).

According to this study, headache was found to be the most common symptom in both primary and metastatic brain tumors, based on history taking and physical examination. It affected 368 cases (68.78%) of the patients. Hemiparesis and cranial nerve palsy were also common, affecting 278 (51.96%) and 277 cases (51.77%), respectively.

Table 2. Primary Brain Tumor According to Gender and Location

Tumor Type		**N**	**Gender**		**Location**		
			Male	**Female**	**Supratentorial**	**Infratentorial**	**Both**
Gliomas	Low Grade Glioma (LGG)	44 (14.76%)	31 (70.45%)	13 (29.54%)	35 (79.54%)	9 (20.45%)	-
	High-Grade Glioma (HGG)	123 (41.27%)	73 (59.34%)	50 (40.65%)	117 (95.12%)	6 (4.87%)	-
Meningiomas		94 (31.54%)	19 (20.21%)	75 (79.78%)	87 (92.55%)	4 (4.25%)	3 (3.19%)
Embryonal tumors		1 (0.33%)	1 (100%)	-	-	1 (100%)	-
Pineal tumor		2 (0.67%)	1 (50%)	1 (50%)	2 (100%)	-	-
Cranial and paraspinal nerve tumors		10 (3.35%)	5 (50%)	5 (50%)	-	10 (100%)	-

Mesenchymal, non-meningothelial tumors	9 (3.02%)	8 (88.88%)	1 (11.11%)	5 (55.55%)	3 (33.33%)	1 (11.11%)
Primary CNS lymphoma	7 (2.34%)	7 (100%)	-	5 (71.42%)	-	2 (28.57%)
Tumor of the Sellar Region	8 (2.68%)	5 (62.5%)	3 (37.5%)	8 (100%)	-	-
Total	298	150 (50.33%)	148 (49.66%)	259 (86.91%)	33 (11.07%)	6 (2.01%)

Table 3. Primary Brain According to Age Group

Tumor Type		**N**	**Age Group**					
			18-30	31-40	41-50	51-60	61-70	>71
Gliomas	Low Grade Glioma (LGG)	44 (14.76%)	10 (22.72%)	5 (11.36%)	8 (18.18%)	17 (38.63%)	1 (2.27%)	3 (6.81%)
	High-Grade Glioma (HGG)	123 (41.27%)	9 (7.31%)	28 (22.76%)	21 (17.07%)	37 (30.08%)	18 (14.63%)	10 (8.13%)
Meningiomas		94 (31.54%)	7 (7.44%)	5 (5.31%)	40 (43.95%)	28 (29.78%)	9 (9.57%)	5 (5.31%)
Embryonal tumors		1 (0.33%)	1 (100%)	-	-	-	-	-
Pineal tumor		2 (0.67%)	1 (50%)	1 (50%)	-	-	-	-
Cranial and paraspinal nerve tumors		10 (3.35%)	1 (10%)	1 (10%)	-	4 (40%)	3 (30%)	1 (10%)
Mesenchymal, non-meningothelial tumors		9 (3.02%)	2 (22.22%)	3 (33.33%)	3 (33.33%)	-	1 (11.11%)	-
Primary CNS lymphoma		7 (2.34%)	1 (14.28%)	2 (28.57%)	-	-	4 (57.14%)	-
Tumor of the Sellar Region		8 (2.68%)	2 (25%)	2 (25%)	3 (37.5%)	1 (12.5%)	-	-
Total		298	34 (11.4%)	47 (15.77%)	75 (25.16%)	87 (29.19%)	36 (12.08%)	19 (6.37%)

According to this study, headache was found to be the most common symptom in both primary and metastatic brain tumors, based on history taking and physical examination. It affected 368 cases (68.78%) of the patients. Hemiparesis and cranial nerve palsy were also common, affecting 278 (51.96%) and 277 cases (51.77%), respectively.

Of the primary brain tumors we analyzed, 167 (56.04%) were diagnosed as glioma, comprising 44 (14.76%) Low-Grade Glioma (LGG) and 123 (41.27%) High-Grade Glioma (HGG). The majority of patients with both LGG and HGG were men, accounting for 70.45% and 59.34%, respectively. Regarding the location of tumors, we found that supratentorial sites were the majority, accounting for 79.54% of LGG and 95.12% of HGG cases, while infratentorial sites accounted for only 20.45% of LGG tumors and 4.87% for HGG. The age group of 51-60 comprises the highest percentage at 38.63%, for LGG and HGG.

Meningioma is the second most common primary brain tumor, accounting for 94 cases (31.54%) of all the cases researched. The vast majority of those affected by meningioma are female, with 75 samples (79.78%). The tumor is mostly found in the supratentorial area, accounting for 87 samples (92.55%). The age group most commonly affected by meningioma is 41-50 years, with 52 samples (38.8%).

The findings of the research indicate that the group of cranial and paraspinal nerve tumors is the third most frequent primary brain tumor, with a prevalence of 3.35%. The study revealed that the majority of patients were in the 41-50 age group (43.95%).

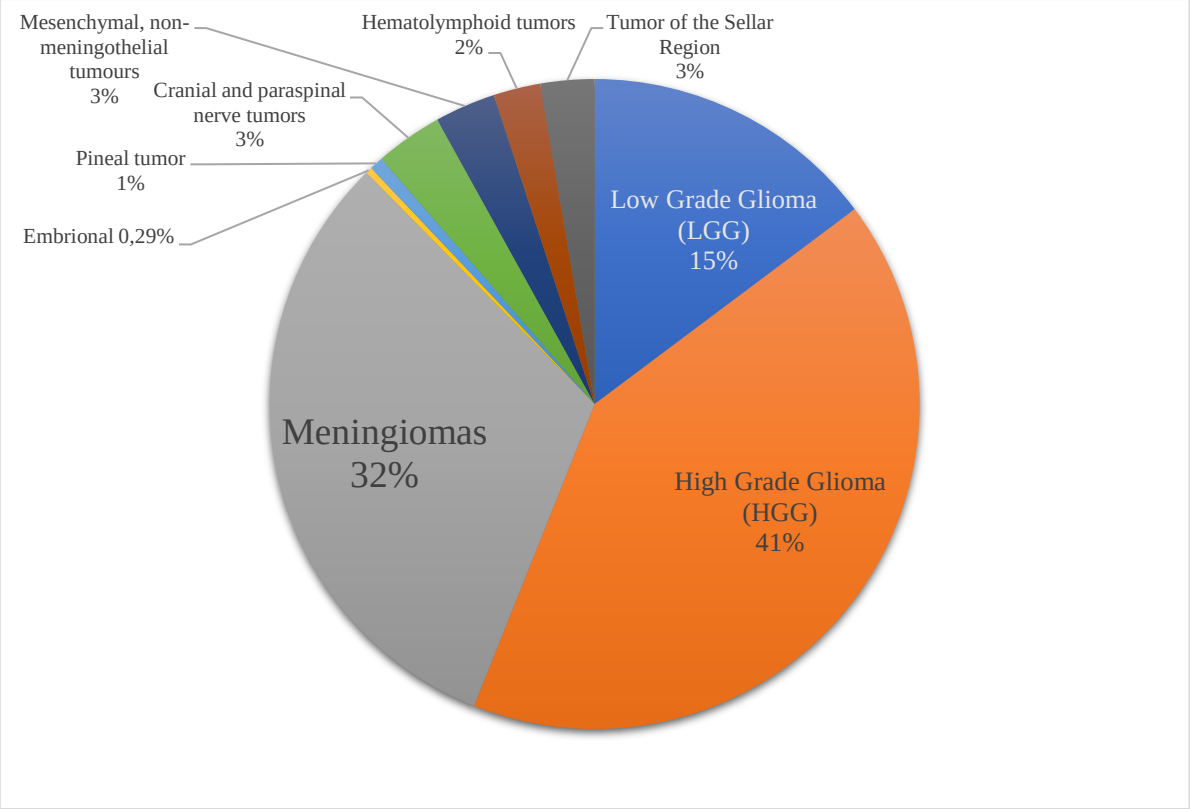

Fig 1. Distribution of Primary Brain Tumors

Table 4. Origin Brain metastasis

Cancer Origin	N	Gender		Age Group					
		Male	Female	18-30	31-40	41-50	51-60	61-70	>71
Lung Cancer	104 (43.88%)	70 (67.3%)	34 (32.69%)	2 (1.92%)	9 (8.6%)	18 (17.3%)	44 (42.3%)	23 (22.11%)	8 (7.69%)
Breast Cancer	23 (9.7%)	-	23 (100%)	-	2 (8.69%)	6 (26.08%)	8 (34.78%)	7 (30.43%)	-
metastasis unknown primary	47 (19.83%)	25 (53.19%)	22 (46.8%)	4 (8.51%)	6 (12.76%)	6 (12.76%)	15 (31.91%)	10 (21.27%)	6 (12.76%)
Cervix Cancer	7 (2.9%)	-	7 (100%)	-	-	1 (14.28%)	6 (85.71%)	-	-
Nasopharynx Cancer	23 (9.7%)	15 (65.21%)	8 (34.78%)	-	5 (21.73%)	12 (52.17%)	4 (17.39%)	2 (8.69%)	-
Prostat Cancer	3 (1.26%)	3 (100%)	-	-	-	1 (33.33%)	1 (33.33%)	1 (33.33%)	-
Hodgkin's lymphoma	4 (1.68%)	-	4 (100%)	-	1 (25%)	-	2 (50%)	1 (25%)	-
Uterus Cancer	3 (1.26%)	-	3 (100%)	1(33.33%)	1(33.33%)	-	1(33.33%)	-	-
Melanoma	4 (1.68%)	1 (25%)	3 (75%)	-	-	-	1 (25%)	1 (25%)	2 (50%)
Renal Cancer	3 (1.26%)	3 (100%)	-	-	-	-	-	3 (100%)	-
Mediastinum Cancer	3 (1.26%)	2 (66.66%)	1 (33.33%)	-	-	-	1 (33.33%)	1 (33.33%)	1 (33.33%)
Bladder Cancer	1 (0.42%)	1 (100%)	-	-	-	-	1 (100%)	-	-
Colon Cancer	2 (0.84%)	2 (100%)	-	-	-	-	2 (100%)	-	-
Thyroid Cancer	3 (1.26%)	1 (33.33%)	2 (66.66%)	-	-	2 (66.66%)	-	1 (33.33%)	-
Rectal cancer	1 (0.42%)	1 (100%)	-	-	-	1 (100%)	-	-	-
Parotid cancer	2 (0.84%)	-	2 (100%)	-	-	2 (100%)	-	-	-
osteosarcoma cancer	2 (0.84%)	2 (100%)	-	2 (100%)	-	-	-	-	-
Multiple Myeloma	2 (0.84%)	2 (100%)	-	1 (50%)	-	-	-	1 (50%)	-
Total	237	128 (54%)	109 (45.99%)	10 (4.21%)	24 (10.12%)	49 (20.67%)	86 (36.28%)	51 (21.51%)	17 (7.17%)

A total of 237 subjects with intracranial metastasis were examined, revealing that males constituted the majority with 128 individuals (54%). The age group most affected was 51-60 years, with 86 cases (36.28%), while the least affected group was 18-30 years, with only 10 cases (4.21%).

Lung cancer was the leading cause of intracranial metastasis, accounting for 104 cases (43.88%). Males were found to be the majority of patients with brain metastases from the lung, with 70 cases (67.3%). A significant proportion of lung cancer with intracranial metastasis was in the 51-60-year age group, with 44 cases (42.3%).

Breast cancer was the second most prevalent type, affecting 23 (9.7%) participants, all of whom were female. The majority of cases (36.35%) were from the 51-60 years age group, with 36 cases. The 31-40 year old age group had the lowest number of cases in this study, with only 2 cases (8.69%), while no cases were detected in the 18-30 and >71 years age group.

Nasopharynx cancer was the third most prevalent in 23 cases (9,7%) of subjects. Most cases with brain metastases were male, with 15 cases (65.21%). The majority of cases (52.17%) were from the 41-50 years age group, with 12 cases. The 61-70 year old age group had the lowest number of cases in this study, with only 2 cases (8.69%), and no cases were detected in the age groups of 18-30 and >71.

In this study, 47 cases (19.83%) were found to have unknown primary metastasis. The majority were male, with 25 cases (53.19%), and the majority came from the age group of 51-60 with 15 cases (31.91%).

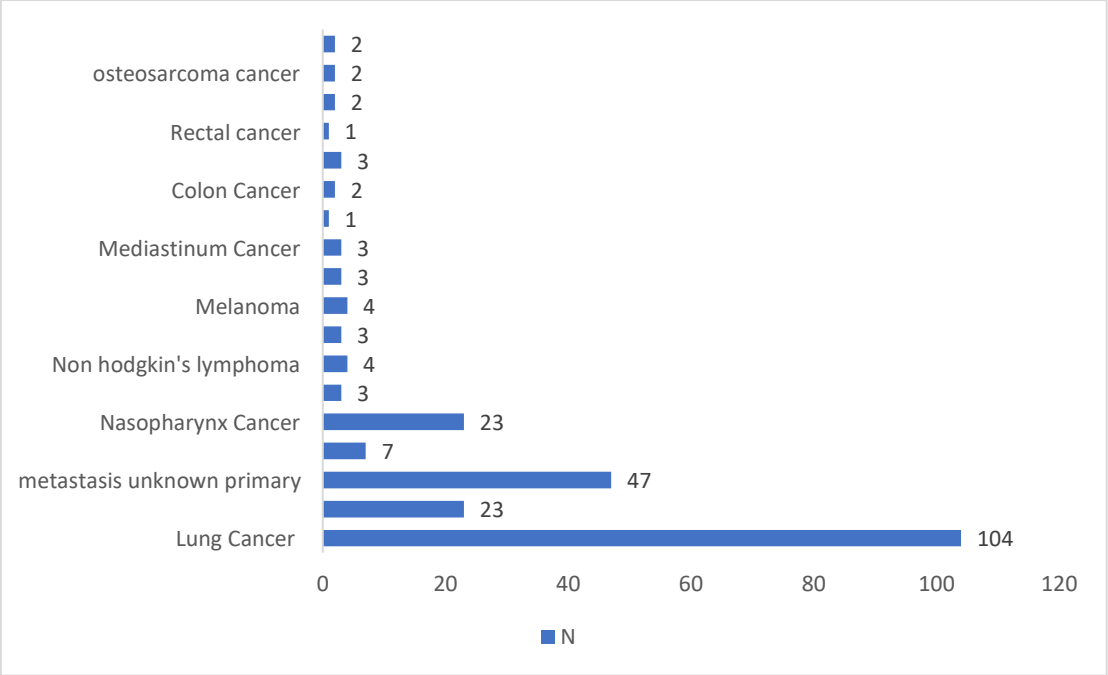

Fig.2 Chart Origin Brain metastasis

DISCUSSION

This research was descriptive, with a retrospective approach, utilizing patients diagnosed with primary and metastatic brain tumors who were treated in the emergency unit at Prof. Dr. I.G.N.G. Ngoerah between the years 2020 and 2022 as the subjects. The data was gathered from patients' medical records through a retrospective analysis of their histories and physical examinations. In this research, the incidence of primary brain tumors was more common in males than in females, with 50.33% of cases in males and 49.66% in females. This finding aligns with the results of a study conducted by Comelli (2017) and Pineros (2016), which demonstrated that the incidence of brain tumors in South America is higher in males

than in females in the setting of the emergency department. [4,8]

To date, the author has not obtained data related to primary tumor cases in the emergency department at other centers in Indonesia. However, based on epidemiological research data conducted at several centers in Indonesia, it can be observed that the majority of primary brain tumors suffered by women compared to men. This is evidenced by data from Kariadi General Hospital (38.3% male, 61.7% female) and Cipto Mangunkusumo General Hospital (32% male, 68% female). The data from CBTRUS and meta-analysis databases also contradict this finding. A study conducted in the United States revealed that the incidence of female patients was higher than that of male patients, with a ratio of 24.77:20.34 per 100,000 populations in the former group and 15.8:14.33 per 100,000 populations in the latter. [1,2,3]

The study revealed that the majority of patients with primary brain tumors were in the age range of 51-60 years (29.19%). In the case of high-grade glioma, most cases were found in the age range of 51-60 years (30.08%), in the case of meningioma there was an age range of 41-50 years (43.95%), while in the case of low-grade glioma the most cases were in the age range of 51-60 years (38.63%). This differs from the findings of Comelli (2017), which indicated that the majority of primary tumor cases were found in the age range of 70-79 years. A brain tumor epidemiology study published by Ardhini et al. in Indonesia demonstrated that the peak incidence of brain tumors occurred in individuals aged 41-50 years.[3,8]

According to the findings, most primary tumor sites were located in the supratentorial area (86.91%), infratentorial area (11.07%), or both (6%). High-grade gliomas were mostly found in the supratentorial area (95.12%), while low-grade gliomas were located there 79.54% of the time. Meningiomas were predominantly found in the supratentorial area (92.55%). These results are consistent with research conducted at Cipto Mangunkusumo Hospital, where the majority of tumor sites were also in the supratentorial area (89.9%).[2]

This study identified the most prevalent clinical features observed in 535 cases of primary and metastatic brain tumors, the most prevalent symptoms were headache (68.78%), hemiparesis (51.96%), and cranial nerve palsy (51.96%). Other clinical features noted were seizure (26.72%), loss of consciousness (32.33%), vomiting (11.77%), and visual impairment (8.59%). These findings are consistent with previous studies that have shown headaches, mental status changes, and seizures to be the most frequent symptoms of brain tumors. Another study conducted at Kariadi Hospital in Semarang found that headache was the most common symptom (44.9% of cases), followed by hemiparesis (12.7%), visual impairment (8.9%), and loss of consciousness (7.9%).[3.9]

The study revealed that the highest incidence of brain tumors in the Emergency room was observed in primary brain tumors, with gliomas accounting for the majority of cases. Of these, 41.27% were high-grade gliomas, followed by meningiomas (31.54%) and low-grade gliomas (14.76%). This finding is consistent with the results of a previous study conducted by Comelli et al., which identified glioma as the most prevalent primary tumor in the IGD. Their findings revealed that glioma accounted for 46.3% of cases, with meningioma representing 22% of cases. Other research, such as that conducted by Pineros et al. from the United States, Fuentes-Raspall et al. from Spain, and Wanis et al. from England, has claimed that glioma is the most common histopathological feature. In contrast, CBTRUS has stated that meningioma is the most common primary brain tumor. Furthermore, some studies have indicated that there is a higher incidence of meningioma in Western regions compared to Asia. This phenomenon can be attributed to the fact that high-grade gliomas tend to exhibit more pronounced clinical manifestations, largely due to their rapid growth and extensive edema. [1,4,6,7,8]

The current research on brain metastasis in emergency care settings has limited data on

demographics. However, up to 40% of cancer patients develop brain metastasis, with 60-75% showing symptoms. It has been estimated that the number of brain metastases is 3-10 times higher than that of primary malignant brain tumors. The age group of patients with brain metastasis in this study was mainly between 51-60 years old, which is consistent with the findings of Ostrom et al. that show the peak incidence of brain metastasis occurs at 60 years of age. Furthermore, the study revealed that lung cancer was responsible for 43.88% of brain metastasis cases, making it the most common cancer to metastasize to the brain. In addition, 19.83% of brain tumor metastases had an unknown primary. These findings are consistent with previous research conducted by This, which demonstrated that brain metastasis is a common occurrence and the most frequent cancer to spread to the brain. Aninditha et al. also identified lung metastasis as the primary cause of brain metastasis, in line with the findings of this study.[2,10]

CONCLUSION

Discovering the most common type of brain tumor in emergency departments can be a vital step in understanding the characteristics of brain tumor patients. This study has revealed that primary brain tumors, particularly high-grade gliomas, are the most frequently occurring type of brain tumor in emergency departments. Not only this, but the study also found that metastatic brain tumors most often resulted from lung cancer. These findings are unique to the Indonesian context and thus provide valuable insights into the epidemiology of brain tumors in emergency settings. It is hoped that this study will encourage further research in this area, and ultimately lead to improved care for brain tumor patients in emergency departments.

Declaration by Authors

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