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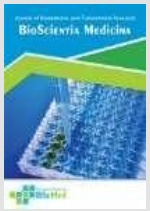

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Navigating Spheno-Orbital Meningioma in Indonesia: Clinical Characteristics and Diagnostic Considerations from a Decade of Experience

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A B S T R A C T

Background: Spheno-orbital meningiomas (SOM) represent a distinct subgroup of meningiomas originating from the sphenoid wing, characterized by orbital extension, significant bony invasion, and hyperostosis. These tumors present diagnostic and therapeutic challenges due to their complex anatomical location near critical neurovascular structures and a notable tendency for recurrence. Understanding the specific clinical profile of SOM patients is essential for timely diagnosis and effective management strategies. This study aimed to delineate these characteristics within an Indonesian population. **Methods:** A retrospective, descriptive, cross-sectional study was performed using medical record data from patients diagnosed with SOM between January 2012 and December 2022 at the Department of Neurosurgery, Dr. Hasan Sadikin General Hospital, Bandung, Indonesia. Data collected included patient demographics, case history (new vs. recurrent), presenting symptoms, neurological status (Glasgow Coma Scale), and radiological findings (lesion singularity/multiplicity). Total sampling was employed, and data were analyzed descriptively. **Results:** The study included 252 subjects. A striking female predominance was observed (95.6%), with a mean patient age of 44.3 years (range 14-79). The vast majority were new cases (94.4%). Protrusion (proptosis) was the most frequent presenting symptom (79.0%), followed by headache (11.1%), blindness (5.2%), and blurred vision (4.0%). Most patients (97.2%) were fully conscious (GCS 15) upon admission. Radiological assessment revealed single lesions in 71.4% of cases. **Conclusion:** In this large Indonesian cohort, SOM predominantly affected middle-aged females and typically presented with proptosis. Awareness of this distinct clinical signature is crucial for improving diagnostic accuracy and facilitating prompt, comprehensive management. The findings underscore the need for high clinical suspicion, particularly in female patients presenting with orbital symptoms.

1. Introduction

Meningiomas, neoplasms arising from the arachnoid cap cells of the meninges, represent a notable fraction of primary intracranial tumors, accounting for approximately 15 to 20% of such growths. These tumors are typically characterized by their slow growth pattern and benign histological features, with the majority classified as WHO Grade I, which generally confers a favorable prognosis. However, the indolent progression of meningiomas can lead to substantial tumor volumes before clinical detection, potentially resulting in symptoms due to mass effect on adjacent critical neurovascular structures. These structures include, but are not limited to, the optic nerves, carotid arteries, cranial nerves, and the pituitary gland. Within the spectrum of intracranial meningiomas, those that originate from the sphenoid wing and extend into the orbit are specifically designated as spheno-orbital meningiomas (SOMs). SOMs constitute a distinct clinical entity and a challenging subgroup, representing approximately 9 to 18% of all adult

intracranial meningiomas. These tumors are characterized by a unique set of features that add complexity to their clinical management. One of the defining characteristics of SOMs is their pattern of periorbital extension. These tumors often exhibit an 'en plaque' growth pattern along the sphenoid wing, infiltrating the orbit through anatomical pathways such as the superior and inferior orbital fissures and the optic canal. This infiltrative growth not only involves the soft tissues of the orbit but also has a propensity for dural and osseous invasion. SOMs frequently induce reactive hyperostosis of the involved sphenoid bone and the orbital walls, further contributing to the complexity of these lesions. The intraorbital tumor component, in conjunction with the associated hyperostosis, commonly leads to proptosis, characterized by the protrusion of the eyeball. Proptosis can result in significant cosmetic deformity and functional impairment, including a decline in visual acuity and visual field deficits, thereby affecting the patient's quality of life.[1-3]

The clinical presentation of SOMs often reveals a marked predilection for females, with reported female-to-male ratios ranging from 2:1 to higher. The incidence of these tumors typically peaks in middle age, predominantly affecting individuals between 40 and 50 years old. While the presenting symptoms of SOMs can be varied, progressive and painless proptosis is frequently considered the hallmark sign. Additional common manifestations include visual disturbances, a palpable temporal mass, headache, and, in some cases, cranial nerve palsies. The primary management strategy for SOMs revolves around surgical resection, with the goals of achieving maximal safe tumor removal, decompressing critical neurovascular structures (particularly the optic nerve), alleviating symptoms such as proptosis and visual loss, preventing tumor recurrence, and obtaining tissue for histological diagnosis. The ideal surgical outcome is complete resection, encompassing both the soft tissue tumor component and the involved hyperostotic bone, often corresponding to Simpson Grade I resection. This extent of resection offers the greatest likelihood of long-term tumor control. However, the intricate anatomical relationships of SOMs frequently hinder the achievement of gross total resection. These tumors are intimately associated with critical structures within the orbit, cavernous sinus, optic canal, superior orbital fissure, and middle cranial fossa. These structures include the optic nerve, oculomotor nerves (III, IV, VI), trigeminal nerve (V1, V2), internal carotid artery, and pituitary gland. The attempt to achieve complete tumor removal in the presence of extensive infiltration of these structures carries substantial risks of neurological deficits. Potential deficits include blindness, ophthalmoplegia, and anesthesia in the trigeminal distribution. Consequently, subtotal resection is often necessitated, leaving behind residual tumor, particularly in challenging locations such as the cavernous sinus or optic canal. This inherent difficulty in achieving complete removal, coupled with the invasive nature of SOMs, contributes to a relatively elevated risk of recurrence, even following seemingly extensive resection. Recurrence rates reported in the literature exhibit considerable variability, underscoring the challenge of achieving long-term tumor control. Residual tumor volume has been identified as a significant predictor of recurrence. Even in cases where resection appears to be complete, recurrence can still occur, with estimates suggesting rates of 5 to 12% in some series.[4-7]

Given the therapeutic challenges posed by SOMs, including the complexity of surgical management and the risk of recurrence, a comprehensive understanding of the typical clinical presentation and patient characteristics is of paramount importance. Early identification, based on recognizing the characteristic constellation of symptoms, particularly within the relevant demographic groups, facilitates timely diagnostic workup and the formulation of an appropriate multidisciplinary management plan. While numerous studies have contributed to the description of SOM characteristics across diverse populations, there remains a relative paucity of data from specific regions, such as Indonesia.

Characterizing the presentation of SOMs within the Indonesian population holds the potential to provide valuable insights for clinicians in this region. Such characterization may reveal unique features or confirm similarities with global patterns, thereby enhancing diagnostic accuracy and treatment strategies.[8-10] Therefore, this study was designed to retrospectively analyze and describe the clinical characteristics, presenting symptoms, and radiological features of patients diagnosed and managed for spheno-orbital meningioma over a ten-year period. The study was conducted at a single, large tertiary referral hospital in Indonesia. By delineating this profile, the study aimed to enhance the understanding and clinical suspicion of SOM among healthcare providers in the region, with the ultimate goal of contributing to improved diagnostic accuracy and patient management.

2. Methods

This study employed a descriptive, cross-sectional study design, utilizing retrospective data collection to analyze the clinical characteristics of spheno-orbital meningioma (SOM). The study was conducted at the Department of Neurosurgery, Dr. Hasan Sadikin General Hospital in Bandung, Indonesia, which serves as a major public tertiary referral center.

The research was carried out within the neurosurgery department of Dr. Hasan Sadikin General Hospital. As a prominent tertiary referral center, this hospital receives patients from a wide geographical area, encompassing diverse demographics and clinical presentations. The hospital's extensive neurosurgical service manages a high volume of intracranial tumors, including meningiomas, making it an ideal setting for this retrospective study. The study population comprised all patients diagnosed and hospitalized with spheno-orbital meningioma over a 10-year period. The timeframe for data collection spanned from January 2012 to December 2022. This duration was chosen to provide a substantial sample size and capture a comprehensive view of SOM cases managed at the institution over a clinically relevant period.

The study's inclusion criteria were designed to ensure the selection of all relevant cases of spheno-orbital meningioma. All patients, regardless of age (both adult and pediatric, defined as age ≥1 year old), who received a diagnosis of spheno-orbital meningioma within the specified timeframe were potentially eligible for inclusion. The diagnosis of SOM was primarily based on characteristic findings observed in neuroimaging studies, specifically Computed Tomography (CT) and/or Magnetic Resonance Imaging (MRI). These characteristic findings included the presence of a tumor originating from the sphenoid wing with extension into the orbit, often accompanied by hyperostosis. This criterion ensured that the study focused on the specific anatomical and radiological features defining SOM. Conversely, exclusion criteria were established to maintain the integrity and validity of the data analysis. Patients were excluded from the final analysis if their medical records had incomplete data regarding essential clinical symptoms or neuroimaging findings. This exclusion was crucial to minimize bias and ensure that only cases with sufficient information for the study's descriptive objectives were included. The completeness of medical records is vital in retrospective studies to accurately reconstruct the clinical picture and avoid misinterpretations or inaccuracies in data analysis.

A total sampling method was employed for this study. In total sampling, all patients who met the predefined diagnostic criteria within the specified study period were included in the study. This approach eliminates sampling bias and ensures that the results are representative of the entire population of SOM patients treated at the institution during the study period. Given the specific nature of the condition and the setting of a single tertiary referral center, total sampling was deemed feasible and appropriate to capture the complete spectrum of SOM cases.

The study protocol underwent a thorough review by the institutional review board of Dr. Hasan Sadikin General Hospital. This review ensured that the

research adhered to ethical principles and guidelines for studies involving human subjects. Given the retrospective nature of the study design and the use of de-identified data extracted from existing medical records, the ethics committee granted a waiver of informed consent. The retrospective design minimized the risk to patients, as the study involved the analysis of already collected data without requiring new interventions or patient contact. Furthermore, the use of de-identified data ensured that patient privacy and confidentiality were protected throughout the research process. All data collection, analysis, and presentation were conducted in a manner that maintained patient confidentiality.

Data were meticulously extracted from two primary sources to ensure accuracy and comprehensiveness. The first source was the hospital's electronic information system, known as Sistem Informasi Rumah Sakit (SIRS). SIRS is a comprehensive database that contains patient demographics, admission details, diagnoses, and treatment information. The second source was the physical medical records of the included patients. Physical records often contain detailed clinical notes, radiological reports, and operative reports, providing a richer source of information. A standardized data collection form was utilized to ensure consistency in data extraction. This form was carefully designed to capture all relevant variables necessary for the study's objectives. The use of a standardized form minimizes variability in data collection and enhances the reliability of the extracted information.

The data collected encompassed several categories, designed to comprehensively describe the clinical profile of SOM patients. These categories included demographic data, case history, clinical presentation, neurological status, and radiological findings; Demographic Data: This category included patient age at the time of diagnosis and gender. Age was recorded in years, and gender was categorized as either male or female. These variables are fundamental in characterizing the study population and identifying potential demographic patterns in SOM presentation; Case History: Patients were categorized based on their history of prior meningioma diagnosis or treatment. 'New cases' were defined as patients with no previous diagnosis of meningioma. This distinction is important for understanding the incidence of SOM in the population. 'Recurrent cases' were defined as patients with a documented history of previously diagnosed and/or treated meningioma who presented with tumor recurrence or regrowth. Identifying recurrent cases is crucial for analyzing the long-term behavior of SOM and factors influencing recurrence; Clinical Presentation: The primary presenting symptoms reported by the patient or documented during the initial clinical assessment were meticulously recorded. This included a range of symptoms such as protrusion/proptosis, headache, visual disturbances (including blindness and blurred vision), decrease in consciousness, and any other related complaints. Accurate documentation of presenting symptoms is essential for understanding the clinical spectrum of SOM and aiding in early diagnosis; Neurological Status: The patient's level of consciousness upon admission to the hospital was assessed using the Glasgow Coma Scale (GCS). The GCS score, recorded in the medical chart, provides a standardized measure of a patient's neurological status, ranging from fully conscious to comatose. This variable helps in evaluating the severity of the patient's condition and any potential impact of SOM on neurological function; Radiological Findings: Data from CT and/or MRI scans performed for diagnosis and surgical planning were reviewed. Specifically, the presence and number of intracranial lesions were documented. Patients were categorized as having a 'single lesion' if only the primary SOM was identified on imaging. Conversely, patients were categorized as having 'multiple lesions' if more than one distinct meningioma lesion was detected on neuroimaging. This distinction is important as multiple lesions may suggest underlying conditions. Cases with extension to other anatomical sites beyond the sphenoid wing and orbit were also noted, providing a comprehensive description of the tumor's extent.

The collected data were initially entered into a Microsoft Excel spreadsheet to facilitate organization and management. Microsoft Excel is a widely used software for data entry and basic data manipulation, providing a user-friendly platform for organizing datasets. Descriptive statistical analysis was performed to summarize the data and identify key patterns and trends. Numerical data, specifically patient age, were presented as the mean and range. The mean provides a measure of the average age of the patients, while the range indicates the minimum and maximum ages, giving a sense of the age distribution within the cohort. Categorical data, including year of hospitalization, gender, case type (new/recurrent), GCS score, presenting symptoms, and lesion characteristics (single/multiple), were summarized and presented as frequencies and percentages. Frequencies represent the number of occurrences of each category, while percentages provide a relative measure, allowing for easy comparison across different categories. This descriptive statistical approach provides a clear and concise summary of the main characteristics of the SOM patients in the study.

3. Results

Table 1 summarizes the key demographic and clinical features of the 252 patients diagnosed with spheno-orbital meningioma (SOM) at Dr. Hasan Sadikin General Hospital over a 10-year period (2012-2022); Total Patients: The study included a total of 252 patients. This number provides the overall sample size (N), which is essential for understanding the scope of the study and the generalizability of the findings. It's a reasonably sized cohort for a single-center study of a relatively uncommon condition; Gender: There is a striking female predominance. 241 patients (95.6%) were female, while only 11 patients (4.4%) were male. This is a key finding. SOM, like many meningiomas, is known to be more common in females. However, the extremely high female-to-male ratio (approximately 22:1 in this study) is particularly noteworthy and suggests a strong gender bias in this patient population. This warrants further investigation into potential hormonal, genetic, or other contributing factors specific to this population; Age: The mean age of patients at diagnosis was 44.3 years, with an age range of 14 to 79 years. This indicates that SOM can occur across a wide age range, but it is most frequently diagnosed in middle-aged individuals. The mean age of 44.3 years aligns with the general understanding of meningiomas typically presenting in adulthood. The range highlights the importance of considering SOM in both younger and older patients presenting with relevant symptoms; Case History: The vast majority of cases were new (94.4%), with only a small proportion being recurrent (5.6%). This suggests that the hospital primarily sees patients at their initial presentation of SOM. The low recurrence rate in this presentation data might not fully reflect the long-term recurrence rate of SOM, as it only captures the status at the time of data collection. Follow-up studies would be needed to assess the true recurrence rate over time; Neurological Status (Admission GCS): Most patients (97.2%) had a Glasgow Coma Scale (GCS) score of 15 upon admission, indicating that they were fully conscious. Only a very small number had slightly reduced consciousness (GCS 14 and 13, both 0.4%). This is consistent with the generally slow-growing nature of meningiomas. SOM typically causes localized symptoms related to the orbit and surrounding structures, and it often does not significantly affect overall consciousness unless there's substantial intracranial pressure or involvement of critical brain regions. The high percentage of patients with GCS 15 indicates that most patients presented with focal symptoms rather than a decline in their level of consciousness; Main Presenting Symptoms: Protrusion/Proptosis was the most common presenting symptom (79.0%). Headache was the second most common (11.1%). Visual disturbances, including Blindness (5.2%) and Blurred Vision (4.0%), were also notable. Decrease of Consciousness was rare (0.8%). The high prevalence of proptosis strongly emphasizes its role as the cardinal symptom of SOM. This is consistent with the tumor's location and its effect on the orbit. While less

frequent than proptosis, headache is still a clinically relevant symptom and should be considered in the differential diagnosis. The presence of blindness and blurred vision, even in smaller percentages, underscores the potential for SOM to affect vision significantly. Early detection and intervention are crucial to preserve visual function. The low incidence of decreased consciousness reinforces the point made with the GCS data – SOM typically presents with focal symptoms before causing major neurological deterioration; Radiological Lesion Characteristics: A majority of patients had a single lesion (71.4%), while a substantial proportion had multiple lesions (28.6%). This is the more typical presentation of meningiomas, including SOM. The relatively high percentage of multiple lesions is clinically important. It may raise the possibility of underlying conditions such as neurofibromatosis type 2 or necessitate further investigation to rule out other potential causes. It also has implications for treatment planning.

Table 1. Demographic and clinical characteristics of Spheno-orbital meningioma patients (N=252) at Dr. Hasan Sadikin General Hospital (2012-2022).

Characteristic	Category / Value	Number (N)	Percentage (%)
Total patients		252	100.0%
Gender	Female	241	95.6%
	Male	11	4.4%
Age	Mean Age (Years)	44.3	-
	Age Range (Years)	14 - 79	-
Case history	New Case	238	94.4%
	Recurrent Case	14	5.6%
Neurological status (Admission GCS)	GCS 15 (Fully Conscious)	245	97.2%
	GCS 14	1	0.4%
	GCS 13	1	0.4%
Main presenting symptoms	Protrusion / Proptosis	199	79.0%
	Headache	28	11.1%
	Blindness	13	5.2%
	Blurred Vision	10	4.0%
	Decrease of Consciousness	2	0.8%
Radiological lesion characteristics	Single Lesion	180	71.4%
	Multiple Lesions	72	28.6%

Notes: GCS = Glasgow Coma Scale.

4. Discussion

The analysis of demographic data within this study revealed that the mean age of patients diagnosed with spheno-orbital meningioma (SOM) was 44.3 years, with the overall age range spanning from 14 to 79 years. This finding, while seemingly straightforward, carries significant implications when placed within the broader context of meningioma epidemiology and the complex interplay of factors influencing tumor development across the human lifespan. The mean age of 44.3 years serves as a central point of reference, anchoring our understanding of when SOM is most frequently encountered, while the age range compels us to acknowledge the variability of its presentation and the need for a nuanced clinical approach. The observed mean age in this study aligns substantially with the generally accepted patterns of meningioma incidence. Meningiomas, as a class of tumors, demonstrate a well-documented predilection for manifesting in middle-aged adults. Epidemiological studies consistently indicate that the peak incidence of meningiomas, including various subtypes such as SOM, occurs most commonly during the fifth and sixth decades of life. This translates to the age range of 40 to 60 years, a period characterized by a confluence of biological, hormonal, and environmental factors that may contribute to the development and clinical presentation of these tumors. The consistency of our study's mean age with this broader epidemiological trend reinforces the notion that SOM,

while possessing unique anatomical characteristics, shares fundamental biological underpinnings with other meningioma subtypes. This is crucial for clinicians, as it allows them to draw upon the wealth of existing knowledge regarding meningioma pathogenesis and risk factors when evaluating and managing patients with SOM. However, it is equally important to recognize that SOM also exhibits distinct features that necessitate specific considerations, particularly in terms of its anatomical location and its impact on surrounding structures. While the mean age provides a valuable central tendency, the wide age range of 14 to 79 years observed in this study is equally significant. This range underscores a critical clinical reality SOM can occur at virtually any stage of adulthood. The presence of cases in both adolescence (14 years) and advanced age (79 years) highlights the necessity for clinicians to maintain a high index of suspicion for SOM in patients presenting with relevant symptoms, irrespective of their chronological age. In younger patients presenting with orbital symptoms (such as proptosis, visual disturbances), SOM must be included in the differential diagnosis, even though it may be less common than other etiologies in this age group. Similarly, in elderly patients, where other conditions might be more prevalent, SOM should not be overlooked if the clinical picture is suggestive. While the core symptoms of SOM (proptosis, visual changes) tend to be consistent across age groups, the relative prominence of certain symptoms or the presence of comorbidities may vary. For instance, elderly patients may present with more subtle visual changes that are easily attributed to age-related macular degeneration or other ophthalmological conditions, leading to a potential delay in SOM diagnosis. The age of the patient can significantly influence treatment decisions and prognosis. Younger patients may tolerate more aggressive surgical interventions, while older patients may have increased surgical risks due to comorbidities or physiological changes associated with aging. Furthermore, the long-term implications of treatment, such as the risk of recurrence or the impact on quality of life, must be carefully considered in the context of the patient's overall health and life expectancy. The concentration of SOM cases in the middle-aged population, as reflected in the mean age and the general epidemiological trend, is likely attributable to a complex interplay of biological factors that become more prominent during this stage of life. Meningiomas originate from the arachnoid cap cells, which are specialized cells located in the arachnoid mater, one of the three layers of membranes that surround the brain and spinal cord. The development and growth of these tumors are influenced by a combination of genetic predisposition, hormonal influences, and environmental exposures, all of which can undergo significant changes with age. While most meningiomas are sporadic, meaning they arise without a clear familial link, genetic factors can play a role in their development. Certain genetic syndromes, such as neurofibromatosis type 2 (NF2), are associated with an increased risk of developing multiple meningiomas. Furthermore, subtle genetic variations or polymorphisms may influence an individual's susceptibility to meningioma development. Age-related changes in DNA repair mechanisms or the accumulation of somatic mutations over time may also contribute to the increased risk of meningiomas in middle age. Hormonal factors, particularly the influence of sex hormones, have been implicated in meningioma pathogenesis. Meningiomas frequently express receptors for hormones such as progesterone, estrogen, and androgens, suggesting that hormonal fluctuations can affect tumor growth. The hormonal changes that occur during middle age, including the perimenopause in women and age-related changes in testosterone levels in men, may create an environment that is more conducive to meningioma development or progression. Long-term exposure to certain environmental factors, such as ionizing radiation, has been identified as a risk factor for meningiomas. The cumulative effect of such exposures over time may contribute to the increased incidence of meningiomas in middle-aged individuals. Other potential environmental factors, such as exposure to certain

chemicals or viruses, are also being investigated for their possible role in meningioma development. The process of cellular aging itself may contribute to the increased risk of meningiomas in middle age. Age-related changes in cellular senescence, telomere shortening, and oxidative stress can create a tumor microenvironment that promotes tumor growth and progression. Furthermore, age-related changes in the immune system may impair its ability to recognize and eliminate developing tumor cells. The characteristically slow growth rate of meningiomas is a crucial factor contributing to their frequent diagnosis in middle-aged individuals. Meningiomas are typically benign tumors that grow slowly over many years. This indolent growth pattern often results in a prolonged period during which the tumor gradually increases in size without causing noticeable symptoms. As the tumor slowly expands, it exerts increasing pressure on the surrounding structures, including the brain, cranial nerves, and blood vessels. The onset of symptoms typically occurs when the tumor reaches a size sufficient to compress or displace these structures, disrupting their normal function. This process can take many years, explaining why meningiomas are often diagnosed in middle-aged individuals, as the tumor has had sufficient time to grow and produce clinical manifestations. Furthermore, the location of the tumor plays a significant role in the timing of symptom onset. Meningiomas located in certain areas, such as the convexity of the brain, may grow to a relatively large size before causing symptoms, as there is more space for them to expand. In contrast, meningiomas located in confined spaces, such as the optic canal or the cavernous sinus, may cause symptoms earlier due to compression of critical structures. The slow growth rate of meningiomas also has implications for diagnosis and treatment. Because the symptoms develop gradually, patients may initially attribute them to other causes or may not seek medical attention until the symptoms become severe or persistent. This can lead to delays in diagnosis, which may complicate treatment and affect prognosis. The occurrence of SOM in younger individuals, including adolescents, while less common, presents a distinct set of considerations for clinicians and researchers. The development of meningiomas in this age group may involve different underlying mechanisms compared to those in middle-aged or elderly patients. Genetic factors are more likely to play a significant role in meningiomas that develop in younger individuals. Certain genetic syndromes, such as neurofibromatosis type 2 (NF2), are associated with an increased risk of developing multiple meningiomas, often at a younger age. NF2 is caused by mutations in the NF2 gene, which encodes a tumor suppressor protein called merlin. This protein plays a critical role in regulating cell growth and proliferation. In rare cases, meningiomas may even be congenital, meaning they are present at birth. These tumors are thought to arise from remnants of arachnoid cap cells that are misplaced during embryonic development. Congenital meningiomas are typically slow-growing and may not cause symptoms until later in childhood or adolescence. While the cumulative effect of long-term environmental exposures is more relevant in older individuals, certain exposures during childhood or adolescence may increase the risk of meningioma development. For example, exposure to ionizing radiation, such as from cranial radiation therapy for other childhood cancers, has been linked to an increased risk of meningiomas. Hormonal factors may also play a role in meningiomas that develop in younger individuals, although the specific mechanisms are not fully understood. The hormonal changes that occur during puberty and adolescence may influence tumor growth. Diagnosing SOM in younger patients can sometimes be challenging, as the symptoms may be nonspecific and can mimic other more common conditions. For example, orbital symptoms such as proptosis or visual disturbances may be attributed to orbital cellulitis or other inflammatory conditions. Therefore, clinicians need to maintain a high index of suspicion for SOM in younger patients with persistent or unexplained orbital symptoms. The treatment of SOM in younger patients

is generally similar to that in adults, with surgical resection being the primary goal. However, there are some unique considerations. The long-term effects of surgery, radiation therapy, or other treatments on the developing brain and skull must be carefully weighed. Furthermore, the psychological and social impact of the tumor and its treatment on the young patient and their family should be addressed. The complex interplay of factors that contribute to the development of SOM across the age spectrum necessitates further research to unravel the specific mechanisms involved in each age group. A deeper understanding of these mechanisms will have significant implications for improving diagnostic accuracy, tailoring treatment strategies, and developing preventive measures. Molecular profiling studies, which analyze the genetic and molecular characteristics of SOM tumors, can help to identify age-specific differences in tumor biology. These studies may reveal that tumors in younger patients have different genetic mutations or express different proteins compared to tumors in older patients. This information could lead to the development of targeted therapies that are specifically designed for different age groups. Longitudinal studies, which follow patients over time, can provide valuable insights into the natural history of SOM and the factors that influence tumor growth and progression in different age groups. These studies can help to identify risk factors, predict prognosis, and evaluate the long-term outcomes of treatment. Large-scale epidemiological studies can investigate the incidence and prevalence of SOM in different age groups and identify potential risk factors, such as genetic predisposition, environmental exposures, and lifestyle factors. These studies can help to clarify the role of age as a risk factor for SOM and identify populations that may be at increased risk. Basic science research, using cell culture and animal models, can help to elucidate the cellular and molecular mechanisms that underlie SOM development and growth in different age groups. This research can identify potential targets for new therapies and lead to the development of more effective treatments.[11-15]

The demographic profile of patients with sphenoorbital meningioma (SOM) in this study revealed a particularly striking feature a pronounced female predominance. The data indicates that an overwhelming majority, 95.6%, of the patients diagnosed with SOM were female, while only a small fraction, 4.4%, were male. This translates to a female-to-male ratio of approximately 22:1, a figure that stands out when compared to the gender distribution typically observed in meningioma cases. While it is a well-established fact that meningiomas, in general, exhibit a higher prevalence in females, this study's findings present an exceptionally skewed ratio, deviating significantly from the more commonly reported female-to-male ratios of 2:1 to 3:1 that are often cited in Western and other regional studies. This notable gender disparity, characterized by such a strong inclination towards the female population, necessitates careful and in-depth examination. It prompts a crucial inquiry into the underlying factors that might be contributing to this phenomenon, particularly within the specific context of the Indonesian population under study. Understanding the reasons behind this skewed gender distribution is essential for a more comprehensive grasp of the disease's epidemiology and for tailoring effective clinical management strategies. The observation of a higher incidence of meningiomas in females has long fueled speculation and research into the potential role of hormonal influences in the development and progression of these tumors. Meningiomas are known to frequently express receptors for various sex hormones, including progesterone receptors (PR), estrogen receptors (ER), and androgen receptors. This expression of hormone receptors on meningioma cells suggests a potential link between hormonal fluctuations and imbalances and the development, growth, and overall behavior of these tumors. Extensive research efforts have been directed towards exploring the intricate relationship between hormone receptor status and different aspects of meningioma biology. Studies have investigated the potential

correlation between PR status and key tumor characteristics such as tumor biology and the likelihood of recurrence. Some research findings have indicated that negative PR expression, meaning the absence of progesterone receptors on tumor cells, may be associated with higher rates of tumor recurrence. This suggests that the presence or absence of PR could potentially serve as a prognostic marker, helping to predict the likelihood of tumor regrowth after treatment. Similarly, the influence of estrogen receptor (ER) levels on various cellular processes within meningiomas has also been a subject of investigation. Researchers have explored the potential correlation between ER levels and proliferation markers, such as Ki67. Ki67 is a cellular marker that is used to assess the rate of cell proliferation, or how quickly cells are dividing and growing. Understanding the relationship between ER levels and Ki67 expression could provide insights into the growth dynamics of meningiomas. Furthermore, studies have also examined the potential link between exogenous progesterone exposure and the risk of developing meningioma. Exogenous progesterone refers to progesterone that is introduced into the body from external sources, such as through certain hormonal therapies or medications. Some research has suggested that exposure to exogenous progesterone may be associated with an increased risk of meningioma development. This finding raises important considerations regarding the potential impact of hormonal therapies on meningioma risk, particularly in women. While the exploration of hormonal therapies holds promise as a potential future avenue for the management of meningiomas, it is crucial to emphasize that extensive and rigorous research is still necessary to fully unravel the complex interplay between hormones and meningioma biology. The mechanisms by which hormones influence tumor development, growth, and behavior are likely multifaceted and involve intricate signaling pathways. A deeper understanding of these mechanisms is essential before hormonal therapies can be safely and effectively implemented in clinical practice. The exceptionally high female-to-male ratio observed in this study, far exceeding the typical gender distribution reported for meningiomas, likely reflects the combined influence of several contributing factors. It is plausible that genetic predispositions within the specific Indonesian population under study play a significant role in the increased susceptibility of females to SOM. Genetic variations or polymorphisms that are more prevalent in Indonesian women could potentially increase their risk of developing these tumors. Further genetic studies are needed to explore this possibility and identify specific genetic markers associated with SOM in this population. In addition to genetic factors, the potential influence of differential environmental or hormonal exposures specific to the Indonesian population cannot be disregarded. Variations in dietary habits, lifestyle factors, or exposure to certain environmental toxins could potentially contribute to the observed gender disparity. Similarly, differences in hormonal profiles or patterns of hormonal fluctuations within the Indonesian female population might also play a role. Investigating these potential environmental and hormonal influences requires carefully designed epidemiological studies that take into account the unique characteristics of this population. Furthermore, it is important to acknowledge the potential for referral biases to have influenced the observed gender distribution in this study. Referral bias occurs when certain patient groups are more likely to be referred to a specific healthcare facility than others. In this case, it is conceivable that female patients with SOM are more likely to be referred to the tertiary referral center where the study was conducted, compared to male patients with the same condition. This could be due to various factors, such as differences in healthcare-seeking behavior between genders or referral patterns among primary care physicians. To address the potential for referral biases and obtain a more accurate and representative understanding of the gender distribution of SOM in Indonesia, it is essential to conduct further investigations using multi-center or population-based

study designs. Multi-center studies involve collecting data from multiple healthcare facilities across a wider geographical area, which can help to minimize the impact of referral biases specific to a single center. Population-based studies, on the other hand, aim to capture all cases of SOM within a defined population, regardless of where patients seek medical care. These types of studies provide a more comprehensive picture of the disease's epidemiology and can help to elucidate the true gender distribution. The implications of the strong female predominance observed in this study extend beyond purely epidemiological considerations. They have significant ramifications for both clinical practice and future research directions. From a clinical standpoint, healthcare providers in Indonesia should maintain a heightened level of vigilance in considering the possibility of SOM in female patients who present with orbital symptoms. This is particularly important given the potential for delayed diagnosis if the condition is not promptly recognized. Future research efforts should prioritize a more in-depth exploration of the specific hormonal profiles, genetic markers, and environmental factors that may contribute to the increased risk of SOM in Indonesian women. This research could involve a combination of approaches, including molecular studies to identify genetic variations, hormonal assays to measure hormone levels, and epidemiological surveys to investigate environmental exposures. A more comprehensive understanding of these contributing factors could pave the way for the development of targeted prevention strategies aimed at reducing the risk of SOM in susceptible individuals. Furthermore, it could also lead to the development of personalized treatment approaches that take into account the unique biological characteristics of the tumor in female patients, potentially improving treatment outcomes and reducing the likelihood of recurrence.[16-20]

5. Conclusion

This study has provided a comprehensive description of the clinical and demographic characteristics of spheno-orbital meningioma (SOM) in a large Indonesian cohort. The findings highlight the importance of considering SOM in the differential diagnosis of patients presenting with orbital symptoms, particularly proptosis. The striking female predominance observed in this study, with a female-to-male ratio of approximately 22:1, underscores the need for further research to elucidate the underlying hormonal, genetic, and environmental factors contributing to this gender disparity. The mean age of 44.3 years at diagnosis aligns with the typical presentation of meningiomas in middle-aged adults, but the wide age range (14-79 years) emphasizes that SOM can occur at any stage of adulthood. Recognizing this age variability is crucial for timely diagnosis across all adult age groups. While the study provides valuable insights into the clinical profile of SOM in Indonesia, it also acknowledges the limitations of a single-center, retrospective design. Future research should aim to validate these findings in multi-center or population-based studies to minimize referral bias and enhance the generalizability of the results. Further investigations into the molecular characteristics of SOM, including hormonal receptor status and genetic markers, may contribute to a more personalized approach to treatment and risk stratification. Ultimately, a deeper understanding of the factors influencing SOM development and progression will lead to improved diagnostic accuracy, more effective management strategies, and potentially, the development of preventive measures.

6. References

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