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Intracranial Meningiomas in Madagascar : A 4-Year Clinicopathological Study of 27 Cases

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ABSTRACT

Background: *Meningiomas are the most common primary intracranial tumors worldwide; however, data from low-resource settings such as Madagascar remain limited. The aim of this study was to determine the epidemiological, clinical, and histopathological profiles of meningiomas diagnosed at the study site.*

Methods: *We conducted a retrospective descriptive study of 27 histologically confirmed meningiomas diagnosed in an anatomical pathology laboratory between January 2022 and December 2025. Demographic, clinical, and histopathological features were analyzed and compared with international data.*

Results: *During the study period, 27 cases were included. The cohort included 20 females and 7 males (female-to-male ratio: 2.9:1), with a mean age of 45.98 ± 15.37 years (range: 2.5–63 years). Clinical presentation included intracranial hypertension in 10 cases and suspected brain tumor in 17 cases. Tumor location was frontal (n=5), posterior fossa (n=2), and cerebellopontine angle (n=1), while the remaining cases were unspecified. Histologically, 25 tumors (92.6%) were WHO grade I, including meningothelial (n=12), angiomatous (n=7), fibrous (n=3), psammomatous (n=2), and microcystic (n=1) subtypes, whereas 2 cases (7.4%) were atypical (grade II).*

Conclusion: *This study highlights a predominance of benign meningiomas and female patients, consistent with global trends. The younger age at diagnosis and symptomatic presentation likely reflect demographic characteristics and limited access to neuroimaging in Madagascar.*

Keywords

Brain neoplasms, Epidemiology, Histopathology, Madagascar, Meningioma.

Introduction

Meningiomas account for approximately 37–53% of primary central nervous system tumors and represent the most common intracranial neoplasms worldwide [1,2]. They are characterized by a broad spectrum of clinical presentations, ranging from incidental findings to symptoms related to intracranial hypertension or focal neurological deficits. Histologically, meningiomas encompass diverse subtypes defined by the 2021 World Health Organization (WHO) classification, with most tumors being benign (grade I). Despite extensive data from high-income countries, evidence from low-resource settings remains scarce, particularly in sub-Saharan Africa and Madagascar. This study aims to describe the clinicopathological characteristics of intracranial meningiomas in Madagascar and to compare these findings with literature.

Materials and Methods

This was a retrospective and descriptive study of histologically confirmed intracranial meningioma cases over a 4-year period, from January 2022 to December 2025, conducted at the Anatomical Pathology Laboratory of the Joseph Ravoahangy Andrianavalona University Hospital Center, Antananarivo, Madagascar. Data were collected anonymously and confidentially from pathology request forms, laboratory registers, and pathology reports. The following variables were collected: age, gender, clinical presentation, tumor location, histological subtype, and WHO 2021 grade. Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were reported as frequencies and percentages. The results were compared with data from African, European, American, and Asian studies.

Results

During the study period, 27 cases were collected. A marked female predominance was observed, with a sex ratio of 0.35 (Figure 2).

Age of Patients

Patient age ranged from 2.5 to 67 years, with a mean of 45.98 ± 15.37 years (Figure 1).

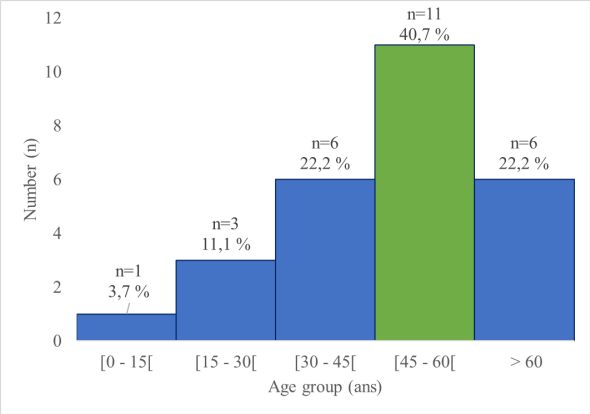

Figure 1: Distribution of patients according to age groups.

Gender

A female predominance was observed, with a **sex ratio of 0.35**.

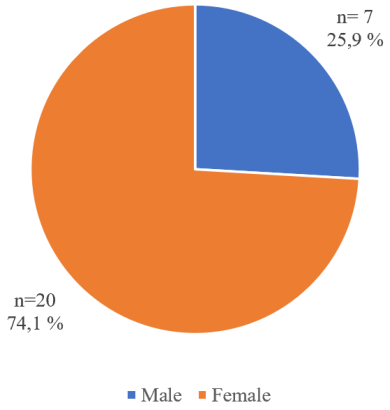

Figure 2: Distribution of patients according to gender.

Clinical information provided

The main presenting circumstance was intracranial hypertension syndrome in 37% of cases. Tumor location was frontal in 18.5% of cases (Table 1).

Table 1: Distribution of patients according to clinical data.

Clinical data	Number (n)	Percentage (%)
Presenting circumstances		
– Intracranial hypertension syndrome	10	37
– Not specified	17	63
Location		
– Frontal	05	18.5
– Posterior fossa	02	7.4
– Cerebellopontine angle	01	3.7
– Not specified	19	70.4

Types histologiques

The most frequently observed histological type was WHO grade I meningioma, with a predominance of the meningothelial subtype (Table 2).

Table 2: Distribution of patients according to histological types.

Histological types	Number (n)	Percentage (%)
Benign meningioma		
– Meningothelial	12	44.4
– Angiomatous	07	25.9
– Fibromatous	03	11.1
– Psammomatous	02	7.4
– Microcystic	01	3.7
Atypical meningioma	02	7.4

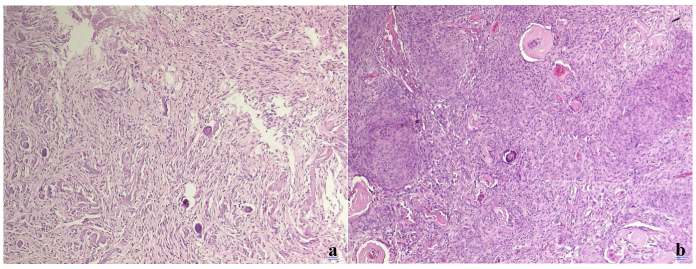

Figure 3: Meningioma grade I. a. fibromatous with psammoma bodies, b. meningotheliomatous.
Hematein eosin stain
Magnification x40
Source: Department of Pathology CHU/JRA

Discussion

During the study period, 27 cases of meningioma were collected, representing 56.25% of brain tumors diagnosed at the study site. In the literature, meningioma is one of the most common tumors of the central nervous system. According to Ogasawara C et al. in Japan in 2021 [1], it accounts for 37.6% of primary CNS tumors and 53.3% of benign tumors, while Ostrom QT et al. in the United States in 2022 reported a proportion of 39.7% [2]. In Africa,

hospital-based series show variable frequencies, either lower or comparable depending on the context and healthcare centers. In Côte d'Ivoire, N'Dri Oka D et al. [3] reported a frequency of approximately 33% of intracranial tumors, whereas it was only 18.7% in Senegal according to Badiane SB in 2011 [4]. These regional differences may be explained by variations in study methodology (hospital-based series versus national registries) and differences in access to diagnostic tools. In low-resource settings, limited access to imaging leads to delayed diagnoses, which may underestimate asymptomatic cases.

In this series, the mean age at diagnosis was 45.98 ± 15.37 years, which is consistent with some African studies such as that of N'Dri Oka et al., reporting a mean age of 43 years. However, this remains lower than in large Western cohorts, where the mean age ranges from 55 to 66 years [1,5]. These differences may be explained by several factors. First, the demographic structure of populations : African and Malagasy populations have a younger age distribution compared to those in Europe and the United States, which may lower the mean age at diagnosis [6]. Second, a selection bias exists, as this series, derived from an anatomical pathology laboratory, included only symptomatic cases referred for diagnostic purposes.

In this study, a female predominance was observed, with a sex ratio of 0.35 (74.1% females). This finding is consistent with most reported series. Ogasawara et al. in Japan (2021) reported a sex ratio of 0.42, and Colli et al. in Brazil (2021) reported 0.27 [1,5]. This female predominance may be explained by the frequent expression of sex hormone receptors, particularly progesterone receptors, in meningioma cells, suggesting a hormonal role in tumorigenesis. Some studies indicate that men have a slightly higher proportion of aggressive or high-grade meningiomas [1,7]. In the present series, one of the atypical meningioma cases occurred in a male patient. This predominance of aggressive forms in males may be explained by specific genetic alterations, including mutations or loss of the NF2 gene and deletions of CDKN2A/CDKN2B, leading to dysregulation of the cell cycle. These abnormalities are associated with rapid tumor growth, increased risk of recurrence, and anaplastic transformation. Additionally, biological differences between sexes may contribute: the female immune system is generally more active and more effective in eliminating transformed cells compared to males, potentially resulting in more aggressive tumor progression in men [8].

Regarding tumor location, in cases where it was specified in the clinical records, the most documented sites were the frontal lobe (5 cases), posterior fossa (2 cases), and cerebellopontine angle (1 case). The literature indicates that tumors arising from the dura mater and skull base are the most frequent [1,9]. Concerning clinical presentation, intracranial hypertension syndrome was the presenting symptom in 37% of cases, with no further details available for the remaining cases. In the literature, clinical manifestations range from intracranial hypertension to focal neurological deficits and epileptic seizures. European and North American series, based on large datasets, also report incidentally discovered cases on MRI or CT scans [5,9]. In some African and Malagasy series, a higher proportion of advanced symptomatic cases (marked intracranial hypertension) has been observed, likely related to delayed diagnosis and limited access to imaging [6,10].

Histologically, according to the WHO classification, meningiomas are divided into three grades of malignancy (I, II, III) based on histological and molecular criteria, allowing evaluation of their biological behavior and recurrence risk, as described by Louis et al. Recent studies have emphasized that benign forms remain largely predominant in most clinical and pathological series, reflecting the generally indolent nature of these tumors, although some may exhibit more aggressive behavior depending on their location and histological features [11,12].

In this series, the majority of tumors were benign meningiomas (grade I), consistent with the literature. Indeed, grade I meningiomas account for approximately 80–90% of all cases, while atypical (grade II) and anaplastic (grade III) forms are much less frequent. This histological distribution has been widely reported in several studies and recent reviews on meningeal tumors [8,11]. According to the WHO, several histological subtypes of meningioma are recognized. In this series, the meningothelial subtype was the most frequent, representing 44.4% of cases. This distribution is consistent with the literature, where it accounts for 40–60% of cases in European and North American studies [8,11], 61.1% in the study by Raza AKMM et al. in Bangladesh (2017) [13], and 58.5% in the study by Pienaar JA et al. in South Africa (2024) [14]. The predominance of meningothelial meningioma may be explained by its origin from arachnoid cap cells, which constitute the main cellular component of the meninges. Other histological variants correspond to specific morphological differentiations of these cells, often associated with stromal or vascular changes, as seen in angiomatous meningioma, characterized by abundant vascularization, or psammomatous meningioma, characterized by numerous calcified psammoma bodies.

In this series, 2 cases (7.4%) of atypical meningioma were identified. This proportion is consistent with the literature, where grade II meningiomas account for approximately 5–15% of intracranial meningiomas [8,11]. Similar findings have been reported in African hospital-based series, with frequencies ranging from 6 to 12% [13,14].

From a morphological perspective, the diagnosis of atypical meningioma is based on specific criteria, including the presence of at least 3 mitoses per 10 high-power fields (HPF) or features of aggressive histological proliferation such as hypercellularity, moderate cytonuclear atypia, tumor necrosis, and brain invasion. In the two cases of this series, the diagnosis was established based on moderate hypercellularity, increased mitotic activity, and cortical invasion. Distinguishing grade II meningiomas is crucial, as they are associated with a higher risk of local recurrence, with reported recurrence rates ranging from 29% to 41% at 5 years after complete resection [11]. Patients with grade II meningiomas

therefore require close postoperative imaging surveillance.

Conclusion

This study confirms that intracranial meningiomas in Madagascar are predominantly benign tumors with a marked female predominance, in line with global epidemiological trends. The younger age at diagnosis and the predominance of symptomatic presentations likely reflect demographic characteristics and limited access to neuroimaging. These findings underscore the importance of improving diagnostic resources and establishing national tumor registries to better characterize brain tumors in Madagascar.

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