

Demographic profile of patients diagnosed with intracranial meningiomas in two academic hospitals in Johannesburg, South Africa: a 12-month prospective study

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Abstract

Background: Meningiomas are common brain tumours and display gender, racial and ethnic differences in their demographic profile. The demographic profile of our patients diagnosed with intracranial meningiomas is presented and compared with the literature.

Objectives: To determine the age, gender, racial and ethnic distribution of our patients diagnosed with intracranial meningiomas.

Methods: Consecutive patients (48 in number) seen at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) and Chris Hani Baragwanath Academic Hospital (CHBAH), Johannesburg, with histologically proven meningiomas over a 12 month period were recruited for the study.

Results: Meningiomas accounted for 33.8% of all primary brain tumours. The mean age of patients was 45.7 ± 10.5 years with a female-to-male ratio of 3.8:1. The mean age for male patients was 39.3 ± 13.5 years while that of female patients was 47.4 ± 9.0 years. The peak age range at presentation was in the fifth (41.7%) decade. The highest frequency was among Black Africans (75%) and Sotho ethnic nationality (27.1%).

Conclusion: The study showed a female preponderance for intracranial meningiomas among our patients. Although intracranial meningiomas were more in frequency among Black Africans, the racial distribution mirrored our population distribution while the highest frequency was among Sotho ethnic nationality.

Key words: intracranial meningioma, demographic profile, age, gender, race, ethnic

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Introduction

Although meningiomas are common intracranial neoplasms, they remain under-studied and under-reported.^{1,2} However, over the years there has been growing interest in meningiomas with new questions and challenges relating to every aspect of meningiomas.^{2,3} Worldwide there has been consistent increase in the frequency of

occurrence of meningiomas and also studies confirm increase in occurrence with age as well as a female preponderance.^{4,6} As our population ages due to increase in our life expectancy, a closer look at this disease in our environment is therefore justified.

The presentation of intracranial meningiomas displays racial/ethnic differences as can be seen between Caucasians, Africans and African-Americans.⁶ Meningiomas are more common in Africa than in North America and Europe^{6,7} and account for nearly 30% of all primary intracranial tumours in Africa.⁶ The information relating to the highest occurrence of meningiomas being in Africa^{7,8} adds to the challenge for a closer look at the demographic profile of this disease in our environment. This is in addition to the observation of a lack of such study in our environment. The geographical and ethnic differences displayed by meningiomas^{4,7} present South Africa as a suitable environment for studying the demographic profile of intracranial meningiomas because of her peculiar multiracial and multiethnic setting.

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Patients and Methods

This was a prospective study carried out at the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) and Chris Hani Baragwanath Academic Hospital (CHBAH). Both hospitals are located in Johannesburg and serve as teaching hospitals of the University of the Witwatersrand. The study was over a period of 12 months (13th July 2009 – 12th July 2010). Approval for the study was obtained from the Human Research Ethics Committee (Medical) of the University. While CMJAH is located within the city centre in Parktown, CHBAH (largest hospital in South Africa) is located in Soweto. They serve as tertiary hospitals for Gauteng Province and cares for public patients although CMJAH has a wing for private patients. They also serve as referral hospitals for Provincial Hospitals in Mpumalanga and North West Provinces in South Africa. Consecutive patients seen at the both hospitals with histologically proven intracranial meningioma during the study period were recruited for the study. We obtained data from the patients using an investigator-administered questionnaire. All patients were seen as in-patients. Diagnosis was made after detailed history

and careful physical examination, neuroimaging including CT scan and or MRI, and histological confirmation. All patients who underwent neurosurgical operative intervention had specimens removed at operative intervention and subjected to histology for a final tissue diagnosis. Patients who had non-operative intervention were taken off the study due to the absence of a final histological diagnosis. The data obtained from the patients were analysed by the use of Epi Info™ 2002. Data are presented as median, mean (range), frequency and percentages.

Statistical diagram using tables was created to highlight the findings.

Results

During the 12 months study period, 48 consecutive patients (out of 142 patients with primary brain tumours) seen at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) and the Chris Hani Baragwanath Academic Hospital (CHBAH), Johannesburg had histologically confirmed intracranial meningioma with a hospital distribution of 27 patients at CHBAH and 21 patients at CMJAH. Frequency of distribution of intracranial meningiomas among primary brain tumours (table 1)

Table 1 show that meningiomas (33.8%) had the highest frequency among primary brain tumours during the study period.

Table 1: Frequency of distribution of intracranial meningiomas among primary brain tumours

Diagnosis	Frequency	Percentage
Meningioma	48	33.8%
Pituitary adenoma	35	24.6%
Glioma	32	22.5%
Craniopharyngioma	4	2.8%
Ependymoma	4	2.8%
Medulloblastoma	4	2.8%
Schwannoma	3	2.1%
Myeloma	3	2.1%
Lymphoma	2	1.4%
Epidermoid cyst	2	1.4%
PCNSL	1	0.7%
Meningeal haemangiopericytoma	1	0.7%
Haemangioblastoma	1	0.7%
Atypical teratoid/rhabdoid tumour	1	0.7%
PNET	1	0.7%
Total	142	100%

PCNSL: Primary Central Nervous System Lymphoma

PNET: Primitive Neuroectodermal Tumour

Age of patients (with intracranial meningiomas) at presentation (table 2)

Table 2: Age of patients at presentation

Age group in years	Number of patients	Percent
Both genders		
21-30	4	8.3%
31-40	9	18.7%
41-50	20	41.7%
51-60	13	27.1%
61-70	2	4.2%
Total	48	100%
Males		
21-30	3	30%
31-40	2	20%
41-50	2	20%
51-60	2	20%
61-70	1	10%
Total	10	100%
Females		
21-30	1	2.6%
31-40	7	18.4%
41-50	18	47.4%
51-60	11	29.0%
61-70	1	2.6%
Total	38	100%

The mean age of all patients with intracranial meningiomas was 45.7 ± 10.5 years (range 23-67 years, median 46.5 years). The mean age for male patients was 39.3 ± 13.5 years (range 23-61 years) while that of female patients was 47.4 ± 9.0 years (range 27-67 years). The peak age range was in the age group 41-50 years accounting for 41.7% of patients with meningiomas and corresponding to the fifth decade of life. (Table 2)

Gender, Race and Ethnic Nationality (Home language) distribution (table 3)

The gender, race and ethnic nationality is shown in table 3 with females (79.2%), Black Africans (75%), and Sotho ethnic nationality (27.1%) having the highest percentages in the different categories. There were 4 (8.3%) foreign nationals from neighbouring Southern African countries.

Table 3: Gender, Race and Ethnic Nationality (Home language) distribution

Variable	Number of patients	Percent
Gender		
Male	10	20.8%
Female	38	79.2%
Total	48	100%
Race		
Black African	36	75%
White	6	12.5%
Coloured	4	8.3%
Indian	2	4.2%
Asian	0	0.0%
Total	48	100%
Ethnic Nationality (Home language)		
Sotho	13	27.1%
Zulu	5	10.4%
English	5	10.4%
Afrikaner	5	10.4%
Tswana	5	10.4%
Xhosa	5	10.4%
Foreign National	4	8.3%
Pedi	3	6.3%
Indian	2	4.2%
Tshivenda	1	2.1%
Total	48	100%

Discussion

There are few prospective studies on histologically proven intracranial meningiomas in the literature. The study was intended to be a Pilot study with the aim of further research based on the findings of the preliminary results after the first 12 months. Continuation of the study was designed and included profiling DNA copy number changes in South African meningiomas. However, funding was not available to continue the study. Hence due to the short study period, the results were displayed in descriptive terms for comparison with other published data.

The relative frequency of intracranial meningiomas (33.8%) in this study compares with other studies^{5,9-11} which showed similar high relative frequency of intracranial meningiomas among primary brain tumours. The findings in our study show that meningiomas were the

most common primary intracranial tumours among adults seen in our institutions. When adjusted for number of patients per year, the findings (48 patients per year) in our study rate highest compared to that of Das et al¹¹ in Singapore (41 patients per year), Fynn et al¹² in Pretoria (17.3 patients per year), Gasparetto et al¹³ in Brazil (15.6 patients per year), Quiñones-Hinojosa et al¹⁴ in US (9.6 patients per year), Jaggon and Char¹⁵ in Jamaica (5.3 patients per year) and Mezue et al¹⁶ in Nigeria (7.6 patients per year). The detection rate for central nervous system tumours have improved in our hospitals through the increasing availability of modern diagnostic neuroimaging facilities in our hospitals including the ease of accessibility by public patients who are not required to pay for diagnostic neuroimaging in public hospitals. These are performed free for our public patients in our public hospitals and may have contributed to the high trend in the relative frequency of meningiomas in this study.

Meningiomas affect women more often than men with a male-to-female ratio ranging from 1:1.4 to 1:2.8.6 Our study showed a female-to-male ratio of 3.8:1 and compares with the findings of Idowu et al⁵ which revealed a female-to-male ratio of 4.2:1 in both age group, and 4:1 in the adult population. It, however, contrasts with the findings of Jaggon and Char¹⁶ in Jamaica (2.8:1), Fynn et al¹² in Pretoria, South Africa (2.5:1) and Gasparetto et al¹³ in Brazil (2:1). It is also a sharp contrast to, Mezue et al¹⁵ in Enugu, Nigeria (1.1:1) and Odebode et al¹⁷ in Ibadan, Nigeria (1.3:1). The findings in our study also differs from earlier observations in the literature,^{6,8,18} which report equal gender distribution or a male predominance among Africans. However, the female-to-male ratio of 1:3 in the third decade of life in our study is in keeping with reports in the literature which showed no predominance in women in their fourth decade and below.^{8,19,20}

Racial/ethnic differences in the frequency of intracranial meningioma have been reported between Caucasians, Africans and African-Americans.⁶ In our study, the racial distribution of patients diagnosed with intracranial meningiomas tended to mirror the population distribution of Gauteng Province with Black Africans accounting for 75% of patients and other races (White/Coloured/Indian) accounting for 25%. The percentage of the population groups in Gauteng Province as captured in the 2001 Census in South Africa showed Black African 73.8%; Coloured 3.8%; Indian or Asian 2.5% and White 19.9% with a total population of 8,837,178 persons.²¹ Our study findings indicating a higher distribution of intracranial meningiomas among the black race (75%) therefore appear to reflect the predominantly black population in our environment. In our study Indians had the lowest rate and there was no Asian, in keeping with the findings in other studies elsewhere.^{8,22-24} In a recent US study,¹⁰ reported rates for Black Non-Hispanics are slightly higher (6.67) than for White Non-Hispanic and Hispanics (5.90 and 5.94, respectively).

Meningiomas are said to constitute 30% of brain tumours in Bantus in Africa²⁵ and this compares with the high frequency among Sotho ethnic nationality (27.1%) noted in our environment, despite the dominant ethnic group in Johannesburg, Gauteng Province,²¹ being Zulu (10.4%). The percentage distribution of ethnic nationality by home language in Gauteng Province as captured in the 2001 Census in South Africa showed

Afrikaans 14.4%; English 12.5%; Ndebele 1.9%; Xhosa 7.6%; Zulu 21.5%; Pedi 10.7%; Sotho 13.1%; Tswana 8.4%; Swati 1.4%; Tshivenda 1.7%; Xitsonga 5.7% and others 1.0%.²¹ There is no definite explanation for the high frequency of intracranial meningiomas among the Sotho ethnic nationality, though the influence of genetic factors may partly play a role. Other possible reasons may be the fact that patients are referred to our Gauteng teaching hospitals from other provinces/areas that do not have teaching/tertiary hospitals and this may merely reflect the population make up of those provinces/areas. The relative contributions of risk factors including environmental, hormonal or genetic factors to this sociodemographic variation are yet to be determined in our environment.

Meningiomas have a tendency to occur from the third to sixth decades of life^{26,17} and peaks between the ages of 40-60 years.²⁷ Meningiomas are rare in patients younger than 20 years.²⁵

This compares with the findings in our study which showed the peak age range in the fifth (41.7%) and sixth (27.1%) decades for both gender. Females showed similar peak age range of 47.4% and 29% respectively, whereas males had a fairly equal spread with the highest peak age range in the third (30%) decade of life. There was no meningioma in infancy and childhood in our study. This is in keeping with the rarity of meningiomas in infants and children,^{19,26,28,29} though this finding in our study may have been influenced by the short period of our study.

The mean age at diagnosis of meningiomas is 45 years.²⁹ In our study, the youngest patient was 23 years old; the median age was 46.5 years while the mean age was 45.7 years. This corresponds with other reports.^{12,15,29} A lower mean age of 40 years was noted by Odebode et al¹⁷ in Ibadan, though this may have been influenced by the low number of patients (n=35) in their study. A higher mean age of 52.7 years was noted in the study by Quiñones-Hinojosa et al¹⁴ in the United States. However, their study assessed pre-operative factors affecting resectability of giant intracranial meningiomas (≥ 5cm in the longest dimension). From their study, one can infer the likelihood of a shift towards older age group in large sized meningiomas. Large sized meningiomas are more likely to reflect long standing disease for these slow-growing and generally benign tumours, and therefore their likely occurrence in the older age group.

When compared to other studies, the age range (23-67 years) in our study differs from that of Fynn et al¹² in Pretoria (2-83 years), Odebode et al¹⁷ in Ibadan (9-77 years), and Jaggon and Char¹⁵ in Jamaica (13-80 years). It compares with the findings of Gasparetto et al¹³ in Brazil (23-81 years), in not having any patient in the paediatric age group but contrasts with it by the lack of patients from the eight decade upwards in our series. The absence of meningiomas in the paediatric age group in this study may have been influenced by the short study period, which may have limited the possibility of identifying patients in the paediatric age group within the study period. And the absence of meningiomas among patients from the eight decade upwards in our study may reflect a cautious approach to operative intervention among the elderly who fall within some of the patient-related factors prognostic of a high postoperative morbidity which includes advanced patient age, co-morbid conditions including diabetes mellitus and severe preoperative neurological impairment.⁶

Conclusion

The study showed a female preponderance for intracranial meningiomas among our patients while the highest frequency was among Sotho ethnic nationality. Although intracranial meningiomas were more in distribution among Black Africans (75%) compared to other races (White/Coloured/Indian/Asian) (25%), the racial distribution mirrored our population distribution (Black African-73.8%, White/Coloured/Indian/Asian-26.2%). Genetic and environmental factors may be responsible for some of the findings in this study and further study may be required to identify these factors. Preferably a multicentre collaborative study in different Provinces in South Africa may help to have a clearer picture of the demographic profile of this tumour in our environment. And we do hope that the observations in this study will serve as an important baseline for the design and interpretation of future studies on the demographic profile of intracranial meningiomas in our environment.

Abbreviations: CMJAH, Charlotte Maxeke Johannesburg Academic Hospital; CHBAH, Chris Hani Baragwanath Academic Hospital; CT, computed tomography; MRI, magnetic resonance imaging; PCNSL, Primary Central Nervous System Lymphoma; PNET, Primitive Neuroectodermal Tumour.

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