Epidemiology of Primary Brain Tumors in Anatomical Pathology Laboratory at National Brain Center Prof. Dr. dr. Mahar Mardjono Hospital Jakarta on 2021-2022

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KEYWORDS

Brain Tumors, Demography, Epidemiology, Location, Type.

ABSTRACT

Brain neoplasms constitute an infrequent pathology with a relatively low prevalence; nevertheless, they are associated with a noteworthy fatality rate. The aggregate occurrence of primary brain neoplasms is estimated at approximately 7 per 100,000 individuals per annum, representing merely 1.4% of all malignancies. The primary intent of this investigation is to delineate the descriptive epidemiology of brain neoplasms as observed within the Anatomical Pathology Laboratory at the National Brain Center (NBC) Prof. Dr. dr. Mahar Mardjono Hospital, Jakarta, spanning the years 2021 to 2022. This inquiry employs a descriptive epidemiological approach, utilizing medical archives of individuals diagnosed with primary brain neoplasms throughout the 2021–2022 period at the Anatomical Pathology Laboratory of NBC Prof. Dr. dr. Mahar Mardjono Hospital, Jakarta. The data encompasses demographic attributes alongside clinical parameters, including neoplasm localization and classification. A cumulative 917 instances of primary brain neoplasms were documented (429 in 2021 and 488 in 2022). Of these, 41.6% (44.1% in 2021 and 39.5% in 2022) were identified in male individuals, whereas 58.4% (55.9% in 2021 and 60.5% in 2022) were observed in female individuals. The apex prevalence was discerned within the 41–50-year demographic (28.8%), with a distribution of 31.5% in 2021 and 26.4% in 2022. The predominant anatomical location was supratentorial (84.5%), with 84.8% in 2021 and 84.2% in 2022. The prevailing histopathological classification was meningioma (42.7%), comprising 42.6% in 2021 and 42.8% in 2022. Meningiomas were markedly more frequent in female individuals (80.9%), with an incidence of 77.9% in 2021 and 83.6% in 2022. Metastatic occurrences constituted 8.7% of cases (8% in 2021 and 9.3% in 2022). The predominance of primary brain neoplasms is discernibly higher in female individuals, with the zenith incidence observed within the 41–50-year age bracket. Meningiomas emerge as the foremost histological subtype, predominantly localized within the supratentorial compartment.

INTRODUCTION

Brain tumors, also referred to as intracranial neoplasms, arise from aberrant and unregulated cellular proliferation within the brain, predominantly involving neurons (glial cells). In certain instances, these neoplasms may also originate in lymphatic structures, vascular networks, cranial nerves, meningeal layers, the skull, or endocrine structures such as the pituitary and pineal glands.[1] In the adult population, the preponderance of brain tumors comprises secondary neoplasms, which result from metastatic dissemination of malignancies originating in extracranial organs, ultimately infiltrating cerebral structures and manifesting as intracranial tumors, 40% of all adult cancer patients experience metastases with approximately 25% involving the brain and lung cancer is the most frequently found brain metastasis (34.1%).[2,3]

Brain tumors have strong sex-specific incidence variation. Brain tumors are generally more common in men than in female. However, there is variation in incidence depending on the type of tumor. Malignant tumors are more common in men (with an annual incidence rate

of 8.3 vs. 6.0) while nonmalignant tumors are more common in female (with a rate of 19.8 vs. 12.5).[4,5]

The location of intracranial tumors in the infratentorial ranges from 21 to 67%, while tumors in the supratentorial range from 30 to 64% and between 2 to 15% invading both supratentorial and infratentorial spaces.[6] Study at Hasan Sadikin Hospital Bandung reported that 92.9% of primary brain tumors were located in the supratentorial, 5.3% in the infratentorial and 1.8% in both locations. While in metastatic tumors 71% were located in the supratentorial, 3.2% in the infratentorial and 25.8% in both locations.[7]

Non-malignant neoplasms manifest at twice the frequency of their malignant counterparts, with approximately 30.2% of all intracranial tumors classified as malignant, whereas 69.8% are non-malignant. The most prevalent intracranial neoplasm is glioblastoma, accounting for 14.6% of all brain tumors and 48.3% of malignant cases. Conversely, meningioma represents the most frequently occurring non-malignant neoplasm, comprising 37.6% of all brain tumors and 53.3% of non-malignant cases. Notably, glioblastoma exhibits a higher incidence in male individuals, whereas meningioma is more commonly observed in female individuals.[5]

This investigation endeavors to elucidate the descriptive epidemiology of brain neoplasms documented within the Anatomical Pathology Laboratory at NBC Prof. Dr. dr. Mahar Mardjono Hospital, Jakarta, spanning the period from 2021 to 2022.

METHOD

This research constitutes a descriptive epidemiological study employing a retrospective methodology to delineate the profile of brain tumor patients at NBC Prof. Dr. dr. Mahar Mardjono Hospital, Jakarta. The dataset was derived from patient medical archives within the Anatomical Pathology Laboratory during the years 2021 and 2022. The study encompassed all patients diagnosed with brain neoplasms who underwent anatomical pathology evaluation. The variables collected included demographic parameters such as sex, age, tumor localization, and histopathological characteristics. The aggregated data were subsequently subjected to descriptive analysis to elucidate the epidemiological profile of brain tumors.

RESULTS AND DISCUSSION

Sociodemographic Characteristics of Research Samples

In this study, there were 917 cases (429 case in 2021 and 488 case in 2022) of primary brain tumor. The majority of brain tumor patients were female (58.4% (55.9% in 2021 and 60.5% in 2022) with peak incidence is in 41-50 years old (28.8%), 3.15% in 2021 and 26.4% in 2022. The minimum age range is 71-80 years old (2.8%), 2.3% in 2021 and 2.3% in 2022.

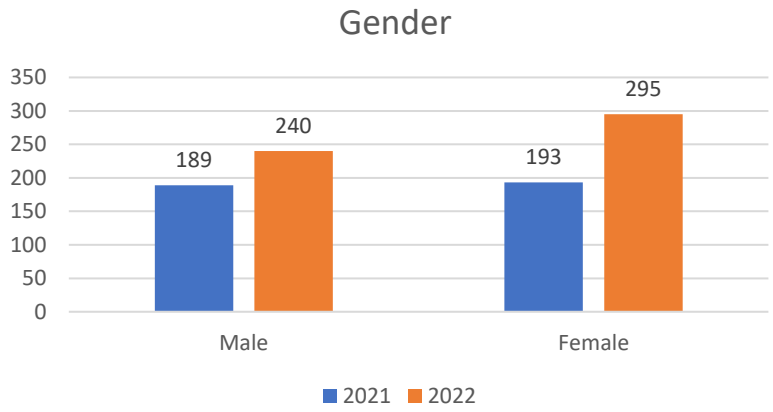

Figure 1. Distribution of Primary Brain Tumours Based on Gender

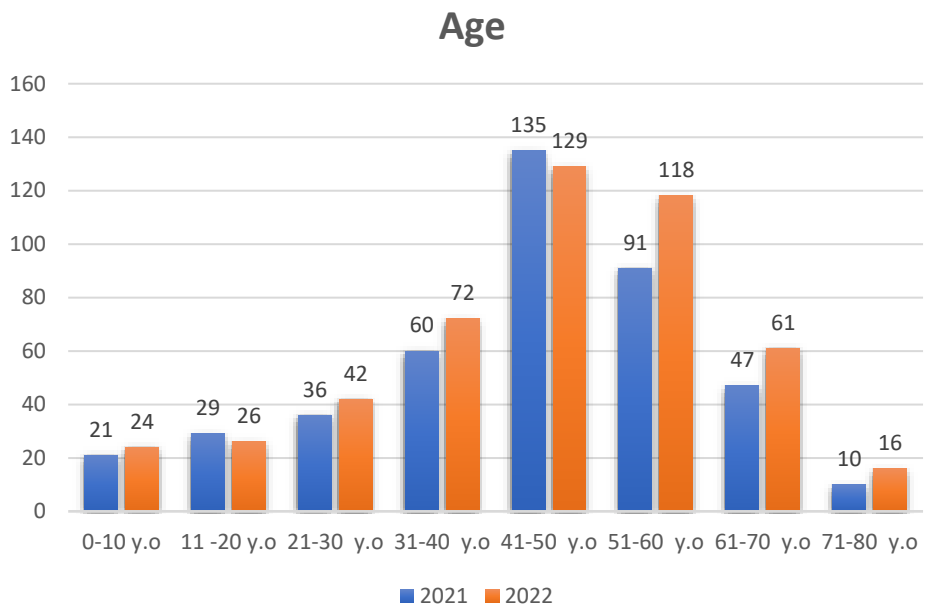

Figure 2. Age-Wise Distribution of Primary Brain Neoplasms

Table 1 ***Sociodemographic Characteristics of Research Samples***

Characteristic	Total (n = 917)	2021 (n = 429)	2022 (n = 488)
Gender			
- Male	382 (41.6)	189 (44.1)	240 (55.9)
- Female	535 (58.4)	193 (39.5)	295 (60.5)
Age			
- 0 – 10 years old	45 (4.9)	21 (4.9)	24 (4.9)
- 11- 20 years old	55 (6.0)	29 (6.8)	26 (5.3)
- 21 –30 years old	78 (8.5)	36 (8.4)	42 (8.6)
- 31– 40 years old	132 (14.4)	60 (14.0)	72 (14.8)
- 41– 50 years old	264 (28.8)	135 (31.5)	129 (26.4)
- 51– 60 years old	209 (22.8)	91 (21.2)	118 (21.2)
- 61– 70 years old	108 (11.8)	47 (11.0)	61 (11.0)
- 71– 80 years old	26 (2.8)	10 (2.3)	16 (2.3)

Clinical Characteristics of Research Samples

The most common location was in the supratentorial (84,5%), 84.8% in 2021 and 84,2% in 2022. **(Table 2)**

The eight most common types of tumors are meningioma, glial tumor, schwannoma, metastasis, pituitary adenoma, round cell tumor, germ cell tumor, and craniopharyngioma. The most common type was meningioma (42,7%), 42,6% in 2021 and 42,8% in 2022 and the rarest type of tumor is craniopharyngioma (42,7%), 42,6% in 2021 and 42,8% in 2022 (**Table 3**).

Table 2 ***Clinical Characteristics of Research Samples***

Characteristic	**Total (n = 917)**	**2021 (n = 429)**	**2022 (n = 488)**
Location			
- Supratentorial	775 (84.5)	364 (84.8)	411 (84.2)
- Infratentorial	142 (15.5)	65 (15.2)	77 (15.8)
Histopathological Features			
- Meningioma	325 (35.4)	154 (35.9)	171 (35.0)
- Glial Tumor	199 (21.7)	97 (22.6)	102 (20.9)
- Pituitary Adenoma	50 (5.5)	29 (6.8)	21 (4.3)
- Schwannoma	76 (8.3)	32 (7.5)	44 (9.0)
- Metastasis	66 (7.2)	29 (6.8)	37 (7.6)
- Round Cell Tumor	36 (3.9)	14 (3.3)	22 (4.5)
- Germ Cell Tumor	29 (3.2)	19 (4.4)	10 (2.0)
- Craniopharyngioma	17 (1.9)	10 (2.3)	7 (1.4)
- Other Tumors	119 (12.9)	45 (10.5)	74 (15.2)

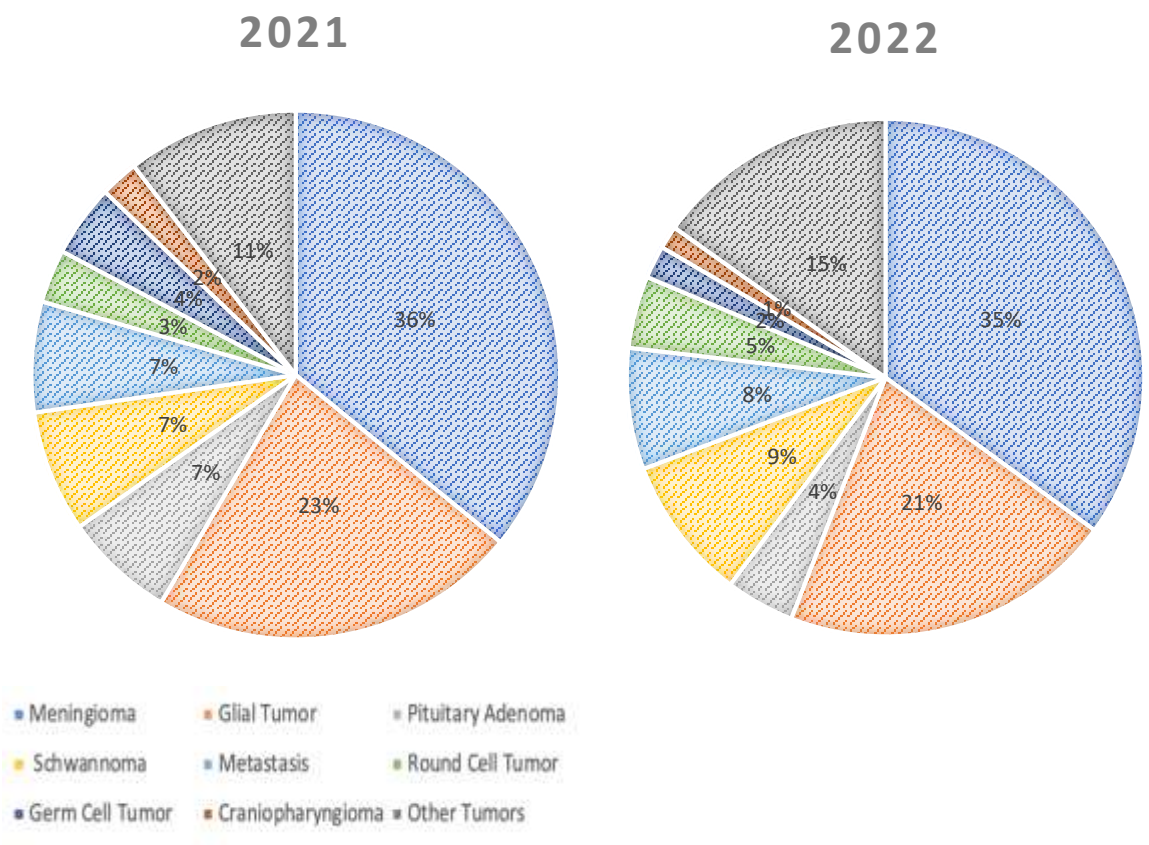

Figure 3. Histopathological Classification of Primary Brain Neoplasms

Tumor Hystology Based on Gender

Meningiomas exhibited a marked predilection for the female population, constituting 80.9% of cases. Likewise, schwannomas demonstrated a greater proclivity for occurrence in females, accounting for 63.2% of cases. Conversely, the prevalence of other tumor variants remained relatively equivalent across both sexes. (**Table 3**).

Table 3. Tumor Hystology Based on Gender

Characteristic	Gender		Total (n = 917)
	Male (n = 382)	Female (n = 535)	
- Meningioma	62 (19.1)	263 (80.9)	325 (35.4)
- Glial Tumor	99 (49.7)	100 (50.3)	199 (21.7)
- Pituitary Adenoma	26 (52.0)	24 (48.0)	50 (5.5)
- Schwannoma	28 (36.8)	48 (63.2)	76 (8.3)
- Metastasis	42 (63.6)	24 (36.4)	66 (7.2)
- Round Cell Tumor	18 (52.9)	16 (47.1)	34 (3.9)
- Germ Cell Tumor	16 (55.2)	13 (44.8)	29 (3.2)
- Craniopharyngioma	9 (52.9)	8 (47.1)	17 (1.9)
- Other Tumors	82 (67.7)	39 (32.3)	121 (13.2)

Tumor Hystology Based on Age

Within the age cohorts of 0–10, 11–20, and 21–30 years, the majority of patients had glial tumors. While in the age ranges of 31-40, 41-50, 51-60, 61-70 and 71-80 years old, the majority of patients had meningioma histopathology (**Table.4)**

Table 4. Tumor Hystology Based on Age

Characteristic	Age								Total
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	
- Meningioma	6 (13.3)	8 (14.5)	17 (21.8)	45 (34.1)	123 (46.6)	82 (39.2)	37 (34.3)	7 (26.9)	325
- Glial Tumor	11 (24.4)	18 (32.7)	18 (23.1)	33 (25.0)	51 (19.3)	53 (25.4)	10 (9,3)	5 (19.2)	199
- Pituitary Adenoma	0 (0)	2 (3.6)	3 (10.3)	8 (13.6)	12 (4.5)	18 (8.6)	5 (4.6)	2 (7.7)	50
- Schwannoma	0 (0)	2 (3.6)	15 (19.2)	15 (11.4)	19 (7.2)	14 (6.7)	11 (10.2)	0 (0)	76
- Metastasis	0 (0)	0 (0)	2	3 (2.3)	18 (6,.8)	19 (9.1)	18 (16.7)	6 (23.1)	66
- Round Cell Tumor	6 (13.3)	2 (3.6)	1 (1.3)	1 (0.8)	6 (2.3)	11 (5.3)	6 (5.6)	3 (11.5)	36
- Germ Cell Tumor	8 (17.8)	10 (18.2)	3 (3.8)	2 (1.5)	4 (1.5)	0 (0)	2 (1.9)	0 (0)	29
- Craniopharyngioma	3 (6.7)	2 (3.6)	2 (2.6)	3 (2.3)	2 (0.8)	3 (1.4)	2 (1.9)	0 (0)	17
- Other Tumors	11 (24.4)	11 (20.0)	17 (21.8)	26 (19.7)	29 (10.9)	9 (4.3)	17 (15.7)	3 (11.5)	121
Total	45	55	78	132	264	209	108	26	

This study is a descriptive epidemiological study with subjects of primary brain tumor patients at NBC Prof. Dr. dr. Mahar Mardjono Hospital Jakarta in 2021 - 2022 with a retrospective approach from patient medical records in the anatomical pathology laboratory. In this study, the incidence of female was more common than male, namely 58.4% female and 41.6% men, consistent with the previous study by Ardhini et al. (2019), which found that the frequency of primary brain tumor patients was higher among females (61.7%) compared to males (38.3%), a similar pattern is observed. Another study by Anindhita et al. (2021), involving 316 subjects, also reported that the majority of primary brain tumor patients (68%) were female. Additionally, data from the Central Brain Tumor Registry of the United States (CBTRUS) and meta-analysis studies in the United States indicate a higher incidence in females than males, with rates of 24.77 vs. 20.34 per 100,000 population and 15.8 vs. 14.33 per 100,000 population, respectively.

Patients with primary brain tumors are mostly aged 41-50 years, in line with Ardhini's research at Kariadi Hospital Semarang which stated that the highest occurrence of primary brain tumors is found in individuals within the 41–50 year age group.[8] Slightly different from the research by Wanis et al. in 2021, which found that the majority of brain tumor patients were aged 65 - 74 years (23.6%).[9]

Age is a significant risk factor for cancer, with individuals aged 65 years and older representing 60% of cancer cases and 70% of all cancer-related fatalities. Studies have shown that age-adjusted cancer mortality rates are 16 times higher in patients aged 65 and older compared to those under 65 years of age. In addition, treatment and care for elderly patients are also more challenging due to the many high-risk diseases suffered by these subjects, which can increase the likelihood of various comorbidities.[10,11]

Aging is a multifaceted process that influences nearly every facet of the immune system. It adversely affects the clearance of apoptotic cells, the number of naive T cells, and the body's ability to heal wounds. T cell senescence becomes more pronounced with advancing age, particularly through the induction of p16. Aging also significantly alters the expression of immunosuppressive genes in specific tissues, creating a microenvironment that facilitates oncogenesis, tumor progression, and/or resistance to therapies based on immunoregulation.[10,11]

The most prevalent histopathological finding in this study was meningioma, accounting for 35%. In accordance with this research, the Central Brain Tumor Registry of the United States (CBTRUS) reported that meningioma is the most common primary brain tumor, constituting 37.6% of cases. Similarly, Anindita's research at Cipto Mangunkusumo Hospital concluded that the majority of brain cancer patients had meningioma tumors (45.9%).[3]

In this investigation, metastatic neoplasms were identified in 7.2% of the cases. Cerebral metastasis ranks among the most prevalent forms of intracranial neoplasms and is intricately linked to substantial morbidity and mortality. These metastatic lesions frequently emerge as a secondary effect of poorly controlled primary malignancies such as those originating in the lungs, breasts, melanoma, colon, and kidneys. Therefore, an accurate diagnostic approach is imperative, and the condition must be managed and regulated by a multidisciplinary medical consortium to procure authentic and dependable data, curtail the prevalence of cerebral metastases, ameliorate the patients' quality of life, and diminish mortality rates.[12,13]

CONCLUSION

There were 917 cases (429 case in 2021 and 488 case in 2022) of primary brain tumor at NBC Prof. Dr. dr. Mahar Mardjono Hospital Jakarta in 2021-2020. In this study, it can be concluded that the incidence of primary brain tumors are more common in females with the peak incidence are age 41-50 years. The majority of tumor types are meningiomas and are located supratentorially.

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