Severe Headache as the Initial and Isolated Manifestation of a High-Volume Intracranial Meningioma: A Case Report

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ABSTRACT

Meningiomas are the most common benign intracranial tumors and make up 13-26% of all primary intracranial tumors. This tumor can be seen through radiological images and classified through the results of anatomical pathology examination. A 48-year-old woman came from Cileungsi Hospital with complaints of severe headaches in the past 3 days ago. When examined using a CT scan with contrast, an extra-axial mass was found in the right frontal region with prefocal edema around it. This supports the picture of high-grade meningioma which causes midline deviation towards the left. High-grade meningiomas, as one of the aggressive types of brain tumors, pose significant challenges in the fields of neurology and oncology. With its characteristic rapid growth and tendency to relapse, a thorough understanding of its diagnosis, treatment, and prognosis is essential in efforts to improve patient outcomes. This patient is scheduled for craniotomy surgery with a neurosurgeon specialist and found a tumor in the right parietal region with a solid consistency. with the patient's complaint lasting only 3 days, feeling severe headaches, it was found that the tumor image obtained was already large, making it is possible that the final outcome of the disease in these patients is poor due to delays in treatment. This case report shows that early detection of this disease needs to be done considering that the

patient's complaints only lasted 3 days, which is not in line with the progression of the tumor itself.

Keywords: Meningioma, Brain tumor, High-grade, Asymtomatic meningioma

Introduction

Asymtomatic meningiomas often present a challenge in neurological diagnosis[1]. These tumors, although generally benign, can develop without obvious symptoms, making early identification difficult[2]. This ignorance can result in treatment delays and further complications[3]. In this paper, we will explore the factors thacontribute to the undetectability of meningiomas, available imaging methods, and the importance of symptom awareness that has the potential to improve patient clinical outcomes[4]. Some risk factors for meningioma include radiation exposure, especially to the head area, as well as a family history of brain tumors. Additionally, the female gender is more susceptible to meningiomas, and certain genetic conditions, such as neurofibromatosis type II, may also increase the risk[5]. Advanced age and hormonal disorders, such as those related to pregnancy or hormone therapy, have also been identified as possible contributing factors so in these patients it is necessary to explore risk factors for increased symptoms and progression of meningiomas that are not detected early[6].

Meningiomas are primarily classified into three grades based on their histological characteristics and behavior[5]. Grade I, the benign category, includes subtypes such as classical meningiomas, transitional meningiomas, and fibrous meningiomas, all of which typically exhibit slow growth and have favorable outcomes with treatment. Grade II, known as atypical meningiomas, are more aggressive and have a higher likelihood of recurrence after treatment[6]. Grade III consists of anaplastic meningiomas, which are malignant, characterized by rapid growth and a greater potential for metastasis[7]. Additionally, there are variants like metastatic meningiomas that arise from cancer cells spreading from other body parts[6]. This classification system helps guide treatment decisions and prognostic assessments for individuals diagnosed with meningiomas[8].

Case Illustration

A 48-year-old woman came to the hospital with complaints of severe headaches in the past 3 days ago. The patient said this was the first time he felt this severe pain. These headaches really interfere with daily activities. Nausea, vomiting and lack of appetite

during the complaint are also felt by the patient. The patient denies any head trauma. The patient said that the patient had used hormonal birth control pills when the patient was young for 10 years. The patient did not have complaints of vision, hearing or motor disorders, or memory loss. The patient denied a history of high blood pressure and diabetes mellitus. A history of similar diseases in the family was also denied. The patient had a history of ischemia stroke for 13 years ago. The patient said he was diligent in seeking treatment and received medication every month given by a neurologist. The patient was only given 1x80 mg apsilet taken 3 times a day. The results of the physical examination showed that GCS 15 (E4M6V5), blood pressure 100/70 mmHg, pulse frequency 102x/minutes, respiratory rate 20x/minute, temperature 36, oxygen saturation 98% on room air. Patient weighs 60 kg with a height of 155 cm which means belong to class of overweight. She has the general physical examination showed limb weakness was found on the left side of her body since 1 week ago. The patient said he could still walk and hold objects as usual, but her strength was not optimal. Neurological examination found that round pupil isochores 2 mm/2 mm, direct and indirect light reflexes of the right and left eyes are positive. Examination of the cranial nerve cannot be assessed, physiological reflexes are within normal limits, and there are no pathological reflexes.

On physical examination of the extremities, on her left hand the result was 4444 and on her feet the result was 4444. An isodense lesion appears in the extra-axial fronto-temporal region of the right, broad-based, oval shape, size 5.1x5.3x5.8 cm, pre- contrast margin 47 HU, post-contrast 65 HU, firm margin, regular edges, calcification (-), there is perifocal edema around it. sulci and fissura sylvii are not primary. The boundary of the cortex and medulla is clear. Ventricular and cistern edema do not dilate or shrink. midline deviated leftward by 1.4 cm. visible water sheath of cellulae mastoidea dextra. A sclerotic lesion appears on the ninus maxillaris dextra, round shape, density 825 HU, clear borders, regular edges. Bulbus occuli and retrobulbar structures were within normal limits. The visualized skeletal system is intact (Figure 1 and Figure 2).

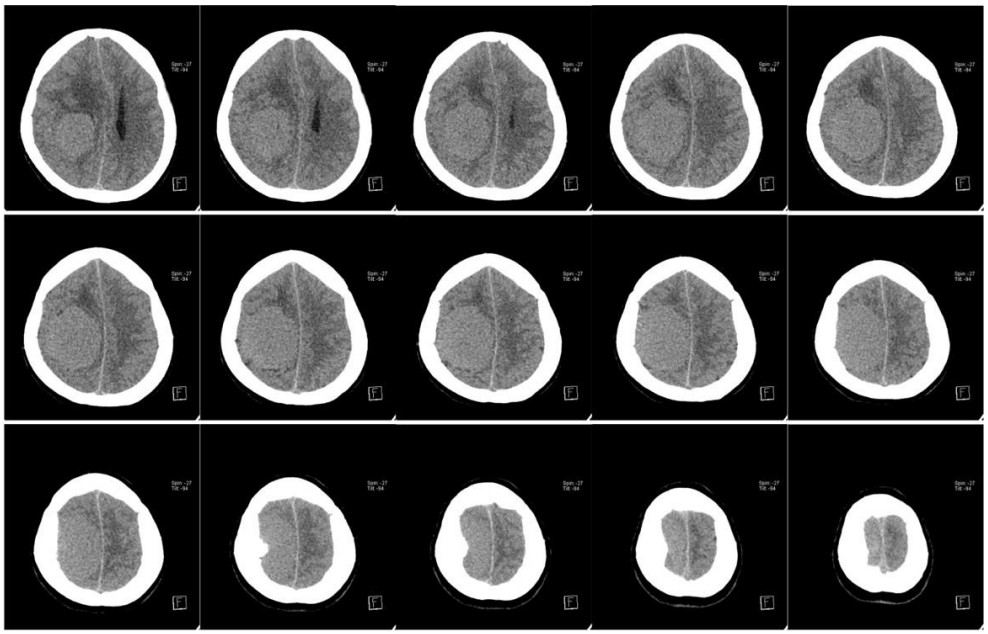

Figure 1. Head CT-Scan without contrast pre-craniotomy.

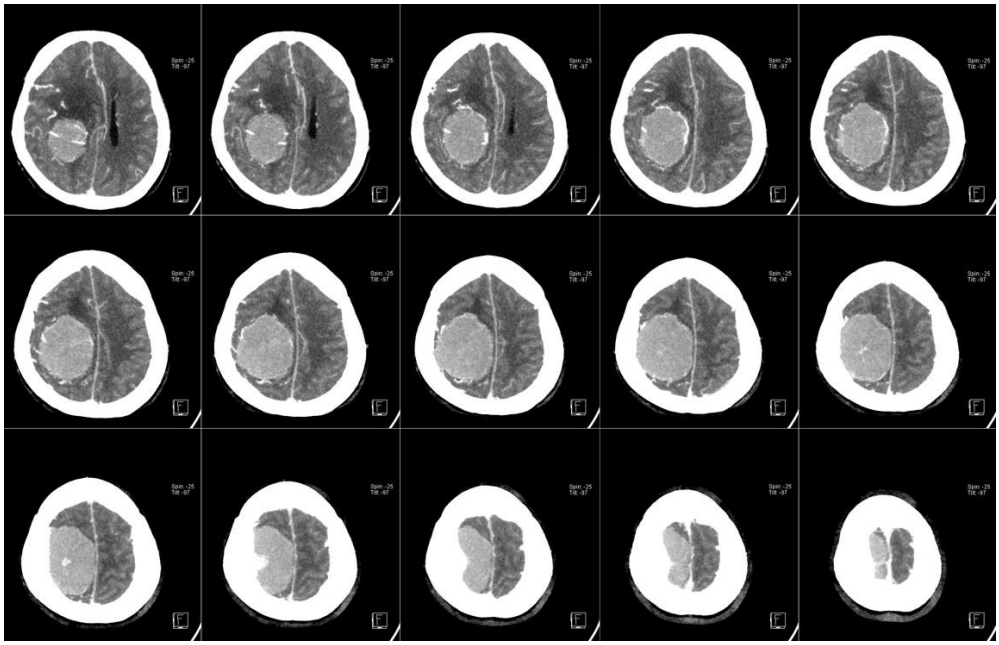

Figure 2. Head CT-Scan with contrast pre-craniotomy.

Discussion

Meningioma is a type of tumor that arises from the protective membranes, known as meninges, surrounding the brain and spinal cord[4]. Typically benign, these tumors can nonetheless lead to significant neurological symptoms depending on their size and location[8]. Understanding meningiomas is crucial, as they can impact patients' quality of life

and necessitate various treatment approaches, from monitoring to surgical intervention[9]. Delving into the characteristics and implications of meningiomas ultimately helps in better patient management and awareness of this condition[10]. Early detection in patients needs to be carried out so that developing tumors can be immediately recognized and intervention taken to prevent unwanted complications[4].

In this patient, the clinical symptoms obtained were very atypical. The patient began experiencing significant complaints starting 3 days ago, indicating that the meningioma obtained in this patient was asymptomatic. Asymptomatic meningioma refers to a type of brain tumor that usually grows slowly and does not show any symptoms in the affected individual[2]. Asymptomatic meningiomas are relatively common, with global prevalence estimates generally ranging from 0.3% to 2% of the general population[6]. Advances in imaging technology have led to increased incidental detection, particularly during scans for unrelated health issues, with some studies indicating that up to 4% ofindividuals may have asymptomatic meningiomas identified at autopsy[7]. The prevalence tends to rise with age and is more frequently observed in females, with a typical female-to-male ratio of about 2:1. Although regional variations exist, comprehensive data on global prevalence is limited, and many asymptomatic meningiomas remain stable over time, often requiring monitoring rather than immediate treatment[3]. This underscores the importance of individualized management strategies for patients diagnosed with these tumors[10].

These tumors are often discovered accidentally during imaging examinations, so these tumors can develop without causing noticeable symptoms for a long time such as MRI or CT scans performed for unrelated medical problems[6]. These tumors can remain undetected for long periods of time[7]. Their benign nature means they do not usually aggressively invade surrounding brain tissue, and many are located in areas of the brain where they exert minimal pressure on important structures such as nerves or blood vessels. In addition, the brain has an extraordinary ability to adapt to the presence of tumors, compensating for changes in pressure or space[1]. Individual anatomical variations also play a role, as some people may have a higher tolerance for abnormalities caused by tumors[10]. As a result, many meningiomas are discovered incidentally during imaging studies performed for unrelated medical problems, highlighting their often-invisible nature[3].

Remembering that in the patient's history there is a history of stroke and use of hormonal birth control pills, this could be a risk factor for the patient developing meningioma[3]. Meningiomas and strokes may be related in some contexts, especially when meningiomas cause compression effects on blood vessels, which can increase the risk of

ischemia. In addition, the presence of a meningioma may complicate the diagnosis of stroke, because the symptoms of both can overlap[11]. Research into the interaction between the two is important to understand how management of these conditions can impact patient outcomes[1]. In this context, attention to symptoms and appropriate imaging are key to effective diagnosis and treatment[10].

The existence of a greater meningioma incidence ratio in women shows that hormones are linked to the risk of meningioma, in addition to the influence of other risk factors[7]. Approximately 70-80% of meningiomas are positive for progesterone receptors and to a lesser extent estrogen receptors, consistent with the greater incidence ratio of meningiomas in women, and strongly related to the hormonalcomponent of tumor growth. There is an association between exogenous hormonal contraception and the risk of meningioma[12]. First, the use of exogenous progesterone (for example in 3-month injectable contraceptives) affects the expression of progesterone receptors (RP) which is associated with the incidence of meningioma. Second, there is some evidence indicating the involvement of the Neurofibromatosis-2 (NF2) gene, as a direct marker of meningioma-specific tumor suppressors in the etiology of meningioma. Several studies show that certain mutations in the NF2 gene increase the risk of meningioma. In addition, several studies suggest that changes in RP expression can affect NF2 expression[13].

The longer the exposure to exogenous progesterone injection, the lower the expression of RP and NF2 messenger ribonucleic acid (mRNA) in the serum. Low expression of PR and NF2 mRNA is significantly and independently associated with a higher risk for women of suffering from meningioma[13]. Using hormonal contraception for more than 10 years increases the risk of meningioma by18.22 times, while using hormonal contraception for less than 10 years increases the risk of meningioma by 5.86 times[7].

In this patient, a tumor was also found in the parietal lobe. This might be a link to why the patient has weakness in the limbs. The parietal lobe functions to process sensory information from the body, such as touch, pain, and temperature. In addition, this lobe plays a role in space mapping and spatial perception, helping us understand the position of objects around us[11]. Due to the size of the tumor, the patient's meningioma may press forward and affect the frontal lobe. The frontal lobe is a vital part of the brain responsible for a wide range of functions that are essential for daily life. It plays a key role in motor control, overseeing the planning and execution of voluntary movements. So that the patient finds weakness in the limbs[14]. Motor descent in the gyrus, particularly within the precentral

gyrus (the primary motor cortex), is primarily driven by the activation of upper motor neurons that initiate voluntary movements. These neurons send signals through the corticospinal tract, which descends from the motor cortex, traversing the brainstem and entering the spinal cord[11].

Here, they synapse with lower motor neurons that directly innervate skeletal muscles, facilitating movement. Additionally, the process involves the planning and coordination of movements by surrounding regions such as the premotor and supplementary motor areas[14]. Sensory feedback from the body, including proprioceptive information, further informs and adjusts motor commands to ensure smooth execution. The involvement of the basal ganglia and cerebellum also plays a crucial role in refining motor output and maintaining coordination. Together, these elements in the gyrus work in concert to regulate motor descent and the execution of voluntary actions[12].

This patient had a craniotomy performed by a neurosurgery specialist at Cileungsi Regional Hospital 1 week after this patient was admitted to the hospital. When the tumor was removed, a yellowish tumor was found 4-5 cm above the surface of the parietal lobe. 1 day after the patient finished surgery, the patient said that symptoms such as severe headaches and weakness in the limbs had decreased quite a lot. The patient is treated approximately 5 days after the operation and the patient can go home with the doctor's prescription medication. 1 week later the patient was taken to the neurosurgery clinic for routine checks. The patient said that the patient had improved from before the operation. The patient has also started to carry out activities as usual. It's just that sometimes patients still feel weak, so they need to sit down frequently to rest.

The patient was also asked to do another CT scan and the results were obtained There was a closed defect in the right frontoparietal os. A semilunar heterogeneous lesion was seen in the right frontoparietal concavity, 0.9 cm thick with pneumocephalus. A heterogeneous lesion appeared in the right frontoparietal lobe with indistinct boundaries. On the contrast post some show the sting. The shape and position of the bilateral lateral ventricles are asymmetrical. The size of the right lateral ventricle, 3 was slightly narrowed, the left ventricle and 4 were not dilated. The subarachnoid space appeared normal. The cisterna ambiens and basalis appeared normal. The juxtaellar area and the "cerebello-pontine angle" area were still within normal limits. The cerebellum and pons parenchyma did not show pathological density. Bilateral mastoid air cells scanned appeared normal. The scanned paranasal sinuses were within normal limits. Bilateral bulbous oculi and retrobulbar spaces were within normal limits. There was a

shift of the midline structure to the left by 0.8 cm.

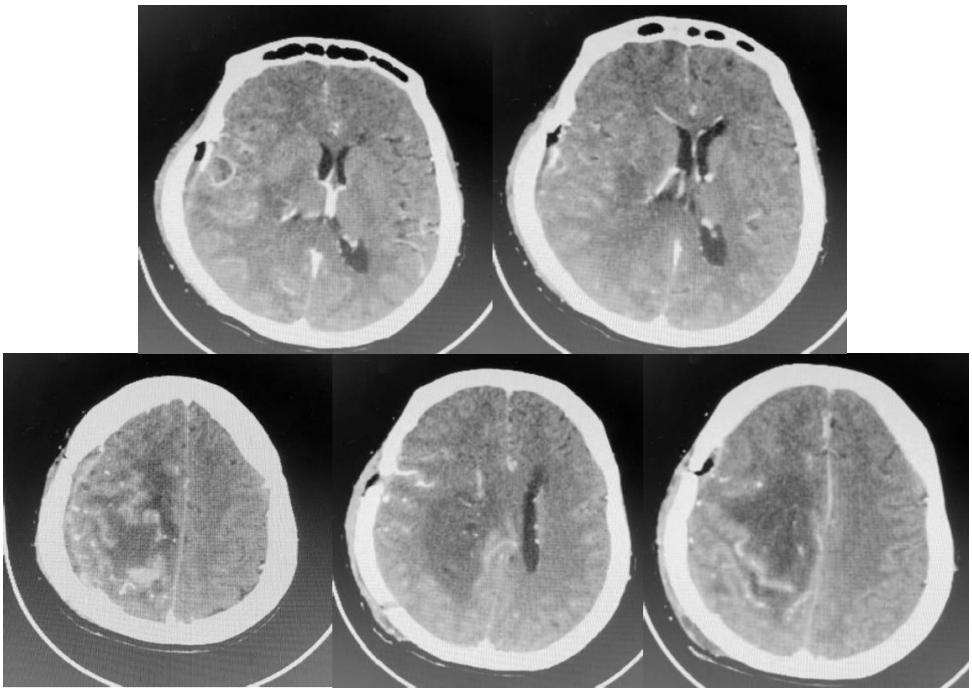

Figure 3. Head CT-Scan with contrast post-craniotomy.

Conclusion

Meningioma shows that although these tumors are generally benign and have a good prognosis after treatment, it is important to pay attention to the risk factors and symptoms that may appear. The patient was found to have risk factors in the form of the patient being female, having a history of stroke and using contraceptives in the form of hormonal pills. Early detection is also very necessary by carrying out supporting examinations. Early diagnosis through appropriate imaging and histological evaluation is crucial in determining tumor type and grade, which in turn influences treatment strategies. Potential complications, including neurological symptoms and risk of recurrence, need to be managed carefully. With a better understanding of the characteristics of meningiomas, it is hoped that clinical outcomes and patient quality of life can be improved.

Asymptomatic meningioma refers to a type of brain tumor that develops from the meninges, the protective membranes surrounding the brain and spinal cord, without causing any noticeable symptoms in the patient. These tumors are often discovered incidentally during imaging tests, such as MRI or CT scans, that are performed for other medical reasons. The reasons for their asymptomatic nature include their typically slow growth rate, which

allows the brain to adapt without triggering neurological issues, and their location; tumors situated away from critical structures in the brain are less likely to cause problems.

Most meningiomas are benign, meaning they do not aggressively invade surrounding tissues, which contributes to their lack of symptoms. When a meningioma is asymptomatic, doctors often adopt a "watchful waiting" approach, involving regular follow-up imaging to monitor the tumor's size and any potential changes. This strategy is especially common for smaller tumors that do not pose an immediate threat. Overall, the prognosis for asymptomatic meningiomas is generally favorable, as many individuals can live without complications unless the tumor begins to grow significantly or symptoms eventually develop, necessitating further intervention.

Ethical Approval

Institutional board approval not required.

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Conflict of Interest

There are no conflicts of interest.

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References

1. Riemann BJ. Long-term outcomes of patients with asymptomatic meningiomas. Neurosurgic Rev. 2018;41(1):151-158. https://doi.org/10.1007/s10143-017-0867.
2. Geng B, Wu X, Brackett A, Malhotra A. Meta-analysis of recent literature on utility of follow-up imaging in isolated perimesencephalic hemorrhage. Clinic Neurol Neurosurg. 2019;180:111-116. https://doi.org/10.1016/j.clineuro.2019.03.006.
3. Mendez JL, Ross JL. A comprehensive review of asymptomatic meningiomas: diagnosis, management and outcomes. J Neurooncol. 2017;134(1):11-20.
4. Warren KE, Ater JL. Meningiomas: Diagnosis and Management. In: Neuro-onclogy 2nd Edition. Oxford University Press. 2015.

5. Flicker J. Asymptomic meningiomas: a review of clinical managemt. J Neurosurg. 2021.
6. Ogasawara C, Philbrick BD, Adamson DC. Meningioma: a review of epidemiology, pathology, diagnosis, treatment, and future directions. Biomedicines. 2021;9(3):319. https://doi.org/10.3390/biomedicines9030319.
7. Jiang H, Yang K, Ren X, Cui X, Li M, Lei Y, Lin S. Retracted: diffuse midline glioma with H3 K27M mutation: a comparison integrating the clinical, radiological, and molecular features between adult and pediatric patients. J Nuerooncol. 2020;22(5):e1-e9. https://doi.org/10.1093/neuronc/noz152.
8. Louis DN, Perry A, Reifenberger G, Deimling Av, Figarella-Branger D, Cavenee WK, et al. The 2016 World Health Organization classification of tumors of the cental nervous system: a summary. Acta Neuropathologica. 2016; 131:803-820. https://doi.org/10.1007/s00401-016-1545-1.
9. Cohen AR, Khanna R. Management of asymptomatic meningiomas: a systematic review. World Neurosurg. 2021;146:e115-e123. https://doi.org/10.1016/j.wnweu.2020.09.096.
10. Paranathala MP, Mitchell P. Neurogenic cough associated with hyperintensity in Dorsal medulla: case report and anatomical discussion. World Neurosurg. 2020;144:196-198. https://doi.org/10.1016/j.wneu.2020.09.096.
11. Baker CH, Matz M. Meningiomas and their association with ischemic stroke. J Neurooncol. 2015;121(1):45-52.
12. Yang X, Liu F, Zheng J, Cheng W, Zhao C, Di J. Relationship between oral contraceptive and the risk of gliomas and meningiomas: a dose-response meta-analysis and systematic review. World Neurosurg. 2021;147:e148-e162. https://doi.org/10.1016/j.wneu.2020.11.175.
13. Kao YC. The association between oral contraceptive use and meningioma: a meta-analysis. J Neurooncol. 2021;152(2):2331-241.
14. Aly MA, Abdalla M. Meningiomas and ischemic stroke: A case report and literature review. J Neurosurg, 2020;132(5):1515-1521.