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Prevalence of Cns Tumors and Histological Recognition in the Operated Patients: 10 Years Experience

El-Zine MAY[1], Ali MAA[2] and Al-Shamahy HA[3*]

[1]Departement of Histopathology, Faculty of Medicine and Health Sciences, Sana'a University, Republic of Yemen

[2]Department of Neurosurgery, Faculty of Medicine and Health Sciences, Sana'a University, Republic of Yemen

[3]Department of Basic Sciences, Faculty of Dentistry, Sana'a University, Republic of Yemen

***Corresponding author:**

Hassan A. Al-Shamahy,
Department of Basic Sciences, Faculty of Dentistry, Sana'a University, P.O. Box 775 Sana'a, Yemen, Tel: +967-1-239551,
Tel: +967-770299847,
E-mail: shmahe@yemen.net.ye

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El-Zine MAY, Ali MAA and Al-Shamahy HA, These authors are contributed equally to this article

1. Abstract

1.1. Background: Tumors of the central nervous system consist of a heterogeneous group of neoplasms of great histological diversity. Despite the increasing prevalence of these tumors in developing countries, some places like Yemen do not have representative studies showing the true impact of these tumors on our population.

1.2. Aims: Description of the characteristics of primary and secondary tumors of the central nervous system in the past ten years in one Yemeni institution.

1.3. Material and method: An observational and descriptive study in patients with CNS tumors that were treated selectively by surgical excision with subsequent diagnosis by studying pathological tissues at the Saudi German Hospital SGH - Sana'a, over a period of 10 years from January 1, 2009 to December 31, 2019. Study variables were qualitative (histological type, gender, affected anatomical site) and quantitative (age). Both group and histopathological diagnoses were formed in line with the 2006 World Health Organization (WHO) classification of nervous system tumors.

1.4. Results: There were a total of 359 central nervous system tumors. Of these, 200 were females and 159 were males, with a ratio of 1.3: 1 and a mean age of 49.3 years. The most common tumors were the neuroepithelium (28.4%), meningiomas (26.55%), followed by mesenchymal tumors (13.4%), sellar region tumors (11.14%) and the nerve sheets tumors (11.14%). Meningiomas had the highest prevalence in female patients (20.33%), while it was in male neuroepithelial tumors (15.32%). Single entity repeat point form, Grade I meningioma was the most common (18.11%) followed by pituitary adenomas (9.2%), Glioblastoma multiform (8.6%), Class II meningiomas (7.24%) and Schwannoma (6.7%).

1.5. Conclusion: This is the first study of a series of cases in Yemen to be conducted on both benign and malignant tumors of the central nervous system, with patients of all age groups with a range of 10 years. While this work represents only a retrospective analysis of a single institution, it can be a strong indicator of the epidemiology of these tumors in the Yemeni environment.

2. Introduction

Central nervous system tumors are a heterogeneous group of tumors of enormous histological diversity and are restricted to the brain, spinal cord, meninges, and cranial and paraspinal nerves [1-3]. A large series was conducted by diverse groups all-around the world in order to verify the clinical and epidemiological features. It can be noticed in these studies that there has been a significant

increase in recent decades, particularly in non-industrialized countries such as Yemen [1-9].

In some study series, these tumors are the leading cause of cancer-related death in children and draw attention to that more than 50% of children survivors of brain tumors have impaired cognitive function linked to the tumor or its treatment [5]. For that reason it is important to determine the recent features of these tumors in our environment. Nevertheless, in Yemen as in the majority of Arab countries, there are few specialized epidemiological records dedicated to this field, and for that reason it is important to encourage, update, build up and continue to offer studies on the manners of CNS tumors with the purpose of achieve a greater extent and influence on public health, with early diagnosis and suitable treatment with the purpose of enhance survival and reduce possible subsequent consequences.

The 6-year-old Saudi-Emirati aggression on Yemen has transformed this already weak country into the largest man-made humanitarian crisis in the world, taking away what its people need most, including basic needs, such as health care [6]. The United Nations report stated that in the year 2020-2021, more than 19.7 million people need health care services in Yemen, while only less than half of health facilities are still functioning. There are also about 1.5 million IDPs currently suffering from existing vulnerabilities including increased exposure to carcinogens [6]. According to the Limited Yemen Cancer Studies, the most common cancer among Yemeni children and adults were leukemia (33.1%), lymphoma (31.5%), central nervous system tumors (7.2%) and bone tumors (5.2%) [6-8]. This study was performed to give base line description of histopathological pattern of CNS tumors recorded in regional hospital SGH-Sana'a. These registers are not population-based cancer registration but is the only available source. We served to prove the basic demographic and histological data which can be competed with available studies on literatures. On other hand to provide primary base line tool to work-up for future population studies on CNS tumors.

3. Patients and Method

A descriptive observational study was performed in patients with central nervous system tumors that were treated selectively by surgical excision with subsequent diagnosis by studying pathological tissues at the Saudi German Hospital SGH - Sana'a, over a period of 10 years from January 1, 2009 to December 31. 2019. The study variables were qualitative (histological group, gender, affected anatomical site) and quantitative (age). Both group and histopathological diagnoses were formed in line with the 2007 WHO classification of nervous system tumors [9]. According to this classification, the patients were divided into 7 groups: neuroepithelial neoplasms, cranial nerve tumors, paraspinal tumors, tumors arising in the meninges, lymphomas, hematopoietic tumors, germinal cell tumors, sellar region, and metastatic tumors. We then classified subgroups according to morphological diversity.

4. Statistical Analysis

Data were reported using appropriate descriptive statistics (including frequency, mean, standard deviation, and P-value). All statistical analyzes of the data were performed using the Statistical Package for Social Sciences (SPSS) version 24 and Excel 2007.

5. Ethical Approval

Ethical approval was obtained from the Medical Research & Ethics Committee of the Faculty of Medicine and Health Sciences, Sana'a University. All data, including patient identification were kept confidential.

6. Results

6.1. For age and gender distribution: This study included 359 CNS tumors patients, 200 (55.7%) females with a mean age of 36.7 years, while 159 (44.3%) were male patients with a mean age of 39.5 years (Figure 1). 295 (82.2%) were adult patients aged 19-70 years with a mean age of 44 years (Figure 2). 164 patients (55.6%) were female with a mean age of 42.5 years, and 131 patients (44.4%) were male with a mean age of 45.9 years (Figure 4). 64 (17.8%) were pediatric patients aged 1-18 years, with a mean age of 9.8 years. 36 patients (56.25%) were female with a mean age of 10 years, and 28 patients (43.8%) were male with a mean age of 9.4 years (Figure 3).

6.2. Frequency of CNS tumors: Of all CNS tumors 359 cases, neuroepithelial neoplasms showed the most common tumor (28.4%) followed by meningiomas (26.5%) then mesenchymal tumors (13.4%) and equal presence of NST with sellar tumors (11.4%) for each (Figure 5). In single entity repeat point form, grade I meningioma was the most common 65 cases (18.11%) followed by pituitary adenomas 33 cases (9.2%), GBM 31 cases (8.6%), grade II meningiomas 26 cases (7.24%) and schwannoma 24 cases (6.7%) (Table 1).

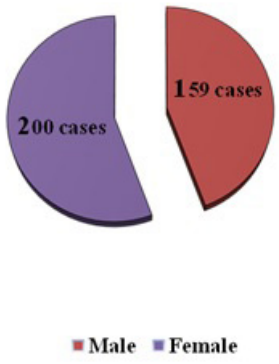

Figure 1: Sex distribution of CNS tumors

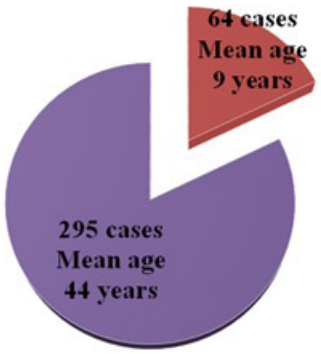

Figure 2: Age distribution of CNS tumors

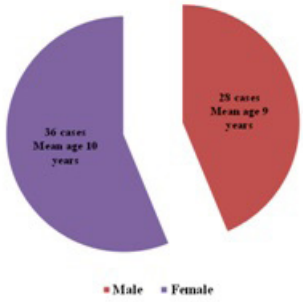

Figure 3: Pediatric age distribution in relation to sex n=64 patients

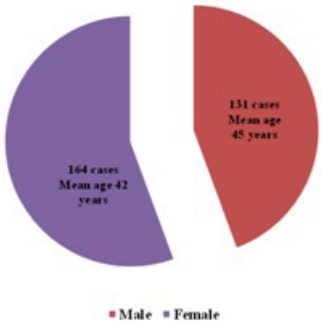

Figure 4: Adult age distribution in relation to sex n=295 patients

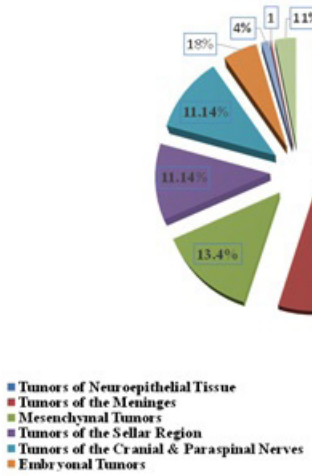

Figure 5: Frequency of CNS tumors in 359 cases

6.3. Frequency of CNS tumors with respect to gender: Male patients showed a predominance in neuroepithelial tumors (15.3%) and sellar tumors (7.2%) while females showed a predominance over males in the other tumors except for NSTs were evenly distributed in both sexes (0.56%) (Figure 6).

6.4. Frequency of CNS tumours in relation adult age: Meningiomas were the first common adult group tumours (31.5%) with predominance of grade-I meningioma 64cases (68.8% of all meningiomas), grade-II 26 cases (28%) and grade-III 3 cases (3.2%). Gliomas were the second common tumours (25.4%) with predominance of astrocytomas 55 cases (73.3% of all Gliomas). GBM was the commonest type of astrocytoma 29 cases (52.7% of all astrocytomas). The third tumours category was NSTs (12.9%), equally in both male and female. Schwanomma was commonest type 24 cases (63.2% of all NSTs) affected more male patients (70%). Mesenchymal tumours (MTs) category were (12.2%), lymphoma was the commonest single entity 8 cases (22.2% of al MTs) followed by hamingioblastoma 6 cases (16.7% of all MTs) both showed male predominance (31.8%) (18.2%) respectively. Sellar tumours category were (11.9%) with male predominance (16.4%), pituitary adenomas were 32 cases (91.4% of all sellar tumours) (Figure 7, Table 1).

6.5. Frequency of CNS tumours in relation pediatric age (Figure 8, Table 3): Gliomas were the first common tumours (42.2%) with predominance of astrocytomas 20 cases (74.1% of all Gliomas). Pilocytic astrocytoma was the commonest type of astrocytoma 14 cases (70% of all astrocytomas). More common in male (34.6%). Embryonal tumours were the second common tumours (20.31%) with predominance of medulloblastoma 10 cases (76.9% of all ETs). The third tumours category was Mesenchymal tumours (MTs) (18.75%), lymphoma was the commonest single entity 5 cases (41.67% of all MTs) followed by cavernous angioma and chondroma 2cases (16.67% of all MTs) for each.

6.6. Prevalence rate of CNS tumours with site (Figure 8): 81.64% of all tumours located intracranial while (18.36%) were intraspinal which was the main site for metastasis 6/11cases and NSTs 28/40 cases.

6.7. Distribution of CNS tumours by grading in adult (Table 1): 79.1% were non malignant tumours (WHO grade I/II), included meningiomas (41.3%), NSTs (16.4%), Gliomas (15.9%). 20.5% were malignant included gliomas (18.2%), embryonal tumours 1.8% and MPNST 0.5% (Figure 9, 10).

6.8. Distribution of CNS tumours by grading in pediatric (Figure 9, Table 1): 65.4% were non malignant tumours (WHO grade I/II), included gliomas (44.2%) sellar tumours (7.7%), meningiomas , NSTs (3.8%) for each. 34.6% were malignant included embryonal tumours 25%, gliomas 7.6% and MPNST 0.5%.

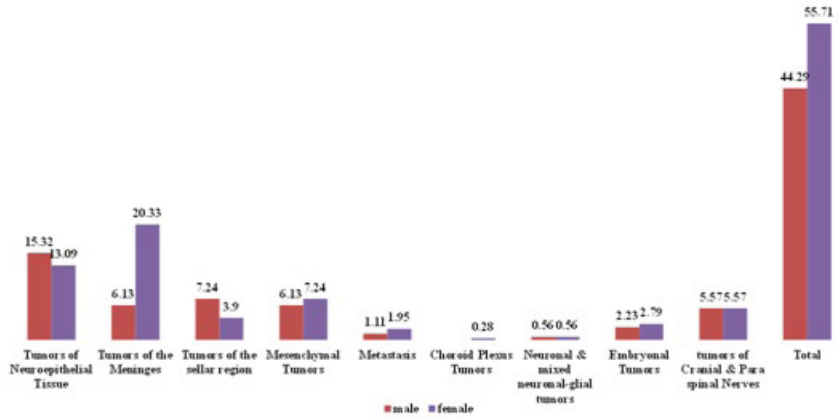

Figure 6: Sex Distribution of CNS tumors in percentage

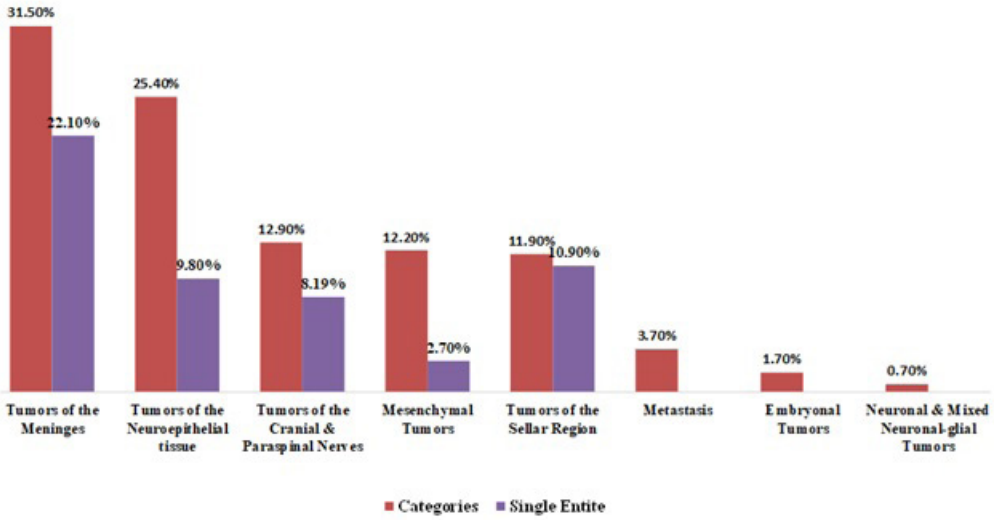

Figure 7: The frequency of different types of CNS tumors in Adult

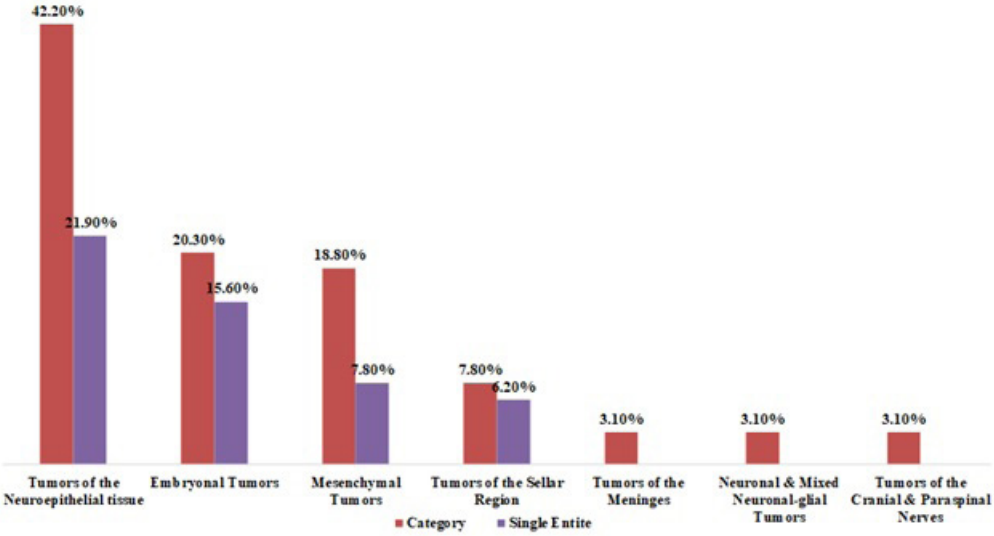

Figure 8: Frequency of different types of CNS tumors in Pediatric patients

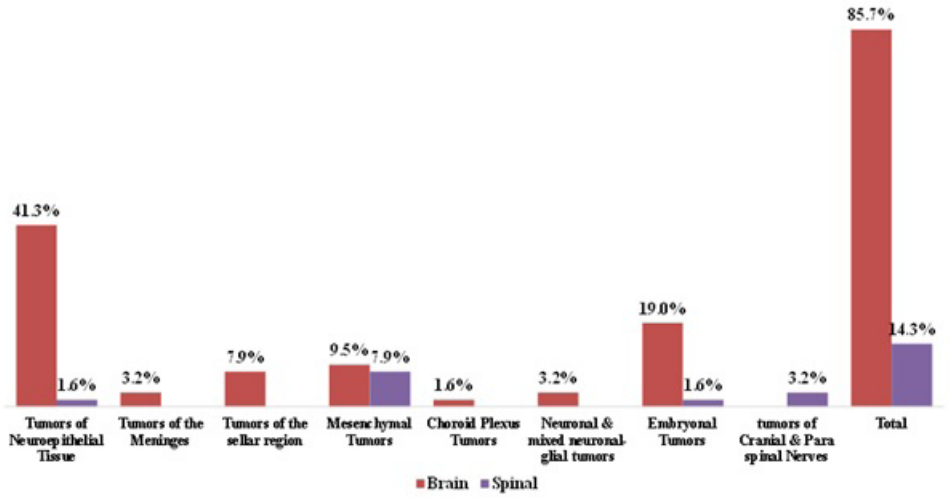

Figure 9: Frequency of CNS Tumors among children by site

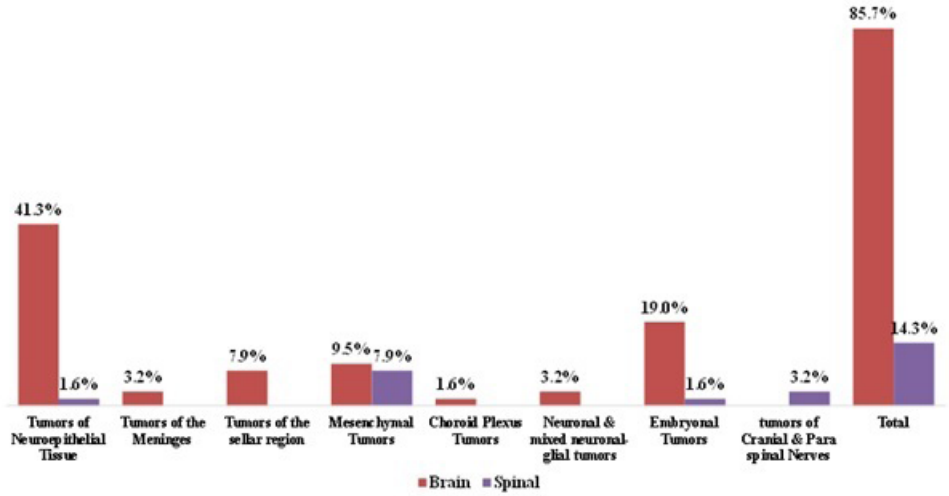

Figure 10: Frequency of CNS Tumors among adult by site

Table 1: The percentage of CNS tumors in relation to WHO grading in total, adult, and pediatric cases

Tumors	Total cases %	Adults cases %	Pediatric cases %
Grade 1	53.3	55	46.2
Gliomas	8.1	3.6	26.9
Mesen TO	2.2	2.7	0
Sellar	2.6	1.4	7.7
NST	14	16.4	3.8
Meninges	24.6	29.5	3.8
Mixed	1.1	0.9	1.9
Ch plexus	0.4	0	1.9
Emberyo TO	0.4	0.5	0
Grade 2	23.2	24	19.2
Gliomas	13.2	12.3	17.3
Meninges	9.6	11.8	0
Mesent TO	0.4	0	1.9
Grade 3	5.9	5.9	5.8
Gliomas	4.8	5	3.8
Meninges	0.7	0.9	0
Mixed	0.4	0	1.9
Grade 4	17.7	15	28.8
Emberyo TO	6.3	1.8	25
Gliomas	11.4	13.2	3.8
total	100	82.2	17.8

7. Discussion

Tumors of the central nervous system are one of the primary tumors in children and one of the most common reasons for consulting adult neurosurgery services. The survival rate can be as poor as 26% at 5 years for posterior fossa tumors and 7% when the brainstem is affected [10-12]. Neurocognitive sequelae are another major concern, primarily due to the management of neurosurgery and the neurotoxicity of chemotherapy and radiation [13, 14]. The tumor series reported in Yemen either specifically focus on cancer in general, with no publications on CNS cancers [4,7,8]. Studies of different groups containing large numbers of adults indicate that there are differences in terms of histological group and the most prevalent tumors; in the neighboring and world series, meningiomas are more common, at about 35% [3,15,16]. In the current study, Gliomas were the most common central nervous system tumors with 28.4% (Figure 5). Neuroepithelial tumours are more prevalent in the European series, with 53.9% in France and 33.3% in Greece. In Asia, in the series from China, neuroepithelial neoplasms account for 38% and meningiomas 36.5%. In Japan, Nakamura *et al.*[17] reported a clear prevalence of meningiomas of 38.2% [17-20]. The only report from Latin America was the study by Ramos Clason *et al.* [21] Performed in Colombia, and reviewed a total of 390 cases, meningiomas were the most common 50%. The difference in proportions in nervous system tumors may be caused by that there are differences in the methodology used in each of the different studies, that a few series reported primary and secondary tumors and that the study period is another important variable, as the number of centers participating in each study and the sample size of the patients in each study. In the current study, in the adult group, meningiomas were the most common tumor with a rate of 25.9% with a Grade I-I of 17.8%, and these results are consistent with many studies in both developing and developed countries; for example, in Saudi Arabia about 26% [22-24], Jordan 26.2% [25], Iran 27.1% [26]. However, the results are lower than those recorded in the United States (36.1%) [27].

In the current study, meningioma is predominantly a female cancer (20.33%) (Figure 6). This is similar to studies conducted in Saudi Arabia [22-24] as well as the study reported by Adalberto Miranda-filo *et al.* 2017 [28] and it may be related to the high incidence of breast cancer among Yemeni patients [4], confirming the hormonal effects that make females more susceptible to meningioma [29]. Astrocytomas was the second entity of individual neoplasms in adults after meningiomas in the current study, which represented 18.43% of all adult central nervous system tumors and 72.9% of glioma subtype tumor roughly close to the findings from Zalata *et al.* [30] who reported that astrocytomas was the common one with predominant of glioma subtype (79.4%), but our results were lower than Mohammad *et al.* [31] (29%) of all CNS tumors; and are higher than Suh *et al.* in Korea [32]. Although GBM was the most common glial tumor (39.2%) in this study, this is roughly close to Zalt *et al*. [30] (38.3%), and higher than the Jordanian study of 18.9% [25] but still lower than other studies by Mohammad *et al.* [31] (65.2%) and Cibtrus 2006 [33] 50.7%. We noticed that a third of our GBM cases appeared after the war on Yemen, and many of these cases came from areas that were subjected to the air attacks. Pituitary adenoma was frequent in this study 31 cases (10.9%) of adult CNS tumors with male dominant and was the second adenoma after a grade I meningioma which is similar to Bary *et al.* [34] (10%) but slightly lower than Zalata *et al.* [30] (11.6%) but higher than Mohammed *et al.* [31] (6.2%) and Cbtrus (2002) [33] (6.3%).

In the pediatric group in this study, pilocytic astrocytoma was the first single entity tumor of 22.7% followed by medulaoblastoma at 15.15%, and these results are consistent with Gaidi *et al.* [35] and Cbtrus 2015 [33] who stated that pilocytic astrocytoma is the leading histological type in infants and children. Contrary to our findings, previous studies conducted in Yemen and Saudi Arabia showed that medulloblastoma was the most common childhood tumor followed by astrocytomas [7,8,23,24]. Also, this study found that the rate of medulablastoma was 15.15% which is still lower than that reported in several studies such as Govindan *et al*. (30.9%) [36] and Catch *et al.* (25.7%) [37]. The Yemen Cancer Center stated [7,8] that lymphoma is one of the most common tumors among Yemeni children, which may be in line with our conclusion that lymphoma is the third most common type of tumor in the children's group (7.75%). Primary intracranial tumors accounted for 82.8%, which is less than that reported by Suh *et al.* (93.4%) [32] and Cbtrus (2006) (94.3%) [33], but close to Zalata *et al.* (86.7%) [30]. Almost all astrocytomas and all gliomas and embryonal were intracranial as is the case with Komot and Mills [38]. In the current study, primary spinal tumors accounted for 17.2% which is higher than that reported by Zalata *et al.* [30] (10.9%) and Schillinger *et al.* (4-8%) [39]. In this study, 47% of intraspinal tumors were nerve sheath tumors followed by mesenchymal tumors which differed from those reported by Jalali *et al.* who reported that nerve sheath is more common followed by meningioma [40].

In the current study, ependymoma accounted for 71.4% of all spinal gliomas and are higher than those reported by Razi *et al.* [41] (30-60%) and Zalata *et al.* [30] (54%). Metastasis were also recorded at 3.1% in this study, which appeared to be lower than many studies conducted by Zalata *et al.* [30] (5.8%) and Suh *et al.* [32] (6%). In the current study, most of the metastatic lesions were in females (63.63%) with intraspinal perdilation (54.54%).

8. Conclusion

This is the first case series in Yemen looking at CNS tumors, which includes patients of all age groups over a period of 10 years. Although this study is only a retrospective analysis of a single institution, it can be a strong indicator of the epidemiology of these tumors in Yemen. In addition, the current study recorded data matches with those in the global literature and neighboring coun-

try studies, with some differences.

9. Acknowledgments

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