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Malignant Tumours of the Brain and Spinal Cord in Bahrain: Patterns of Incidence over a Fifty-Two Year Period

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Objective: To review malignant neoplasms of the brain and spinal cord in Bahrain, and to compare the incidence with other parts of the world.

Design: A retrospective study

Setting: All Histopathology Departments in Bahrain

Method: Data relating to all malignant CNS neoplasms which were diagnosed histologically in Bahrain were extracted from the relevant patient medical records. All tumors were histologically diagnosed in Bahrain between 1952 and 2004.

Results: There were 103 malignant CNS tumors representing 1.4% of all malignancies histologically reported during the same period. Of the 103 patients, 77 (74.8%) were Bahraini. Of the Bahraini patients, thirty-one (40.3%) were female and the male: female ratio was 1.48:1. Sixty-two of the 77 Bahraini tumors (80.5%) were primary brain tumors, nine (11.7%) were primary spinal cord tumors, and six (7.8%) were secondary tumors. Astrocytoma and medulloblastoma were the commonest primary malignant CNS neoplasms in both adults and children.

Conclusion: The apparent incidence of malignant brain and spinal cord neoplasms in Bahrain is very low. The small Bahraini population, inefficient registration of cancers, and the lack of routine hospital autopsies are contributory factors for the low numbers observed.

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In North America and North West Europe primary malignant CNS neoplasms account for approximately 2% of all cancers[1], and approximately 20% of all cancers in the pediatric age group (under 15 years)[2]. Most primary CNS neoplasms are neuroepithelial (Table 1) although a broad range of histogenesis is represented including mixed forms. The proportion of CNS neoplasms that have metastasized from other sites varies greatly between studies (14-40%)[3]. Unfortunately, many epidemiological studies are confounded by selection bias conferred by sole reliance on tertiary referral centres.

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In the present study we have attempted to outline the general epidemiological features of malignant CNS neoplasms within the Kingdom of Bahrain, using data from 1952 to 2004. This is entirely a histopathological study in which the identification and classification of specific tumor types was based on the microscopic features of the biopsied or neurosurgically resected tumors. The clinical and radiological characteristics were not studied.

This is the first thorough study that describes the salient epidemiological characteristics of malignant CNS neoplasms in Bahrain.

METHODS

Data relating to all malignant CNS neoplasms which were diagnosed histologically in Bahrain between 1952 and 2004 were extracted from the relevant available patient medical records. In each case a specific diagnosis was made on the basis of histological examination after biopsy or neurosurgical resection. As far as we are aware the tumors discussed in this study represent all the malignant CNS neoplasms diagnosed in the various histopathology departments of Bahrain during that specific fifty-two year period.

All neoplasms in this study were categorized according to the classification of the World Health Organization (Table 1).

Table 1.

RESULTS

Of the 103 patients with malignant CNS neoplasms diagnosed during the fifty-two year period, 77 (74.8%) were Bahraini while 26 were non-Bahraini. All 103 cases (100%) were histologically diagnosed after biopsy or surgical resection. During the same period there were a total of 7338 malignant tumors diagnosed histologically at the three hospital centres. The CNS neoplasms (which were all malignant or at least of low malignant potential) represented 1.4% of all malignancies.

Of the 77 malignant CNS neoplasms in Bahraini patients, 62 (80.5%) were primary brain tumors, nine (11.7%) were primary spinal cord tumors, and six (7.8%) were secondary tumors (four metastatic to brain and two to spinal cord). Thirty-one of the 77 patients (40.3%) were female, of whom 26 (33.8%) had brain tumors and five (6.5%) had spinal cord tumors. Forty (51.9%) of the 46 males had brain tumors. The male: female ratio for Bahrainis was 1.48:1.

The categorization of the seventy-one malignant primary CNS tumors in Bahrainis is shown in table 2 including patient age.

Of the 62 primary brain tumors, there were 32 astrocytomas. Eighteen of these were diffuse fibrillary astrocytomas (WHO grade II), two were anaplastic astrocytomas (WHO grade III), eight were pilocytic astrocytomas (WHO grade I), and four were diagnosed as glioblastoma multiforme (WHO grade IV astrocytoma). Although a number of the astrocytomas showed focal gemistocytic features none of them contained a predominant gemistocytic astrocyte population to merit a diagnosis of

gemistocytic astrocytoma. None of the other variants of astrocytoma (protoplasmic astrocytoma, pleomorphic xanthoastrocytoma, subependymal giant cell astrocytoma) were encountered.

There was one oligodendroglioma (WHO grade II). No anaplastic oligodendrogliomas (WHO grade III) were encountered.

Two patients had ependymomas. Both of these were classic ependymomas (WHO grades I and II). Other variants – clear cell, papillary, tancytic, myxopapillary and anaplastic – were not encountered amongst the primary brain tumors.

There was one subependymoma (WHO grade I).

There were three mixed gliomas. Two of these were oligoastrocytomas (WHO grade II), while the third was an anaplastic oligoastrocytoma (WHO grade III).

There was one case of gliomatosis cerebri, characterized by widespread infiltration of the brain by small neoplastic glial cells.

None of the glioma patients appeared to have features of either Li-Fraumeni or Turcot syndromes.

There were two choroid plexus tumors. One of these was a choroid plexus carcinoma (WHO grade III) demonstrating prominent solid areas, high mitotic rate and high grade cytomorphology; and the other was an atypical choroid plexus papilloma (WHO grade II).

Twelve patients had medulloblastomas (all WHO grade IV). Nine of these were classic medulloblastomas centred on the cerebellar vermis, while three were desmoplastic medulloblastomas arising in the lateral cerebellar hemispheres. The large cell variant, medullomyoblastoma and melanotic medulloblastoma were not encountered. None of the patients appeared to have features of either Turcot or Gorlin syndromes.

There were two primitive neuroectodermal tumors (PNET = extracerebellar medulloblastoma-like tumor, WHO grade IV).

There was three haemangioblastomas (WHO grade I). The patients did not have features of Von Hippel Lindau disease.

There was one mixed germ cell tumor with teratoma and seminoma components, and one primary CNS lymphoma (non-Hodgkin's).

The final primary brain neoplasm was a malignant (epithelioid) haemangioendothelioma. There was no evidence of similar tumor outside the CNS of this patient.

Of the nine malignant primary spinal cord tumors, there was one diffuse fibrillary astrocytoma (WHO grade II), one oligodendroglioma (WHO grade II) and two oligoastrocytomas (WHO grade II). There was one myxopapillary ependymoma

(WHO grade I), one central neuroblastoma (WHO grade IV), and three primary CNS non-Hodgkin's lymphomas.

The categorization of secondary CNS neoplasms in Bahrainis is shown in table 3 including patient age data.

Table 3.

Of the four tumors metastatic to brain one was a papillary (adeno) carcinoma, one was a mucin-secreting adenocarcinoma, and there were two carcinomas – not otherwise specified. Of the two tumors metastatic to spinal cord one was a papillary (adeno) carcinoma, and the other an adenocarcinoma. Primary sites were not identified for any of the six tumors.

Table 4 shows a comparison between the distribution of malignant CNS tumors in adults and children (age < 15 yrs).

Table 4.

Although at first glance it would appear that the childhood tumor medulloblastoma was equally distributed between children and adults (six each), in fact four of the six "adult" tumors were encountered in the age group 15-19 years. Both PNETs were seen in children less than 15 years, and both choroid plexus tumors developed in children under four years. The central neuroblastoma was discovered in an infant and the mixed germ cell tumor in a twelve year-old girl. The age of the patient with myxopapillary ependymoma was not recorded.

DISCUSSION

The global incidence of malignant brain and spinal cord neoplasms is low. Furthermore, there is considerable geographical and temporal variation, the reasons for which are not well understood[4].

In Bahrain malignant CNS neoplasms account for about 1.4% of all malignancies, a figure on par with or just below that described for North America and Europe[5]. The actual number and incidence of these tumors in Bahrain is significantly lower than that observed in other parts of the world and the corresponding incidence of total malignancies of any kind is also lower[4-13].

Given that the population of Bahrain (a small island Kingdom) was estimated to be 677,886 in July 2004, the present study reveals an average incidence over the past fifty-two years of 0.29/100000/yr. The indigenous Bahraini component of the population number 442,778, and for this majority group the incidence of malignant CNS neoplasms is 0.33/100000/yr. From 1952 to 1986 only seven CNS neoplasms were encountered, and therefore the apparent incidence of these tumors significantly increased in the eighteen years after 1986 – a greater percentage were successfully detected[14].

Studies from other parts of the world show much higher rates of malignant CNS tumor incidence. In Southwestern France the incidence is 15.5/100000/yr[4]. In the Eastern Province of Saudi Arabia, an area regarded as having a particularly low rate

of CNS neoplasms, the incidence is 3.1/100000/yr[5]. The Saudi (Eastern Province) figure is similar to that reported for Chinese, Romanians and Yugoslavians, but less than that seen in Ashkenazi and Sephardic Jews[5]. In Norway the reported incidence is 12.0/100000/yr and malignant CNS neoplasms comprise 2.8% of all cancers[6].

Amongst the Bahraini population, astrocytomas were the most commonly encountered malignant primary CNS neoplasm (46.5%). Of the malignant primary tumors in adults astrocytomas comprised 58.7%, while in children astrocytomas comprised 25% of malignant primary CNS tumors. In most series astrocytomas constitute between 45.7% and 68% of malignant primary CNS neoplasms[11]. Medulloblastoma was the second most common malignant primary CNS tumor (16.9% of all primary CNS neoplasms). Of the malignant primary tumors in adults they comprised 13.0%, while in children they comprised 25% of malignant primary CNS tumors. In both adults and children therefore, astrocytoma and medulloblastoma were the two commonest malignant primary CNS tumors. It should be noted that two of the six "adult" medulloblastomas actually presented in adolescents/young adults below the age of 19. The relative frequencies of medulloblastoma and ependymoma were comparable to other studies[10].

The number of secondary CNS neoplasms revealed by our study is undoubtedly an underestimate of the actual incidence. A large number of inoperable (e.g. because of multiple deposits) secondary cases are likely to have occurred in Bahrain, which would not have reached the pathologist's attention.

Similarly the number of CNS lymphomas must be an under-representation. Although they can exist as solitary space-occupying lesions amenable to surgery, the majority present as diffuse lymphomatous meningitis for which surgical intervention is inappropriate.

In our series the pediatric tumors represented 33.8% of all malignant primary CNS neoplasms. This compares with 13.7% in the United States, and 28.4% in Thailand[15,16].

This study shows that the incidence of malignant brain and spinal cord neoplasms in Bahrain is very low compared to other countries, both regional and remote[4-13]. This can be attributed to a variety of factors: the population of Bahrain is very small at 677,886 (July 2004), and therefore low numbers would be expected; secondly, specialized neurosurgical units are not available in Bahrain and so the majority of local patients with surgical CNS lesions are referred to overseas centers for histological diagnosis and treatment. As a consequence these patients escape local registration in Bahrain. The establishment of a local cancer registry for cases diagnosed in Bahrain and elsewhere is an urgent requirement; thirdly, postmortem examination in Bahrain is restricted to medico-legal cases only. There are undoubtedly significant numbers of CNS neoplasms, which escape detection on account of death intervening before prominent symptoms arise, and the non-existence of routine hospital autopsies.

Further analytical studies incorporating correlation with clinical and radiological features together with data on meningiomas are ongoing.

CONCLUSION

The apparent incidence of malignant brain and spinal cord neoplasms in Bahrain is very low. The small Bahraini population, inefficient registration of cancers, and the lack of routine hospital autopsies are contributory factors for the low numbers observed.

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