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Original Research Article

Epidemiological Description of Primary Brain Tumors: A Single-Center Retrospective Study of 75 Cases, Yemen

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Abstract

Background: Primary brain tumors represent one of the most devastating tumors, characterized by high significant morbidity and mortality with a high rate of neurological sequelae. Only limited studies have described the burden of CNS tumors in Yemen.

Objective: Description of the epidemiological trends of primary brain tumors in a single institution.

Materials and methods: A retrospective study was obtained from registry records of patients with primary brain tumors based on clinical and radiological data or histopathological report at 48 Model Hospital, Sana'a, over a period of 4 years from January 1, 2020 to December 31, 2023. The collected data encompassed demographic and tumor characteristics including patient's gender and age, and type and site of tumor, as well as WHO grade.

Results: 75 cases of primary brain tumors were reviewed. There were 43 (57.3%) females. Adults were the highest age group involved (68%). The majority of tumors (77.3%) were supratentorial. Gliomas constituted the most common neoplastic category (48%). However, meningiomas was the most common single entity (32%).

Conclusion: This is an institution-based, detailed, and descriptive epidemiological study of Yemeni patients with primary brain tumors. In spite of our study's matching with most worldwide studies results, the definitive epidemiological rates in reality need a bigger multi-centric and histopathological based studies to be carried out. Limitations of our study included the clinically and radiologically based diagnosis of most cases.

Keywords: Primary Brain Tumor, Prevalence, Yemen.

Introduction

Primary brain tumors represent one of the most devastating tumors, characterized by high significant morbidity and mortality with a high rate of neurological sequelae [1-3]. These tumors may originate from various structures, including meninges, brain tissues, cranial nerves, pituitary gland, or germinal cells [4]. Despite the advancements in oncological therapies, brain cancer remains an enduring challenge in such communities due to its aggressive nature. The American Cancer Society suggests that by 2040, cancer incidence will rise substantially, potentially reaching approximately 27.5 million cases. of the total cancer-related deaths, approximately 3% of them are attributed to central nervous system (CNS) tumors, with a higher mortality rate observed among men [7,8]. Furthermore, brain cancer is notably one of the most common malignancies with a distressingly high mortality rate among pediatric populations [9].

According to the GLOBOCAN 2020 estimates, Yemen reported 16,476 new cancer cases, with CNS tumors accounting for 4.9% (803 cases) of all cancer types, making them the 7th most common malignancy in the country. CNS tumors predominantly affect males, comprising 59.5% (478 cases) of the total and ranking as the 6th most common cancer among men. The total number of cancer-related deaths in Yemen was 12,103, with CNS tumors contributing to 5.7% (689 cases) of these fatalities, making them the 7th leading cause of cancer mortality.

However, these figures are estimations, given the lack of a comprehensive statistical system and the limited scope of studies on tumors in Yemen. The true burden of CNS tumors in the Yemeni population remains difficult to ascertain due to the country's weak healthcare infrastructure, ongoing economic crisis, and prolonged civil conflict. This study, aims to describe the epidimiological and clinical characterstics of primary brain tumors cases who had been attending the outpatient clinic or admitted to neurosurgical department for management.

Methods

Study Design and Setting: А retrospective study was carried out for all cases diagnosed with primary brain tumor using the clinical, radiological data, and histopathology studies at 48 Model Hospital, Sana'a, Yemen, over a 4-year period between January 2020 and December 2023. The epidemiology and clinical data of the tumors, including age, gender, the anatomical site of primary brain tumor, histopathological diagnosis, and WHO grade were obtained from the hospital's database, medical records, radiological films, and histopathological reports.

Inclusion Criteria: All cases diagnosed with primary brain tumors of any age and sex were included based on the availability of full clinical records and radiological data or histopathological diagnosis. Furthermore, patients should be registered in neurosurgery clinic or admitted to neurosurgery center, including those who underwent surgical operations in the center.

Exclusion Criteria: Any case with insufficient clinical or radiological data was excluded from our study. Additionally, any non-neoplastic brain lesions, secondary metastases to brain or scalp, and skull tumors with intracranial extension were all excluded as well.

Statistical Analysis: Analysis was performed using the Statistical Package for Social Sciences (SPSS) (V.26.0, International Business Machines Corporation (IBM), Armonk, New York, USA. Data were using appropriate statistics. reported including counts, means, frequencies, ratios, and proportions. Correlation test was used to determine correlation between primary brain tumors patients and independent variables, P-value < 0.05considered and was statistically significant.

Ethical Approval: The ethical approval was obtained from the Medical Research and Ethics Committee at 48 Model Hospital. Further, all data, including patient identification, have been kept confidential. The patients' consent was not required.

Results

Seventy-five patients met the inclusion criteria and were diagnosed with primary brain tumors based on clinical evaluations and radiological findings, or histopathological reports. Of these cases, only 21 patients (28%) underwent surgical procedures15 cases (20%) had gross total tumor excision, and 6 cases (8%) underwent diagnostic biopsy—while the remaining 54 patients (72%) did not receive surgical intervention **Figure 1**.



Figure 1: The percentage of primary brain tumors patients sorted by type of

Among the 75 patients, 43 were female (57.3%) and 32 were male (42.7%). The average age of the patients was 36.23 years, with a standard deviation of 21.9 years. Most patients (68%) were adults between the ages of 19 and 70, as detailed in **Table 1**.

characteristics of the patients $(II - 75)$					
Variables	Frequency	%			
Gender					
Male	32	42.7			
Female	43	57.3			
Age Group					
< 18 years	20	27			
19-70 years	51	68			
>70 years	4	5			
Tumor Location					
Supratentorial	58	77.3			
Infratentorial	17	22.7			
Tumor Type					
Glioma	36	48			
Non-Glioma	39	52			
High/Low Grade					
Low Grade	56	74.7			
High Grade	19	25.3			
Total	75	100%			

Table 1 : Socio-demographic and tumorcharacteristics of the patients (n = 75)

In most patients, the tumor was located in the supratentorial region (n=58; 77.3%), while 22.7% had tumors in the infratentorial region. The majority of cases involved meningeal tumors (n=24; 32%), with approximately 16% located in the frontal lobe and 17.3% in the cerebellum, brainstem, and cerebellopontine angle. **Figure 2** shows the various locations of tumors within the brain.

Nearly 74.7% of the tumors were classified as low-grade, whereas 25.3% were highgrade. The results are presented in Figure 2. Nearly 74.7% of patients had low-grade tumors, whereas 25.3% had high-grade tumors. Approximately 52% of the patients were diagnosed with non-glioma tumors, while 48% (n=36) had gliomas. Meningioma emerged as the most prevalent type of primary brain tumor, accounting for 32%



Figure 2: The distribution of primary brain tumors locations



Figure 3: Distribution of tumors according to type of tumors

(n=24) of cases. Gliomas constituted 48% of the tumors and were equally divided between high-grade (n=18; 24%) and low-grade (n=18; 24%) gliomas. Other less common tumor types included craniopharyngioma

(4%) and pituitary tumors (4%). **Figure 3** further illustrates the distribution of these and other less frequent tumor types, underscoring the wide variety of primary brain tumors encountered in clinical practice.

Primary brain tumors in relation to Gender and Age

In males, glioma was the most common tumor, representing 25.3% of cases, followed by meningioma at 9.3%. Among females, meningioma and glioma were equally prevalent, each accounting for 22.7% of cases. As previously mentioned, the majority of patients were adults aged 19 to 70 years (68%). In this age group, meningioma was the most frequently observed tumor, occurring in 30.7% of cases, followed closely by glioma at 29.3%. Conversely, glioma was the most common tumor among pediatric patients, representing approximately 14.7% of all primary brain tumors. These relationships are detailed in Table 2.

Table 2: The frequency of primary brain tumor in relation to gender and age groups. (N=number,%=percent)								
Type of tumors	Gender N (%)		Age group (Years) N (%)			Total		
	Male	Female	18<	19-70	70>	N (%)		
Meningioma	7 (9.3)	17 (22.7)	0	23 (30.7)	1 (1.3)	24 (32)		
Glioma	19 (25.3)	17 (22.7)	11 (14.7)	22 (29.3)	3 (4)	36 (48)		
Choroid Plexus papilloma	1 (1.3)	1 (1.3)	2 (2.7)	0	0	2 (2.7)		
Choroid plexus carcinoma	0	1 (1.3)	1 (1.3)	0	0	1 (1.3)		
Craniopharyngioma	2 (2.7)	1 (1.3)	2 (2.7)	1 (1.3)	0	3 (4)		
Pituitary tumor	0	3 (4.0)	1 (1.3)	2 (2.7)	0	3 (4)		
Hemangioblastoma	1 (1.3)	1 (1.3)	0	2 (2.7)	0	2 (2.7)		
Teratoma	1 (1.3)	0	1 (1.3)	0	0	1 (1.3)		
Pineocytoma	1 (1.3)	1 (1.3)	1 (1.3)	1 (1.3)	0	2 (2.7)		
Schwannoma	0	1 (1.3)	1 (1.3)	0	0	1 (1.3)		
Total	32(42.7)	43 (57.3)	20 (26.7)	51 (68)	4 (5.3)	75 100)		

Correlations between brain tumors and variables

Table 3 presents a robust positive correlation (1.000) within the gender variable, indicating that changes in gender are closely related to one another. When examining the specific site variable, a statistically significant negative correlation (-0.239) with a p-value of 0.041 is observed, suggesting that as the specific site of the tumor varies, there is a corresponding decrease in another variable. Notably, the table also highlights a highly significant negative correlation (-0.568)

between the specific site and tumor location, with a p-value of 0.000. This indicates a strong statistical relationship, wherein changes in the specific tumor site are closely associated with changes in the tumor's location, whether it is in the supratentorial or infratentorial region. Additionally, the table reveals a statistically significant positive correlation (0.229)between age groups and the patient's age, with a p-value of 0.050. This suggests that as

the age group increases, the patient's age also tends to increase. By carefully analyzing these statistically significant correlations, valuable insights can be drawn regarding the relationships between various factors associated with primary brain tumors within this academic and scientific framework.

Table 3: Correlations between the type of primary brain tumor and variables								
Variables	Correlation	Gender	Age group	Specific site	Tumor Location (supratentorial/ infratentorial	Age years		
Gender	Correlation P-value	1.000						
Specific site	Correlation P-value	-0.239 0.041	-0.013 0.911					
Tumor Location	Correlation P-value	-0.080 0.499	-0.146 0.215	-0.568 0.000				
Age groups	Correlation	0.169	0.242	-0.484	0.439	0.229		

Discussion

According to the GLOBOCAN 2020 report, brain and central nervous system tumors rank as the 7th most prevalent type of cancer in Yemen, representing approximately 4.9% (803 cases) of all cancers. These tumors predominantly affect males, accounting for 59.5% (478 cases), positioning them as the 6th most common malignancy among men. CNS tumors are also the 7th leading cause of cancer-related mortality in Yemen, with 5.7% (689 cases) of deaths attributed to these conditions.

The lack of comprehensive statistical data on tumor prevalence and incidence, particularly brain tumors, in Yemen is attributable to several factors. These include inadequate medical record-keeping, limited diagnostic facilities, a subpar health and statistical infrastructure, and an ongoing economic crisis exacerbated by persistent civil conflict. National cancer registry centers in Yemen are sparse and only track cases that present for chemotherapy or radiotherapy. Consequently, many patients with benign tumors, those with advanced malignant diseases resistant to conventional treatments, or those residing in rural areas, may not be represented in these statistics. This underrepresentation is further compounded by the unavailability of advanced diagnostic tools such as gamma knives and the lack of a systematic approach to cancer reporting. However, recent years have shown an increase in brain tumor cases at our institution, reflecting growing awareness of the importance of medical documentation and electronic record systems. While there are limited studies on tumors in Yemen [11-13], with only one focusing on tumors, [14] this CNS rising trend underscores the need for improved data collection and reporting.

This study indicates that a substantial proportion of patients (72%) did not undergo surgical intervention for their primary brain tumors. This suggests reliance on alternative treatments modalities such as radiation therapy, chemotherapy, or conservative management based on tumor characteristics and patient conditions. In contrast, only 20% of patients received surgical treatment, highlighting the complexities and challenges associated with the surgical management of brain tumors. Surgeons must carefully weigh

the potential benefits and risks of surgical interventions, considering factors like tumor location, size, and the patient's overall health status. Additionally, 8% patients of underwent biopsy procedures for diagnostic purposes, indicating that these tumors were either unsuitable for extensive surgery or were managed primarily through nonsurgical approaches. Factors contributing to the lack of surgical intervention include small tumors requiring only monitoring, inoperable tumors, diffuse or deep-seated tumors necessitating advanced facilities, and patientrelated issues such as associated terminal illnesses or socioeconomic constraints like poverty, or refuse of surgical options by uncooperative patients' relatives.

Study findings reveal that gliomas are the most common category of primary brain tumors (48%), consistent with other studies. [15-17] Meningioma, as a single tumor type, was found to be the most frequent, representing 32% of cases. This prevalence aligns with findings from other studies, [14, 18-20] although the reported rates vary slightly across different regions. These variances had been suggested by El-zine et al that is due to reflecting differences in study methodologies, sample sizes, and reporting practices. [14]

The current study also identified that cerebral meninges is the most common tumor site (32%), followed by the frontal lobe (16%). This is consistent with data from the CBTRUS report, which lists the meninges as the most common tumor site in adults, representing (36.1%) [21,22]. However, some studies suggest the frontal lobe is the predominant site for primary brain tumors,

highlighting variability in tumor site prevalence. [23,24].

This study did not assess the specific subtypes and grades of primary brain tumors due to incomplete data. Systematic reviews have noted inadequate reporting of CNS tumor subtypes in developing countries, [25] recommending the establishment of standardized reporting systems to enhance health management and data accuracy. The development of dedicated histopathological centers with expert teams is crucial for obtaining precise data on tumor subtypes and improving the quality of cancer statistics.

A systematic review study revealed that there is inadequate reporting of CNS tumor subtypes in registries of developing countries. They suggested establishing a unified reporting system to help improve health management for CNS tumors. [22] Unstandardized histology groupings and reporting can lead to different interpretations and incomparable results between different populations. [18]

Limitations

The study is limited by its retrospective design, small sample size, and single-center which may not provide focus. а comprehensive representation of primary brain tumor prevalence in Yemen. Many diagnoses were based on clinical and radiological features rather than histopathological confirmation. Future research should include larger, randomized, multicenter studies to provide more accurate estimates of tumor prevalence and incidence. Additionally, there is a need for improved medical record-keeping to enhance disease tracking and clarity.

Conclusion

Despite its retrospective nature and reliance on clinical and radiological data, this study's

findings are consistent with existing national, regional, and global research. The results offer valuable insights into the epidemiology of primary brain tumors in Yemen. It is recommended that national cancer registries be activated and reorganized to provide a comprehensive overview of brain tumor cases. This effort should be integrated into broader cancer control policies and programs to facilitate larger studies and better reflect the true incidence of tumors in Yemen.

Conflict of Interest Statement:

The authors declare that the article content was composed in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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