



## Central Nervous System Tumors in Guilan, Iran: Epidemiological Features Over 10 Years

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### ABSTRACT

**Background:** Tumors of the central nervous system (CNS) are a heterogeneous group of neoplasms with different prevalence in different sex and age groups and various parts of CNS.

**Objectives:** Determining the relative frequency of different types of CNS tumors in different ages, sex and CNS anatomical locations.

**Materials and Methods:** This retrospective study was performed using pathological reports of CNS tumors from patients in three main referral neurosurgical hospitals in Guilan, Iran from 1999 to 2009, which provided the following demographical data: patient age at the time of hospital admission, gender, histological diagnosis and the anatomical location of tumors.

**Results:** From a total of 365 cases, 292 were brain tumors (80%) and the remaining 20% were diagnosed as spinal tumors. There were 27 different types of CNS tumors in the present study, with astrocytomas (28.5%) and meningiomas (27.1%) being the most common types among brain tumors and schwannomas (35.1%) being the most common among spinal cord tumors. Frontal lobe (17.5%) was the most common anatomical location for brain tumors, and thoracic region was the most common region affected by spinal cord tumors (41.1%). Metastatic or secondary tumors accounted for 3.8% of the CNS tumors in our study. Contrary to most other studies, the frequency of CNS tumors was higher in females than males and was most frequent in the 5<sup>th</sup> decade of life.

**Conclusions:** This study demonstrated the high frequency of CNS tumors with astrocytic origin. The most common tumor was astrocytoma, with meningioma being the second most prominent one.

**Keywords:** Spinal Cord; Neoplasms

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### Introduction

Tumors of the central nervous system (CNS) are a heterogeneous group of neoplasms, which are often derive from the structures within the cranio-vertebral cavity (1, 2). The annual incidence of CNS

tumors ranges from 10 to 17 cases per 100,000 persons for intracranial tumors and 1 to 2 cases per 100,000 persons for intraspinal tumors (3).

Brain tumors are the primary cause of cancer-related mortality in children, and are considered to be the most common solid tumors which develop in childhood, comprising 20% of all neoplasms (4, 5). The mean age of the onset of primary brain tumors was 53 years. However, the age distribution of primary brain tumors or non-metastatic tumors does depend upon their histological features and anatomical location (6). The most common primary intracranial tumors in adults were those of neuroepithelial origin. Gliomas, followed by meningiomas and pituitary gland tumors were the most frequent tumors found, with regard to specific types of tumors. Men appear to be at a higher risk of developing gliomas but at a lower risk for developing meningioma when compared with women (7). Spinal cord tumors are rare malignancies of the CNS. The average age of the patient at diagnosis for spinal cord tumors is 10 years, and these tumors typically affect both genders equally. Astrocytomas, ependymomas and hemangioblastomas are the most common types of intra-medullary tumors (8, 9).

Epidemiological studies have shown a steady increase in the incidence rates of intracranial tumors over the last few decades in both genders and in all age groups; however, there has been some debate whether this increasing trend is accurate or an artefact (7, 10). Mehrazin et al. completed a study on patients with primary intracranial tumors from 1978 to 2003 at the Shariati neurosurgical hospital and reported a male predominance of brain tumors in the Iranian population. They also reported that the mean age of patients at the time of diagnosis was 33.9 years. The five most prevalent types of CNS tumors were meningiomas followed by astrocytomas, pituitary adenoma, glioblastomas and ependymomas. As with

other studies, meningiomas were the only tumors with a significantly higher frequency distribution in the female population (5).

Because of the lack of reliable statistics on CNS tumors in Iran, we conducted this study to investigate possible differences in the relative frequency of different types of brain and spinal cord tumors considering the age and gender of the patient and anatomical location of tumors specifically in the north of Iran and then compared our data with the results of previous studies from other geographic regions.

## Materials and Methods

This retrospective study was approved by the Vice Chancellorship of Research and Technology at the Guilan University of Medical Science. The pathological specimen of patients with brain and spinal-cord tumors, who underwent surgery in three main referral neurosurgical hospitals in Guilan province, in the North of Iran were collected from April 1999 to March 2009.

Data, including age of patient at the time of admission, gender of patient, histological diagnosis and the anatomical location of the tumor were collected from medical records. Histological categorisation of tumors was based on the World Health Organisation (WHO) classifications (1). Examination of H and E stained sections from retrieved paraffin blocks were performed in most cases by independent histopathologists for pathological typing of CNS tumors. Immunohistochemical stains were conducted for problematic cases to confirm final histopathologic diagnosis. A few of the collected specimens were not stained by immunohistochemistry methods.

The research data were analysed using IBM's SPSS predictive analytics statistical

software (Version 16). The relative frequency of CNS tumors was determined considering the variables of age, gender, histology and location and mean and standard deviation were recorded.

## Results

We included 365 pathological samples in our study, with 80% of the cases (292 patients) were diagnosed with brain tumors and 20% (73 patients) with spinal cord tumors. One hundred and seventy six patients were male (48.2%) and 189 patients were female (51.8%). The age of patients ranged between 11 months to 76 years old, with a mean age of 41.1 years. Most diagnosed cases were in their 5<sup>th</sup> (70 cases), 6<sup>th</sup> (62 cases) and 7<sup>th</sup> (59 cases) decades of life.

In general, 27 different tumor types were identified: astrocytic tumors (including astrocytomas and pilocytic astrocytomas) and meningiomas were most prevalent (28.5% and 27.1% respectively). The frequency of all tumors is shown in Table 1 and Diagrams 1, 2.

Approximately, 3.8% of cases were metastatic tumors, of which 57.1% of cases were initially recognised as a brain tumor. Approximately 36.5% of the female patients

suffered from meningiomas and 24.3% from astrocytomas. In contrast 33% of the male cases were affected by astrocytomas and 17% were affected by meningiomas.

Of the 292 patients with a diagnosis of brain tumor, 154 cases were females (52.7%) and 138 cases were males (47.3%). Most patients were in the 5<sup>th</sup> decade of life (58 patients). There were 24 different brain tumor types, of which astrocytic tumors and meningiomas were the most prevalent (34.6% and 28.8%, respectively). In most cases, the anatomical location of the brain tumor was in the frontal (17.5%), cerebellum (12.7%) and temporal (11%) regions of brain. In addition, 2.7% of the tumors were metastatic.

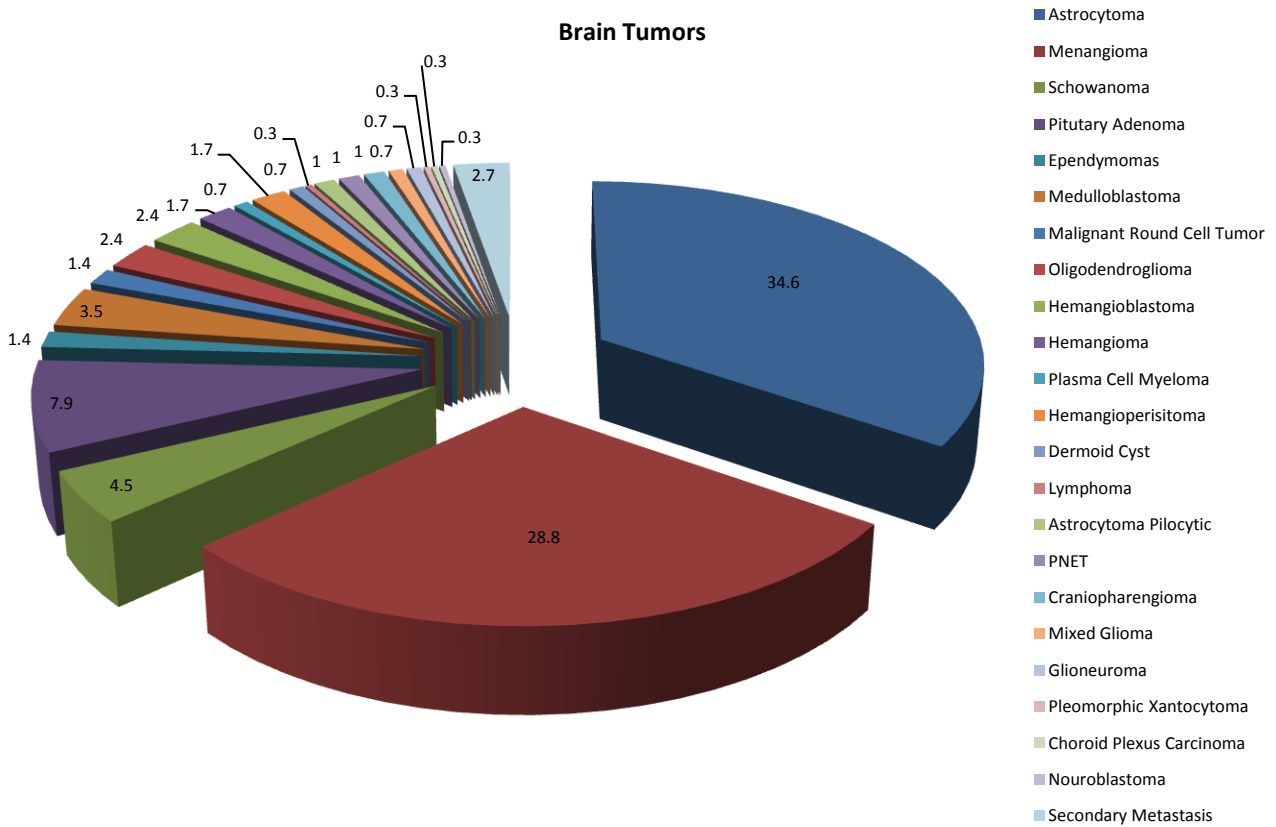
Of the 73 cases of spinal cord tumors, 35 cases were in females (47.9%) and 38 were male patients. Most of the patients were in a later decade of life: 5<sup>th</sup> (12 patients), 6<sup>th</sup> (15 patients) and 7<sup>th</sup> decade (12 patients).

There were 14 different tumors of the spinal cord in which the schwannoma (30.1%) was the most common type, followed by the meningioma (20.6%).

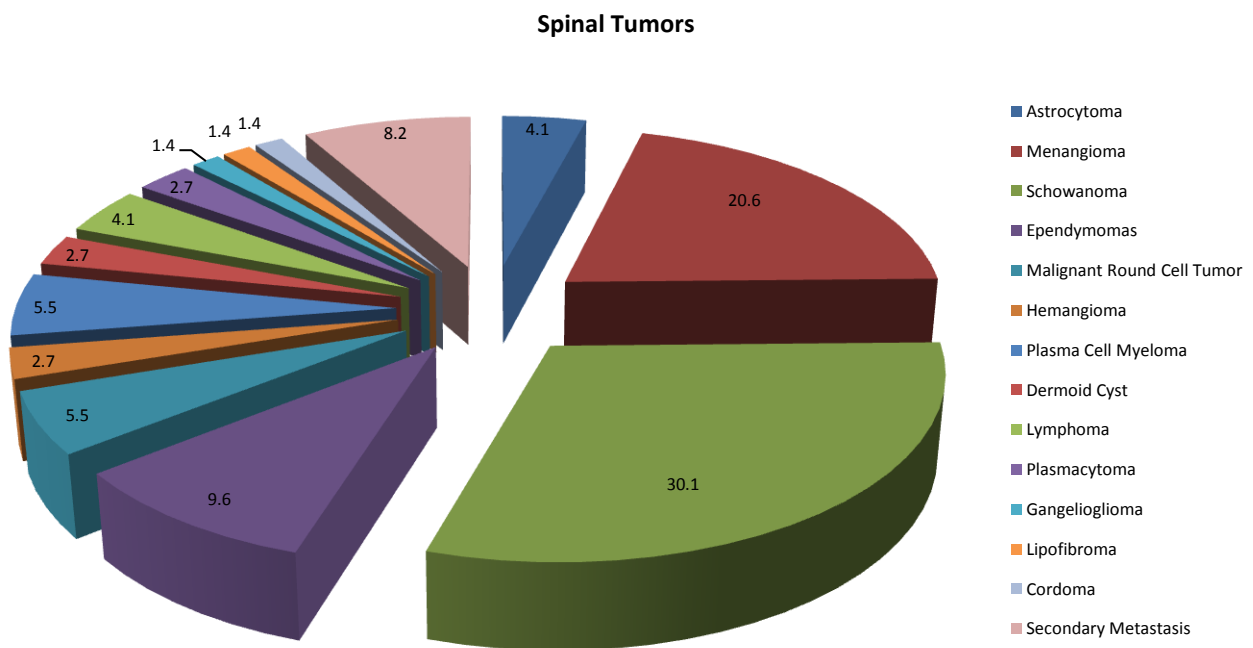
The thoracic region was the most affected region by spinal cord tumors (41.1%). Of the total cases, 8.2% of samples were metastatic tumors of the spinal cord.

**Table 1.** The frequency of CNS tumors according to histology, location, decades of involvement and sex

	Total Prevalence		Most Prevalent Site of Involvement			Sex			
			Brain	Spinal Cord	Age (decade)	Male		Female	
	n	%				N	%	N	%
<b>Astrocytoma</b>	104	28.5	Frontal/ Parietal/ Occipital/ Posterior Fossa	Thoracic	5 <sup>th</sup> -6 <sup>th</sup>	30	30.3	69	69.7
<b>Menangioma</b>	99	27.1	Frontal/Parietal/ Occipital/Temporal/ Posterior Fossa	Cervical	2 <sup>nd</sup>	58	55.8	46	44.2
<b>Schowanoma</b>	35	9.6	CP. Angle	Cervical	5 <sup>th</sup>	20	57.1	15	42.9
<b>Pituitary Adenoma</b>	23	6.3	Pituitary Gland	-	5 <sup>th</sup>	10	43.5	13	56.5
<b>Ependymomas</b>	11	3.0	Ventricles	Lumbar	1 <sup>st</sup>	4	36.4	7	63.6
<b>Medulloblastoma</b>	10	2.7	Cerebellum	-	1 <sup>st</sup>	8	80	2	20
<b>Malignant Round Cell Tumor</b>	8	2.1	Cerebellum	Thoracic	7 <sup>th</sup>	5	62.5	3	37.5
<b>Oligodendroglioma</b>	7	1.9	Frontal/Parietal	-	4 <sup>th</sup>	3	42.9	4	57.1
<b>Hemangioblastoma</b>	7	1.9	Cerebellum	-	3 <sup>rd</sup>	4	57.1	3	42.9
<b>Hemangioma</b>	7	1.9	Cerebellum	Thoracic/Lumbar	3 <sup>rd</sup>	4	57.1	3	42.9
<b>Plasma Cell Myeloma</b>	6	1.6	Temporal/Parietal	Thoracic	4 <sup>th</sup> & 6 <sup>th</sup>	4	66.7	2	33.3
<b>Hemangioperisitoma</b>	5	1.3	Cerebellum	-	4 <sup>th</sup>	1	20	4	80
<b>Dermoid Cyst</b>	4	1.3	Sella Turcica	Sacral/ Cauda Equina	3 <sup>rd</sup>	3	75	1	25
<b>Lymphoma</b>	4	1.3	Frontal	Thoracic	4 <sup>th</sup> -7 <sup>th</sup>	4	100	-	-
<b>Astrocytoma Pilocytic</b>	3	0.8	Fronto-Parietal/Posterior fossa	-	2 <sup>nd</sup>	1	33.3	2	66.7
<b>PNET</b>	3	0.8	Cranial	-	1 <sup>st</sup>	1	33.3	2	66.7
<b>Craniopharengioma</b>	3	0.8	Supra-Sella	-	6 <sup>th</sup>	-	-	3	100
<b>Mixed Glioma</b>	2	0.5	Frontal/Parietal	-	3 <sup>rd</sup> -6 <sup>th</sup>	1	50	1	50
<b>Glioneuroma</b>	2	0.5	Optic Nerve	-	1 <sup>st</sup> -2 <sup>nd</sup>	2	100	-	-
<b>Plasmacytoma</b>	2	0.5	-	Thoracic	6 <sup>th</sup> -7 <sup>th</sup>	2	100	-	-
<b>Ganglioglioma</b>	1	0.3	-	Conus Medullaris	2 <sup>nd</sup>	-	-	1	100
<b>Pleomorphic Xantocytoma</b>	1	0.3	Temporal	-	5 <sup>th</sup>	1	100	-	-
<b>Choroid Plexus Carcinoma</b>	1	0.3	CP. Angel	-	2 <sup>nd</sup>	-	-	1	100
<b>Lipofibroma</b>	1	0.3	-	Sacral	1 <sup>st</sup>	-	-	1	100
<b>Courdoma</b>	1	0.3	-	Thoracic	3 <sup>rd</sup>	1	100	-	-
<b>Nuroblastoma</b>	1	0.3	-	-	1 <sup>st</sup>	1	100	-	-
<b>Secondary Metastasis</b>	14	3.8	Frontal/Parietal Lobe	Thoracic	5 <sup>th</sup> -7 <sup>th</sup>	8	57.1	6	42.9
<b>Total</b>	365	100							



**Diagram 1:** The frequency of CNS tumors in brain according to histology (all data are represented in percent %)



**Diagram 2:** The frequency of CNS tumors in spinal cord according to histology (all data are represented in percent %)

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## Discussion

In the present study, the proportion of brain to spinal cord tumors occurrences was of a 4:1 ratio. This was different from studies performed in other geographic regions. For example, a Chinese study reported an 8:1 ratio, and (Croatia) reported a 9:1 ratio (12, 13). Based on histological type, the results of this study showed that meningiomas and astrocytomas were the most common tumors of brain.

The relative frequency of meningioma in the present study was 27.1% which was similar to the 26% frequency rate found in the entire country of Iran (5). The frequency rate in the Central Tumor Registry Center of the U.S. was 24% and the cities of Zagreb and Labin in Croatia reported frequency rates of 23.5% and 15.5%, respectively (10, 12). The prevalence of meningioma is not significantly different from other studies except the study in Labin, Croatia. Additional recognition must be made for the use of radiotherapy treatment for tinea and ringworm in childhood which could have accounted for higher ratios of meningiomas in this country (5).

In the present study, 3.8% of the cases were metastatic tumors, a result that differed from similar previous studies. In several other studies in various countries, a higher prevalence of metastatic tumors has been reported than in this study (7, 12). It is feasible that the difference in the frequency of most common cancers involving the Iranian population, particularly in northern Iran, when compared to the populations of other countries or regions, is a primary cause for the difference observed in metastatic tumors rates. Lung cancers, the most common cancers in the world, and breast malignancies, the most common malignancies among females, are less prevalent in Iran in general when

compared with global statistics (13-15). This could explain the higher rates of metastatic tumors from other studies, since the most common metastatic neoplasms in the brain are lung, melanoma, renal cell cancer, breast and colorectal neoplasms, respectively (16-18).

In most studies, CNS tumors are observed more commonly in males than females (10, 11). However, the present study showed a slightly higher frequency of CNS tumors in the female population. In the studies by Lee performed in South Korea, and Elia-Pasquet et al. performed in the southwest region of France, the high prevalence of meningioma and pituitary adenoma in females was attributed to the higher rates in general of CNS tumors in that gender (19, 20). Baldi et al. also reported an increased incidence of CNS tumors in women and suggest that gender-related factors such as the use of oral contraception, hormone replacement therapy and sterility treatments, which also increases the use of hormones in women, could be factors accounting for the higher incident rate of these tumors among females (21). It should be noted that farming is the main occupation in the Guilan province, therefore exposure to chemicals such as pesticides, herbicides and fungicides, which previously have been linked to brain tumors, could be another explanation for high frequency of CNS tumors among the Guilanian women, who are more involved in and exposed to the agricultural lands than the men of this region (22-26). In this study, the frequency of astrocytomas and schwannomas was higher in males, whereas meningiomas, pituitary adenomas and ependymomas were higher in females. These results support the findings of previous studies that showed a higher frequency of astrocytomas among males and a higher frequency of meningiomas among females (5, 10, 19, 20). Dobec Meic et



al. reported higher frequency of schwannomas in females and Surawicz and Materljan et al. demonstrated higher frequency of pituitary adenomas in females (7, 10, 12). Additional studies have reported a preponderance of pituitary adenomas or schwannomas in females over males (5, 7, 4). However, Zalata et al. demonstrated equal frequency of schwannomas in both gender (5). Most studies have demonstrated a higher prevalence of CNS tumors in older populations (6, 7, 11, 20). The results of this study showed that brain and spinal cord tumors occurred most commonly in the 5<sup>th</sup> and 6<sup>th</sup> decade of life, respectively. This can be due to the cumulative exposure to tumorigenic factors thought-out life. Pasquet et al. showed an increased trend in the prevalence of CNS tumors from the 3<sup>th</sup> decade (3.7 people out of 100,000) to the 8<sup>th</sup> decade (33.4 people out of 100,000) of life (20).

There is a different age-frequency distribution of CNS tumors based on histological types; however this finding in the present study was still similar to most of the literature reports (6, 7, 12, 27). Specifically, medulloblastomas occurred most commonly in the first decade of life and glioblastomas and meningiomas appeared in the last decades of life. The present study findings differ from previous studies, which have reported a higher prevalence of astrocytomas in the 5<sup>th</sup> and 6<sup>th</sup> decades of life (7, 10, 12). In this study, astrocytomas were more frequent in the 2<sup>nd</sup> decade of life. Additionally, the mean overall age at diagnosis of a spinal cord tumor as reported by Materljan in Croatia was 49.6 years. This was slightly higher than the mean age at diagnosis of 44.6 years in our study (12).

The present study did encounter some limitations. The design of this study was a

retrospective review and was dependent upon the documents of the participating facilities. Thus, this study only included those patients who underwent surgery during a 10 year period. Furthermore, changes in diagnostic methods during the study period (such as use of immunohistochemical staining) could have affected this study's results and introduced bias.

## Conclusion

This study demonstrated a high frequency of CNS tumors with astrocytic origin, including astrocytomas, pilocyticastrocytomas and meningiomas. The most common tumors were astrocytomas and meningiomas respectively. Metastatic or secondary tumors are less frequent than the other CNS malignancies. The frequency of CNS tumors was higher in females than males and was most frequent in the 5<sup>th</sup> decade of life.

## Conflict of Interest

No conflict of interest.

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