RESEARCH COMMUNICATION

Epidemiology of Primary Intracranial Tumors in Iran, 1978-2003

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Abstract

The pattern of primary brain tumors have not been reported in Iran and the etiology remains largely unknown. The need for current estimation of geographical and secular variation is clear. The purpose of this study was to review cases of brain tumors treated in Shariatti hospital, a neurosurgical center, over the twenty five years from 1978 to 2003. A descriptive, retrospective study was made of 3437cases who were hospitalized with brain tumors. Data abstracted from the patients' clinical records included age at the time of admission , sex, histological diagnosis and tumor location. The frequency distribution of brain tumors by age and sex, and histology was calculated for comparison with the literature. There is a preponderance of males over females, the overall ratio of male/female cases was 55.4% to 44.6% (P< 0.05). The average age of the patients at the diagnosis was 33.9 years (SD = 18.1) with a median of 34 years and a ranged from 1 to 95 years. The mean age did not significantly differ between the genders. Of recorded series cases, 20.1% brain tumors occurred in children 15 years and younger, with a mean ± sd of 8.7 ± 3.9 years, and 79.9 % of cases in adults with the mean ± sd of 40.2 ± 14.4. The five most common histological types in both sexes were meningioma in 892 cases (26%) followed by astrocytoma in 805 cases (23.4%), pituitary adenoma in 488 cases (14.2%), glioblasomaoma in 278 cases (5.1%) and ependymoma in 166 cases (4.8%). These accounted for 84 % of all brain tumors . The 10 most frequent brain tumors were ranked separately by sex and age groups. Male predominance was observed for the astrocytoma group, craniopharyngiomas, ependymomas, glioblastomas, medulloblastomas, and pituitary adenomas. Meningiomas were the only tumors with a significant excess in females (p< 0.05) - some 28% of cases occurred in patients younger than 20 years of age; 45% cases 21- 45 years of age; 25% cases 46-65 years of age, and 2% cases in patients older than 65 years of age. In conclusion, the results present an important epidemiological basis for understanding of the brain tumor burden in Iran. Wider epidemiological studies of a prospective nature are now required.

Key Words: Epidemiology - brain tumors - meningiomas - astrocytomas

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Introduction

Primary malignant brain tumors account for 2% of all Cancers in humans and 2% of all cancers in children (Greenwald et al., 1983). They are the leading cause of cancer death among children and the second most common type of pediatric cancer after leukemia (Baldwin et al., 2004).

Brain tumors have been the subject of controversy both with respect to patterns of occurrence and to potential causes (Duvin et al., 1999). Little is known about risk factors or causative agents for brain tumors. The etiology thus continues to be largely unknown despite decades of epidemiologic investigation. In recent decades, the incidence of and mortality from brain tumors has increased, particularly in adults (Greenwald et al., 1983). It is a matter of considerable debate whether this increase is an etiologic phenomenon or the result of alterations in diagnostic and reporting patterns (Kaiser, 1999).

The mortality from brain tumors vary from a low of 0.7-2.3 per 100,000 in Mexico, Chile, Poland, and Japan to a high of 6.8 per 100,000,in Israel. The mortality rates of Japanese migrants to the United States almost correspond to those for U.S whites (4.7/100000 in males and 3.4 /100000 in females). The international differences in the frequency of brain tumors suggest a role for environmental factors in their etiology (Greenwald et al., 1983).

It is estimated that about 50,800 new cancer cases occur in Iran each year (Sadjadi et al., 2005). Among them more than 53% belong to males with age standardized incidence rate of 116.8 and 93.1 per 100,000 in males and females, respectively. Among all cancer types, 3.67% belong to brain and nervous system in both sexes. Some 4% of all deaths

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due to cancer cases in both sexes in country are due to malignant brain tumors (Sadjadi et al., 2005).

The pattern of primary brain tumors has not been previously reported in Iran and the etiology remains largely unknown. To determine the rates following the same pattern described in Western and far Eastern countries, we analyzed the data compiled from patients with brain tumors operated in our Department of Neurosurgery between 1978-2003. The objective was to determine the histopathological pattern of intracranial tumors and to determine the frequency distribution of different brain tumors among Iranian patients admitted in our hospital, and their demographic status over a period of 25 years. All patients entered into this study had pathologically proven brain tumors.

Materials and Methods

From the hospital records, a descriptive, retrospective study was made of 3,437cases with tumors of brain who were admitted at the Shariatti hospital neurosurgical center between 1978 and 2003. Data abstracted from the patients' clinical records included age at the time of admission to hospital, sex, histological diagnosis of the tumors, and tumor locations. The frequency distribution of brain tumors by age and sex, and histology was calculated. For age, the mean, standard deviation, quartiles and 95% confidence intervals were presented. T-test and Chi-squared tests with $p< 0.05$ were used, depending on the variable to be analyzed, using the SSPS statistical package. Demography and the histopathological data of primary brain tumors of all the patients were reviewed and the results were compared to the data of the literature.

Results

Between 1978 and 2003, 3,437 new cases of primary intracranial neoplasm's were diagnosed and /or treated at Shariati Hospital Medical center of Tehran University of Medical Sciences, averaging 138 cases per year. An analysis of total series resulted in the general conclusion that were not equally distributed between males and females (see Tables 1 and 2). There is a preponderance in males (1,904) over females (1,533), the overall ratios of male/female cases being 55.4% to 44.6% ($P<0.05$). The average age of the patients at the diagnosis was 33.9 years (SD = 18.1) with a median of 34 years and a range from 1 to 95 years. The mean age did not significantly differ between the sexes. Some 20.1% (633) brain tumors occurred in children 15 years and younger with the mean $\pm$ sd age of 8.7 $\pm$ 3.9 years, and 79.9 % (2,526) of cases in adults with the mean $\pm$ sd age of 40.2 $\pm$ 14.42 years. There was a significance difference in adults compared to under 15 years old ($P<.05$). Of recorded cases, 8 % (n=284) were classified as "unknown age", of which 56 % (160) were in males and 47% (124) in females.

Frequency distribution of different types of brain tumors by sex and age (under 15 years, above 15 years) are presented in Table 2. The five most common histological types in both sexes among patients were meningioma in 892 cases (26%) followed by astrocytoma in 805 (23.4%), pituitary adenoma in 488 (14.2%), glioblastoma in 278 (5.1%) and ependymoma in 166 (4.8%). These accounted for 84 % of all brain tumors . The less common tumors included oligodendroglioma in 27 patients (0.8%), teratoma in 15 (0.4%), cavernoma in 13 (0.4%), ganglioma in 13 (0.4%), neuroblastoma in 8 (0.2%), and teratocarcinoma in 2 (0.1%).

The 10 most frequent brain tumor sites were ranked separately for males and females and are presented in Table 3. There were 1904 brain tumor cases in males, with the ten most common cancers being: astrocytoma (31.2%) followed by meningioma (19.7%) pituitary adenoma (17.5), schwannoma (9.5%) glioblasomaoma (5.5%),

Table 1. Mean, Median, Standard Deviation (sd) and Quartiles of Patient Ages (Years)- Total

95% CI*	P75*	Median	P25*	Mean $\pm$ sd	Number	Tumor type
(25.8-27.0)	40	24	12	27$\pm$17.2	747	ASTROCYTOMA
(49.8-60.0)	60	55	47	54.9$\pm$8.4	13	CAVERNOMA
(30.4-41.8)	49	34	22	36.8$\pm$16.8	36	CHORDOMA
(18.9-24.4)	32	16	9	21.7$\pm$15.6	123	CRANIOPHARYNGIOMA
(16.1-20.5)	25	17	8	18.3$\pm$13.2	143	EPENDYMOMA
(14.1-34.9)	38	22	9	24.5$\pm$15.5	11	GANGLIOMA
(39.9-45.9)	60	47	31	42.9$\pm$19.2	162	GLIOBLASTOMA
(33.5-42.5)	50	36	28	37.9$\pm$13.5	37	HEMANGIOBLASTOMA
(23.1-35.5)	40	29	12	29.3$\pm$18.5	37	HEMANGIOMA
(29.9-37.1)	51	27	15	33.5$\pm$21.1	136	LYMPHOMA
(10.7-13.8)	15	11	6	12.3$\pm$9.4	145	MEDULLOBLASTOMA
(42.9-44.9)	54	45	35	43.9$\pm$14.7	821	MENINGIOMA
(-2.2-19.7)	15	8	2	8.7$\pm$6.8	4	NEUROBLASTOMA
(40.5-48.3)	54	45	35	44.4$\pm$9.6	26	OLIGODENDROGLIOMA
(35.6-38.0)	46	35	26	36.8$\pm$13.1	448	PITUITARY ADENOMA
(35.2-38.9)	50	35	25	37.1$\pm$15.4	255	SCHWANNOMA
(-77 - 112)		17	10	17.5$\pm$10.6	2	TERATOCARCINOMA
(6.3-17.7)	19	10	10	12$\pm$6.1	7	TERATOMA
(33.3-34.5)	48	34	19	33.9$\pm$18.1	3153	Total

Table 2. Mean, Median, Standard Deviation (sd) and Quartiles of Patient Ages (Years)- Males

95% CI*	P75*	Median	P25*	Mean ± sd	Number	Tumor type
MALES:						
(27.2-30.1)	41	26	14	28.7±17.7	445	ASTROCYTOMA
(45.4-66.9)	.	59	52	56.1±9.9	8	CAVERNOMA
(30.7-42.9)	50	36	26	36.8±14.9	25	CHORDOMA
(19.4-25.9)	37	18	9	22.6±16.2	87	CRANIOPHARYNGIOMA
(16.3-23.1)	25	18	9	19.7±14.2	81	EPENDYMOMA
(12.6-37.4)	.	32	13	25±15.6	6	GANGLIOMA
(41.8-47.7)	60	50	33	44.8±18.8	108	GLIOBLASTOMA
(31.3-43.7)	52	39	28	37.6±13.4	24	HEMANGIOBLASTOMA
(23.3-38.0)	58	35	13	30.6±19.5	17	HEMANGIOMA
(28.5-35.3)	52	25	13	31.9±21.5	79	LYMPHOMA
(9.3-15.6)	15	11	7	12.4±9.3	95	MEDULLOBLASTOMA
(41.4-44.6)	55	44	32	42.9±16.7	357	MENINGIOMA
(-9.5- 25.5)	.	.	3	8±8.2	3	NEUROBLASTOMA
(36.0-51.2)	54	48	35	43.6±10.2	16	OLIGODENDROGLIOMA
(36.5-40.3)	50	35	28	38.4±13.5	257	PITUITARY ADENOMA
(34.5-39.9)	50	34	25	37.2±16.2	130	SCHWANNOMA
	10	10	10	10	1	TERATOCARCINOMA***
(0.0- 30.5)	.	20	11	15.2±5.6	4	TERATOMA
(32.8-34.5)	48	33	18	33.6±18.6	1744	Total
FEMALES:						
(22.9-26.5)	36	22	11	24.7±16.2**	302	ASTROCYTOMA
(39.4-66.6)	.	58	50	53±5.8	5	CAVERNOMA
(25.4-43.7)	65	42	18	34.5±21.1	11	CHORDOMA
(14.2-24.3)	25	15	10	19.3±13.8	36	CRANIOPHARYNGIOMA
(12.5-20.2)	25	16	5	16.4±11.7	62	EPENDYMOMA
(10.4-37.6)	.	35	9	24±17.1	5	GANGLIOMA
(35.0-43.3)	57	43	28	39.1±19.7	54	GLIOBLASTOMA
(30.3-47.2)	61	36	30	38.8±14.2	13	HEMANGIOBLASTOMA
(21.3-34.9)	51	30	12	28.1±18.1	20	HEMANGIOMA
(31.7-39.8)	54	39	17	35.7±20.6	57	LYMPHOMA
(7.7 - 16.3)	15	9	5	11.9±9.8	50	MEDULLOBLASTOMA
(43.2-46.0)	53	45	37	44.6±12.9	463	MENINGIOMA
	11	11	11	11±.	1	NEUROBLASTOMA***
(36.0-55.2)	58	47	37	45.6±9.2	10	OLIGODENDROGLIOMA
(32.5-36.9)	44	34	25	34.7±12.3**	191	PITUITARY ADENOMA
(34.3-39.7)	50	37	25	36.9±14.6	125	SCHWANNOMA
	25	25	25	25±.	1	TERATOCARCINOMA***
(-9.9 -25.2)	.	.	5	7.7±4	3	TERATOMA
(33.3-35.1)	48	35	20	34.2±17.5	1409	Total

*P25=25th percentile; P75=75th percentile; CI=Confidence Interval. ** p<0.05 compared to males. *** only one case observed

medulloblastoma (4.0), ependymoma (3.1%), craniopharingioma (2.7%), lymphoma (1.4%), and chordoma (1.3%). As for the female brain tumors , a total of 1s533 were observed with the ten most frequent brain tumors being: meningioma (32.7%), astrocytoma (20.9%), pituitary adenoma (13.6%), Schwannoma (8.9%), ependymoma (4.4%), lymphoma (4.0), glioblasomaoma (3.8%), eedulloblastoma (3.5%),

A significant ($p<0.05$), male predominance was observed in the astrocytoma group (male/female ratio of 1.51), craniopharyngiomas (2.42), ependymomas (1.44), glioblastomas (2.00), medulloblastomas (1.85), and pituitary adenomas (1.34). The meningioma was the only tumor with a significant excess in females ($p< 0.05$). Sex differences in occurrence were not observed for teratocarcinomas, chordomas, gangliomas, hemangiomas, hemangioblastomas, lymphomas, neuroblastomas, oligodendrogiomas and schwannomas (Table 3).

The 10 most frequent brain tumors were ranked separately for adults (>15 years old) and children, males and females (see Table 4). When the data were examined for age differences, 871cases (28%) occurred in patients younger than 20 years of age; 1,407cases (45%) 21-45 years of age; 782 cases (25%) 46-65 years of age, and 93 cases (2%) in patients older than 65 years of age. Table 5 shows the frequency of patients with brain tumor types with age in both sexes.

Table 1 indicates that patients with brain tumors of the Neuroblastoma were the youngest with a mean age of 8.7±6.8. 100% of these patients were under 20 years old.

Table 3. Frequency Distribution (%)of Different Types of Brain Tumors by Sex and Age

Age		Gender		Total		Tumor types
Above 15 year n=2520	Under 15 year n=633	Female n=1533	Male n=1904	%	Number	
66.5**	33.5	39.9*	60.1	23.4	805	ASTROCYTOMA
100**	0	38.5	61.5	0.4	13	CAVERNOMA
91.7**	8.3	29.7*	70.3	1.07	37	CHORDOMA
55.3	44.7	29.7*	70.3	3.7	128	CRANIOPHARYNGIOMA
54.5	45.5	41*	59	4.8	166	EPENDYMOMA
63.6	36.4	38.5	61.5	0.4	13	GANGLIOMA
85.2**	14.8	33.3*	66.7	5.1	177	GLIOBLASTOMA
94.6**	5.4	35.9	64.1	1.1	39	HEMANGIOBLASTOMA
67.6**	32.4	59.2	40.8	1.4	49	HEMANGIOMA
74.3**	25.7	41.8	58.2	4.2	146	LYMPHOMA
21.4**	78.6	35.1*	64.9	4.5	154	MEDULLOBLASTOMA
95.6**	4.4	56.3*	43.7	26	892	MENINGIOMA
25.0	75	50	50	0.2	8	NEUROBLASTOMA
100**	0	40.7	59.3	0.8	27	OLIGODENDROGLIOMA
98.2**	1.8	42.8*	57.2	14.2	488	PITUITARY ADENOMA
93.7**	6.3	48.9	51.1	8.1	278	SCHWANNOMA
50.0	50	50	50	0.1	2	TERATOCARCINOMA
28.6	71.4	33.3	66.7	0.4	15	TERATOMA
79.9**	20.1	44.6*	55.4	100	3437	Total

*significant as compared to males. ** significant as compared to >15 years old

The mean age of male patients was less than that of female. The average age of female patients with Astrocytoma and Pituitary Adenoma was significantly lower than those of males ($P< 0.05$). No significant difference between the mean ages of two sexes was seen in other brain tumor types. Men with glioblastoma had the highest mean age (44.8 ± 18.8) while among women; patients with meningioma with a mean age of (44.6 ± 12.9) were the oldest.

Table 4. 10 Most Frequent Brain Tumor Types by Sex and Age

Most Tumor types by sex			
Female (%) n=1533	Tumor type	Male (%) n=1904	Tumor type
32.7	MENINGIOMA	31.2	ASTROCYTOMA
20.9	ASTROCYTOMA	19.7	MENINGIOMA
13.6	PITUITARY ADENOMA	17.5	PITUITARY ADENOMA
8.9	SCHWANNOMA	9.5	SCHWANNOMA
4.4	EPENDYMOMA	5.5	GLIOBLASTOMA
4.0	LYMPHOMA	4.0	MEDULLOBLASTOMA
3.8	GLIOBLASTOMA	3.1	EPENDYMOMA
3.5	MEDULLOBLASTOMA	2.7	CRANIOPHARYNGIOMA
2.5	CRANIOPHARYNGIOMA	1.4	LYMPHOMA
1.9	HEMANGIOMA	1.3	CHORDOMA
3.6	Others	4.8	Others
Most Tumor types by age (under and above15 years)			
Above 15 (%) year n=2520	Tumor type	Under 15 year (%) n=633	Tumor type
31.2	MENINGIOMA	39.5	ASTROCYTOMA
19.7	ASTROCYTOMA	18.0	MEDULLOBLASTOMA
17.5	PITUITARY ADENOMA	10.3	EPENDYMOMA
9.5	SCHWANNOMA	8.7	CRANIOPHARYNGIOMA
5.5	GLIOBLASTOMA	5.7	MENINGIOMA
4.0	LYMPHOMA	5.5	LYMPHOMA
3.1	EPENDYMOMA	3.8	GLIOBLASTOMA
2.7	CRANIOPHARYNGIOMA	2.5	SCHWANNOMA
1.4	HEMANGIOBLASTOMA	1.9	HEMANGIOBLASTOMA
1.3	CHORDOMA	1.3	PITUITARY ADENOMA
4.6	Others	2.9	Others

Table 5. Distribution of Different Tumor Types by Age Group (% data)

Age group					
>=66 (%)	46-65 (%)	21-45 (%)	1-20 (%)	Number	Tumor type
1.6	13.9	42.4	42	747	ASTROCYTOMA
7.7	69.2	23.1	0	13	CAVERNOMA
2.8	27.8	50	19.4	36	CHORDOMA
0	9.8	26.8	63.4	123	CRANIOPHARYNGIOMA
0.7	2.8	35	61.5	143	EPENDYMOMA
0	18.2	36.4	45.5	11	GANGLIOMA
3.7	46.9	30.9	18.5	162	GLIOBLASTOMA
0	29.7	59.5	10.8	37	HEMANGIOBLASTOMA
2.7	16.2	37.8	43.2	37	HEMANGIOMA
6.6	28.7	26.5	38.2	136	LYMPHOMA
0	0.7	10.3	89	145	MEDULLOBLASTOMA
5.7	39.2	47.3	7.8	821	MENINGIOMA
0	0	0	100	4	NEUROBLASTOMA
0	50	50	0	26	OLIGODENDROGLIOMA
1.8	23.7	65.6	8.9	448	PITUITARY ADENOMA
2.7	26.3	58	12.9	255	SCHWANNOMA
0	0	50	50	2	TERATOCARCINOMA
0	0	14.3	85.7	7	TERATOMA
2.9	24.8	44.6	27.6	3153	Total

Discussion

A series of 3157 pathologically verified intracranial tumors was analyzed for relative frequency and types of tumors as well as the distribution of age and sex. These data were compared to series from the countries of the region such as Pakistan, Syria, and countries in West. The results showed that tumors of the Meningioma, Astrocytoma, pituitary adenoma, Schwannoma and Glioblasomaoma account for more than two thirds (77%) of all admitted cases with brain tumors. Other study also demonstrated that the most frequently reported histologies were Meningioma (24%) and Glioblastoma (22.6%), (Surwicz et al., 1999).

Sex distribution and the discovery of a clear sex predilection of certain tumor types have proved to be particularly significant (Kalus et al., 1986). An analysis of our total series has resulted in the general conclusion that there is a preponderance of males over females (55.4% to 44.6%), which correspondons to results previously mentioned in the literatures (Kadri et al., 2005, Surwicz et al., 1999, Cheang CM, et al 1997, Kalus et al., 1986). Male predominance was found in a selected group of tumor cases (Kalus et al., 1986, Surwicz et al., 1999, Kadri et al., 2005) According to the present study, for most tumors, male predominance is noted except for Meningioma and Hemangioma. About 33% of all female cases of the histologically verified intracranial tumors were Meningioma, but only 20% among the males. Meningioma seems to have a relationship to sex hormones (Batchelor 2005.). General speaking in our study, male predominancy is comparable to other studies.

It was a special interest that this general sex preponderance of patients with a given tumor was even more pronounced in a particular decades of life. The study showed that among the Meningiomas, males were more frequently affected at ratio of 1.25 within the first two decades of life, whereas after the age of 20 the proportions were reversed and more women were affected. According to the present study, meningiomas with 26.0% were the first most common brain tumors among patients in our study population accounting for more than one fourth of all brain tumors. It was the first most common brain tumors in females and the second in males. Meningioma was here found to be high in comparison to the worlds (Souhami et al., 2002, Raghavan et al., 1999) that make up nearly 20% of all primary brain tumors. The relative frequency is slightly higher compared to the Westernize countries such as US, 24.0% (Surwicz et al., 1999). Discrepancies were found in the percentage of meningiomas, Ameli et al (1979) reporting 29% amongst 1500 intracranial tumors in Iran. Mortazavi (1999) found 6.0% in 857 CNS cases. The high rate of meningioma in Iran might be related to radiotherapy for ringworm in childhood. Astrocytoma, 23.4%, the second most frequent cancer among patients in this study was also common in earlier reports (26-38%) (Mortazavi et al. 1999; Mohagheghi 2002).

Pituitary tumors make up nearly 10% of all brain tumors (Souhami et al., 2002, Raghavan et al., 1999). At present study, Pituitary tumors account for approximately 14% of all primary intracranial tumors; 17.5% of in men and 13.7 in women mainly in the child-bearing years due to increased frequency of prolactine in that period of life. This relative frequency of pituitary adenoma is relatively comparable to the Western countries, 15% (Batchelor2005). Medulloblastoma, was the second most common brain tumors among Iranian patients under 15 years of age (sex ratio:1.5). The fact that this tumor occurs at a much younger age in males suggest the presence of a genetic predisposition in some patients with this disease (Preston-Martin et al., 1993). Craniopharyngioma was more frequent in males than females (P<.05) in our study, while in another study did not vary by gender (Bunin et al., 1998).

Some intracranial tumors occur at all ages, others develop preferentially or sometimes even exclusively in childhood and adult and their pathology will differ. The comparison of the 3,451 tumors in childhood (under 15) and adult (above 15), and also in particular age groups gave support to the above cited concept that the spectrum of pathology in this age group was distinctive. The frequency rate of children brain tumors in the country of the region such as Syria, Pakistan and the rate in Westernize countries is somehow different. The most common tumor found in Syria's' children was medulloblastoma (27.5%), followed by astrocytoma 25.8%), then craniopharyngioma (14.1%) (Kadri et al., 2005). Our data are similar to those reported from the neighboring countries, such as Lahore Pakistan (Hanif et al., 2004) in which astrocytomas 44.8% were the commonest of all brain tumors followed by medulloblastoma 15.5% and ependymoma, 10.3%. In Spain (Sardina et al., 1999), the predominant histological types were medulloblastoma

(33.9%) and astrocytoma (19.6%).

Certain tumor types show a prediction for certain decades of life (Kalus et al., 1986). At present study, approximately half of the brain tumors occurred at 21-45 years of age, with the overall ratio of female/male cases, 46.3% to 43.2%. Authors noted 20% tumors in children up to 15 years, and our rates were generally comparable to another study (Kalus et al., 1986).

In conclusion, the present results of our study present an important epidemiological understanding of patients with brain tumors. It emphasize that gender plays an important role in the frequency of primary intracranial tumors. Primary brain tumors had preponderance in the male sex. We emphasized, how much the ratio of the two sexes varies in some series of tumors. We noted that certain tumor types show a prediction for the certain decades of life in our study population. The frequency and distribution of tumors were somehow different than those reported by authors from the Western and Far Eastern countries. Whether these results are unique to Iran, or reflect a regional difference in the disease distribution between the Middle East region and the rest of the world, remain to be determined. The difference in frequency may be attributed to the role of environmental exposures such as Ionizing radiation, N- nitro's compounds, pesticides, tobacco, electromagnetic features, infections, trauma, parental occupation, medications, gene-environment interactions, genetic factors and also due to the young population of country with 39.5% of under 14 yrs. With half of the population being under the age of 20 years, a large number of brain tumors (25%) were observed in the 0-14 years age group (Statistical Center of Iran 2002).

Although the present study was a retrospective hospital-based review rather than a prospective population study, Shariati hospital was a referral center for neurosurgical services for the period of this study. The data provide a baseline for further evaluation. As the etiology remains unknown in Iran, there is a need for ongoing estimation of geographical and secular variation, demanding closer cooperation between medical staff and cancer registries. Prospective regional studies of incidence patterns and up-to -date epidemiological appraisal are clearly necessary. The results presented here provide encouragment for further, larger and more detailed epidemiological studies of a more prospective nature.

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