Raising Public Awareness about Meningioma : Research Results on Epidemiological and Histopathological Trends at Sembiring Genaral Hospital (2021-2024)

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Abstract- A public awareness campaign on meningioma was held at Martha Friska General Hospital in the form of a health lecture aimed at increasing community knowledge about this common intracranial tumor. The lecture focused on key aspects such as clinical symptoms, diagnostic methods, management strategies, and prognosis of meningioma. It also served to disseminate findings from previous research conducted at Sembiring General Hospital, where the majority of diagnosed cases were grade I (benign). The study reported the highest incidence in two age groups: 41–50 years and 61–70 years. Interestingly, in the 41–50 age group, the majority of cases were found in females, consistent with the general trend of female predominance in meningioma. However, a notable demographic shift was observed in the 61–70 age group, where male patients outnumbered female patients, with a male-to-female ratio of 3:1. This anomaly highlights the need for further investigation into age- and gender-related risk factors. The educational initiative emphasized the importance of early detection and understanding of meningioma, aiming to empower the public to seek medical attention promptly when symptoms arise. Public health education efforts like these are essential in reducing diagnostic delays and improving patient outcomes.

***Index Terms-*:** meningioma, public awareness, brain tumor, health education

I. INTRODUCTION

Meningioma are the most frequently diagnosed primary tumors of the central nervous system (CNS), accounting for approximately 30–40% of all intracranial neoplasms worldwide. These tumors originate from arachnoid cap cells of the meninges and are typically characterized by a slow-growing, benign course, although a subset can display atypical or malignant behavior depending on histological grading (WHO CNS Tumor Classification, 2021). [1]

Epidemiologically, meningiomas exhibit a pronounced sex-based disparity, with women being two to three times more likely than men to develop the disease—a trend strongly associated with hormonal influences, particularly the expression of estrogen and progesterone receptors within tumor tissues.[2,3] Additionally, the peak incidence occurs among individuals aged 40–70 years, with an increasing frequency observed in older populations.[4] The influence of hormonal contraceptives, menopausal hormone therapy, and other exogenous hormonal exposures has been particularly emphasized in recent literature as potential risk factors for female predominance.[5,6]

The histopathological spectrum of meningiomas is broad, yet the majority are classified as WHO Grade I, representing benign and well-circumscribed tumors such as meningothelial and transitional subtypes. Less frequently, tumors may exhibit features consistent with Grade II (atypical) or Grade III (anaplastic) designations, which are associated with higher recurrence rates and poorer prognoses.[7,8] Accurate grading is vital, as it guides clinical decision-making, particularly regarding the necessity of adjunctive therapies and postoperative surveillance.

Geographically, the burden of meningiomas varies significantly. While global incidence data have largely been informed by registries in high-income countries, region-specific studies in Southeast Asia—including Indonesia—have begun to reveal unique demographic and clinical patterns. Our recent retrospective study at Sembiring General Hospital in North Sumatera demonstrated that 64.7% of cases occurred in female patients, with the most affected age group being 41–50 years. Notably, a shift in gender prevalence was observed among patients aged 61–70 years, where male cases were more frequent, aligning with findings that suggest hormonal decline may alter tumor biology in aging populations.[9] These patterns are supported by studies conducted at other Indonesian centers, which highlight the increasing detection of meningiomas through routine imaging and

the role of hormonal contraceptive history as a contributing risk factor.[10,11]

Despite this, public awareness regarding the early symptoms and risk factors of meningioma remains limited, underscoring the importance of community-based educational initiatives. Public health education is needed to raise the knowledge and awareness of this type of brain tumor. This publication aims to translate key clinical insights into accessible health education, promoting awareness, early detection, and informed medical consultation among the general population, particularly in rural and semi-urban Indonesian communities.

II. Methodology

The community outreach program on raising awareness about meningiomas was organized by the Faculty of Medicine, Institut Kesehatan Medistra Lubuk Pakam, in collaboration with Martha Friska General Hospital, located in Pulo Brayan, Medan. The event was held on July 9, 2025, and targeted outpatients visiting the hospital. The timing was strategically chosen to align with a peak period for outpatient visits to ensure maximum participation. Information about the event was distributed through brochures and social media platforms a week before the scheduled session to ensure broad awareness among hospital patients and the local community.

The outreach began with a brief question & answer (Q&A) sesion designed to assess the participants' knowledge and understanding of meningiomas, including symptoms, diagnostic methods, and potential treatment options. This was followed by a detailed lecture delivered by an anatomical pathologist, who provided an informative presentation on meningiomas. The lecture covered key aspects such as the definition of meningiomas, common risk factors, clinical symptoms (such as headaches and seizures), the epidemiology and histopathology grading, and the importance of early detection using imaging techniques like MRI. The speaker also explained various treatment options, including surgical interventions. After the lecture, an interactive question and answer session allowed participants to ask questions and engage further with the material, providing an opportunity for clarification and discussion.

The event was promoted using brochures distributed in the outpatient department of the hospital and social media platforms to ensure maximum participation. All participants were informed about the purpose of the outreach and voluntarily attended. Ethical guidelines were followed, ensuring no personal medical data were collected. While the event was successful in reaching a substantial number of patients, its scope was limited by the size of the venue and the number of attendees on the specific day. Future initiatives could benefit from follow-up sessions or assessments to evaluate knowledge retention and the long-term impact of the outreach.

III. RESULT

The health education session on meningiomas was attended by 55 adults who were outpatients at RSU Martha Friska. The session began with an interactive Q&A to gauge the participants' initial knowledge about meningiomas. Many participants initially believed that brain tumors, like meningiomas, were extremely rare and only found in older individuals. A few participants also thought that brain tumors always caused severe symptoms like paralysis or loss of consciousness. However, it was apparent that many were unaware that meningiomas can often be asymptomatic, particularly in the early stages, and may only present with non-specific symptoms like headaches or mild seizures.

During the lecture, the participants showed strong engagement. The session, led by an expert in pathological anatomy, addressed key aspects of meningiomas, such as their benign nature, the risk factors (including age, sex, and hormonal influences), and their common symptoms like headaches, vision changes, or seizures. Visual aids were used, including diagrams of the brain to help participants understand where meningiomas most commonly occur and how they grow. The lecture also disseminate their previous study at Sembiring General Hospital about the epidemiological and histopathological trends of Meningioma at that hospital. Lecture emphasized the importance of early detection and the role of imaging techniques such as MRI in diagnosing meningiomas.

At the end of the lecture, an interactive Q&A session took place, where participants asked insightful questions about meningiomas. Some of the questions included:

1. What is the difference between a benign meningioma and a malignant one?
2. Can meningiomas be hereditary? Are there any genetic factors involved?
3. What are the treatment options available for meningiomas, and how is the treatment plan determined?
4. Are there any lifestyle changes or preventive measures that can reduce the risk of developing meningiomas?
5. If someone has a family member with a history of meningiomas, should they be regularly screened for the condition?

These questions indicated a growing curiosity and understanding about the nature of meningiomas and the importance of early detection. Most participants also responded positively to a short quiz at the end of the session, which was designed to test their understanding of the key points discussed during the presentation. The quiz questions included:

1. What is the most common symptom of a meningioma?
2. Are meningiomas always dangerous?
3. What is the first step in diagnosing a meningioma?

The results of the quiz revealed that the participants had gained a significantly better understanding of meningiomas, including their symptoms, risks, and treatment options. This outcome highlights the success of the educational session in increasing public awareness and knowledge about meningiomas, which could ultimately lead to earlier detection and better clinical outcomes for patients.

IV. DISCUSSION

Meningiomas are the most common primary tumors of the central nervous system (CNS) and represent a significant portion of all brain tumors, accounting for approximately 37% of cases worldwide. The incidence of meningiomas varies with age, sex, and geography, with studies showing that they are more common in adults, particularly those aged between 40 and 70 years.[10] In terms of gender, meningiomas exhibit a distinct predilection for females, with a reported female-to-male ratio of approximately 2:1. This gender disparity is believed to be influenced by hormonal

factors, as estrogen and progesterone receptors are often present in the tumor tissues.[11]

In Indonesia, meningiomas are also frequently encountered, with the prevalence of these tumors steadily increasing in various medical centers. One study from a hospital in Palembang, Indonesia, found that meningiomas were the most commonly diagnosed type of brain tumor.[11] Another study conducted at Sembiring General Hospital found that most cases were concentrated in individuals aged 41–50 and 61–70. Interestingly, women predominated in the 41–50 age group, but this trend reversed in older patients, with men outnumbering women in the 61–70 age group at a ratio of 3 to 1.[9] The incidence rates in certain regions of Indonesia suggest that meningiomas are an important health concern, especially given their higher frequency in older adults, mirroring global patterns.[10]

The risk factors for developing meningiomas include a combination of hormonal, environmental, and genetic influences. Hormonal exposure, particularly from contraceptives or hormone replacement therapy, is a significant risk factor. Studies indicate that approximately 70% of women diagnosed with meningiomas reported a history of hormonal contraceptive use, reinforcing the association between hormone levels and tumor development.[10] Additionally, head trauma and obesity are recognized as contributing factors to the development of meningiomas in some populations.[11] Genetic predispositions, particularly mutations in the NF2 gene, also increase the likelihood of developing these tumors, as seen in patients with neurofibromatosis type 2.[10]

Geographically, the incidence of meningiomas can differ significantly across regions, with high-income countries reporting higher rates compared to low- and middle-income countries. This difference is often attributed to better healthcare systems, more advanced diagnostic tools, and higher awareness of brain tumor symptoms in wealthier nations.[10] Studies from the United States, such as those conducted by the Central Brain Tumor Registry of the United States (CBTRUS), provide a comprehensive look at meningioma incidence across different demographic groups, showing a higher prevalence in Caucasian women.[11]

Understanding the epidemiology of meningiomas in specific geographic locations, like Indonesia, is crucial for the development of effective screening and treatment strategies. Despite the global trends, local factors such as dietary habits, lifestyle choices, and regional healthcare accessibility likely influence the patterns of meningioma incidence in various populations.[10] Future research should focus on these localized trends to tailor healthcare interventions and improve patient outcomes., may alter tumor dynamics differently, though this mechanism remains under investigation.

Meningiomas are often asymptomatic in their early stages, especially when located in less critical areas of the brain. However, as the tumor grows, it can cause various neurological symptoms due to pressure on adjacent brain structures. The most common symptom is headache, which can occur due to increased intracranial pressure caused by the growing tumor. These headaches are often described as persistent and may worsen in the morning or with physical exertion.[10,11]

Seizures are another significant symptom, with focal seizures occurring in about 25% to 30% of patients. These seizures can result from the tumor’s involvement in areas of the brain responsible for motor control. Meningiomas located in the frontal or temporal lobes are particularly prone to causing seizures.[10,12] Focal neurological deficits are also common, and their manifestation depends on the tumor's location. For example, a meningioma in the frontal lobe can lead to personality changes or cognitive impairment, while a tumor in the temporal lobe may present with visual disturbances or even loss of vision in one eye.[10,11]

In addition to these, other non-specific symptoms such as dizziness, nausea, and vomiting can arise, particularly in meningiomas located near the brainstem or those affecting the ventricular system. These symptoms are often a result of increased intracranial pressure.[10] Another sign of increased intracranial pressure is papilledema, or swelling of the optic disc, which can be observed during a routine eye examination.[11]

While these symptoms can point to meningioma, the slow-growing nature of these tumors means they can often remain undetected for extended periods. Many meningiomas are found incidentally during imaging studies conducted for unrelated reasons. Larger tumors, particularly those located near critical brain structures like the optic nerves or motor cortex, tend to cause more severe neurological impairments.[10] Early detection via advanced imaging, such as MRI, is essential for timely intervention and improved outcomes.

The other brain tumor with high incidence is glioma. These brain tumors are more aggressive and invasive, tend to present with more acute and widespread neurological symptoms. Unlike meningiomas, gliomas often cause progressive headaches, nausea, and vomiting due to the rapid increase in intracranial pressure. These symptoms are typically more severe and may appear suddenly, leading to faster neurological deterioration.[2,12] Gliomas, especially high-grade gliomas like glioblastomas, infiltrate surrounding brain tissue, causing diffuse cognitive deficits, motor dysfunctions, and more severe personality changes.[10] This contrast with meningiomas, where symptoms are typically more localized based on the tumor's position, such as cognitive and motor impairments when the tumor is in the frontal lobe or visual disturbances when it affects the temporal lobe.[11]

Seizures are a common symptom in both meningiomas and gliomas. However, in gliomas, seizures tend to be more generalized and can occur suddenly due to the invasive nature of the tumor, especially in high-grade gliomas like glioblastoma multiforme.[12] In contrast, meningiomas generally cause focal seizures, and they tend to be more localized depending on the tumor’s location in the brain.[10] The slower growth rate of meningiomas allows the brain to somewhat compensate for the mass effect, resulting in less severe and more localized symptoms, whereas gliomas, due to their rapid growth, can quickly lead to widespread neurological dysfunction.

Additionally, meningiomas may present with more subtle and gradual symptoms, such as changes in personality and cognitive impairment, particularly when located in the frontal or temporal lobes. Gliomas, on the other hand, often present with more abrupt and severe changes in cognition and personality due to their aggressive and infiltrative nature. This difference can make gliomas more challenging to manage clinically, as the symptoms may rapidly worsen without proper intervention.[2,12] Furthermore, gliomas tend to cause more diffuse neurological impairments as they infiltrate the brain parenchyma, affecting multiple regions of the brain at once. In contrast, meningiomas tend to remain

localized, causing symptoms that are more specific to the area affected.[10] Meningiomas are typically diagnosed using advanced imaging techniques, with magnetic resonance imaging (MRI) being the gold standard for detecting and assessing these tumors. MRI with contrast is particularly effective, as it provides high-resolution images that clearly depict the tumor's size, location, and relationship with surrounding brain structures, such as the dura mater, from which meningiomas originate. This imaging modality is highly sensitive, allowing for the detection of even small meningiomas, particularly those located in challenging areas like the skull base.[10,11] While CT scans are sometimes used in emergencies, they are less sensitive than MRI and may miss smaller tumors, especially in areas with minimal bone or calcification.[2] PET scans, although more commonly used for gliomas, may occasionally be employed in specific cases of meningiomas to assess metabolic activity, although they are not as effective in detecting these tumors.[10] In addition to imaging, biopsy may be necessary for definitive diagnosis, especially in cases of atypical or recurrent meningiomas, where histopathological evaluation helps determine tumor grade and behavior.[11]

When differentiating meningiomas from gliomas or other malignant brain tumors, several key differences are apparent. Meningiomas are typically extra-axial, meaning they grow outside the brain tissue and tend to displace rather than infiltrate surrounding structures, making them well-defined and more easily surgically accessible. On MRI, meningiomas often appear as well-circumscribed masses with homogeneous enhancement after contrast administration, distinguishing them from gliomas, which are usually intra-axial and tend to infiltrate the surrounding brain tissue, creating irregular and poorly defined borders.[10] Gliomas, particularly high-grade gliomas like glioblastomas, demonstrate a more aggressive growth pattern and often show heterogeneous enhancement with areas of necrosis and edema, which is less common in meningiomas.[12] The infiltrative nature of gliomas also results in a more widespread pattern of neurological deficits, while meningiomas typically cause more localized symptoms based on their location. For example, a meningioma in the frontal lobe may lead to personality changes and cognitive impairment, while gliomas in the same region may cause more diffuse cognitive and motor dysfunctions.[11] The rapid progression of gliomas also contrasts with the slower onset of symptoms in meningiomas, which are often more gradual and less severe.[2] Thus, accurate imaging and clinical evaluation are essential in distinguishing between meningiomas, gliomas, and other brain tumors, ensuring that patients receive the most appropriate treatment.

The histopathological examination plays a crucial role in the diagnosis and classification of meningiomas after tumor resection, as well as in determining the appropriate treatment plan. Meningiomas are classified into three grades by the World Health Organization (WHO) based on their histological features: Grade I (benign), Grade II (atypical), and Grade III (anaplastic or malignant). Histopathological examination is typically performed after surgery to evaluate the tumor’s cell morphology, mitotic activity, and other factors that influence prognosis. Grade I meningiomas, which are the most common and least aggressive, exhibit low mitotic activity and are typically well-defined with clear boundaries.[11] These tumors generally have a favorable prognosis following complete surgical resection.

In contrast, Grade II meningiomas (atypical) show moderate mitotic activity and may exhibit more aggressive behavior, with a higher likelihood of recurrence after surgery. Grade III meningiomas (anaplastic) are malignant and show high mitotic activity, necrosis, and a more invasive growth pattern, often necessitating both surgical resection and adjuvant therapies such as radiation therapy.[2] The histopathological examination is therefore vital for determining the tumor grade and guiding further management decisions.

In addition to the basic WHO grading, advanced molecular and genetic studies may be conducted to provide further insights into the tumor’s behavior and potential response to treatment. For instance, genetic mutations, such as those in the NF2 gene (associated with neurofibromatosis type 2), are commonly observed in patients with meningiomas and may influence the management approach.[2] Additionally, molecular markers and imaging studies are increasingly used to refine treatment strategies and assess the tumor’s response to therapy.

The management of meningiomas is primarily surgical, with the goal being complete resection of the tumor. Surgery remains the treatment of choice for symptomatic meningiomas, especially those causing neurological deficits or increased intracranial pressure. The success of surgery depends largely on the tumor's location and the extent of resection. For benign meningiomas (WHO Grade I), complete surgical resection is often curative, with a low risk of recurrence. The Simpson grading system is commonly used to assess the extent of tumor resection and predict the likelihood of recurrence. This system grades resection from I (complete resection) to V (subtotal resection), with Grade I and II resections associated with better outcomes and lower recurrence rates.[10,12] In cases where the tumor is located in difficult-to-reach areas, such as the skull base, complete resection may not be possible, and subtotal resection may be considered. For higher-grade tumors (Grade II and III), adjuvant therapies such as radiation therapy may be necessary to control tumor growth and reduce the risk of recurrence.[2]

Radiation therapy is generally considered for atypical or malignant meningiomas (WHO Grade II and III), especially when the tumor cannot be completely removed. Stereotactic radiosurgery (SRS) or conventional external beam radiation therapy (EBRT) may be used as adjuncts to surgery, particularly when the tumor is located in a critical area or when there is a high risk of recurrence. SRS is often preferred for small or residual tumors that are difficult to treat surgically. For higher-grade meningiomas, the combination of surgery and radiation therapy has been shown to improve survival rates and reduce the likelihood of recurrence.[12]

The prognosis of meningiomas largely depends on several factors, including the tumor's grade, size, location, and the extent of surgical resection. Meningiomas are most commonly benign (WHO Grade I), and for these tumors, the prognosis is generally very favorable, particularly when complete surgical resection is achieved. The recurrence rate for Grade I meningiomas is low, and with successful resection, patients can have an excellent long-term survival rate.[12] The Simpson grading system plays a critical role in predicting recurrence. A Simpson Grade I or II resection, which involves complete or near-complete removal of the tumor, is associated with the lowest recurrence rates.[10] When meningiomas

are resected in their entirety, the chance of recurrence is minimal, and the long-term outcome is typically positive.

For atypical (Grade II) and malignant (Grade III) meningiomas, the prognosis becomes more guarded. These tumors tend to have higher mitotic activity, a more aggressive growth pattern, and a greater likelihood of recurrence even after surgical resection.[2] Grade II meningiomas may require additional treatments, such as radiation therapy, to reduce the risk of recurrence. In cases of Grade III meningiomas, adjuvant therapies like radiation and chemotherapy are often necessary, and even with aggressive treatment, the prognosis can be less favorable due to the tumor's invasive nature.[12] High-grade meningiomas have a significantly higher risk of local recurrence and, in some cases, metastasis, making long-term monitoring crucial for detecting early recurrence.[11]

In general, the prognosis for patients with meningiomas is better compared to patients with malignant brain tumors like gliomas, especially if the tumor is benign and resected completely. However, the location of the tumor can affect the prognosis. Meningiomas located near critical structures, such as the optic nerves, brainstem, or spinal cord, may be more difficult to remove completely, thus increasing the risk of recurrence.[2] Additionally, the presence of comorbidities, the patient's age, and overall health can influence recovery and the likelihood of recurrence. Younger patients, in particular, tend to have a better prognosis, as their bodies are generally more resilient to surgery and radiation therapy.[10]

While benign meningiomas are typically associated with excellent long-term survival rates, regular follow-up imaging is essential to monitor for recurrence, especially for tumors that could not be completely resected. For patients with higher-grade tumors, more intensive follow-up and adjuvant therapy are required to manage the risk of recurrence and to ensure the best possible outcomes.

Public education plays a crucial role in improving awareness about the clinical signs of meningiomas and the importance of early detection. Early identification of symptoms such as persistent headaches, seizures, and focal neurological deficits can significantly aid in preventing tumor progression and mitigating the risks associated with delayed diagnosis. Meningiomas, particularly when undetected for long periods, can grow in size, potentially leading to significant mass effects, such as brain compression, and worsen neurological function. Educating the public about these warning signs can lead to earlier visits to healthcare professionals, facilitating timely imaging and diagnosis. Additionally, raising awareness about the benefits of early detection could reduce the incidence of late-stage diagnosis, which often results in more complex and aggressive treatment plans. Health education campaigns and community outreach programs should be routinely conducted to ensure that individuals are aware of potential symptoms and understand the importance of seeking medical attention at the first signs of unusual neurological symptoms. Such preventative measures, including regular screenings and public health initiatives, are essential for reducing the burden of meningioma and improving outcomes by preventing the tumor from reaching advanced stages where surgical options become limited or less effective.

V. CONCLUSION

Effective management of meningiomas not only relies on early diagnosis and surgical intervention but also on the critical role that public education plays in improving awareness about this condition. Raising awareness of the clinical signs of meningiomas, such as persistent headaches, seizures, and focal neurological deficits, is essential for the timely identification and intervention that can significantly improve patient outcomes. Public education, through consistent health campaigns and community outreach programs, serves as an important tool in ensuring early detection, thus preventing the progression of the tumor and reducing the risk of serious complications.

- Public education plays a crucial role in raising awareness about the early signs and symptoms of meningiomas, such as headaches, seizures, and focal neurological deficits.
- Early detection through public awareness campaigns can prevent the progression of meningiomas, reducing complications from increasing tumor size and brain compression.
- Health education programs should be routinely implemented to inform the public about the importance of seeking medical attention at the first sign of neurological symptoms.
- Regular screenings and proactive outreach can help identify meningiomas in their early stages, allowing for more effective and less invasive treatment.
- Community-based initiatives are essential to increasing awareness, reducing delayed diagnoses, and ultimately improving patient outcomes by preventing the tumor from advancing to a stage where treatment becomes more difficult.
- The integration of public education into healthcare strategies will enhance the overall management of meningiomas and improve the long-term quality of life for patients.

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