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A Rare Case of Dural Tail Sign in the Patient with Glioblastoma Multiforme: A Case Report

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ABSTRACT

Introduction: The dural tail sign (DTS), which is rarely seen in patients with glioblastoma multiforme (GBM), is reported here. This sign is generally found as a manifestation of meningioma due to the reactive changes of the tumor's invasion. **Case:** A 61-year-old Javanese man presented with a gradually worsening headache two months prior to hospital admission. He also suffered from paralysis of his right extremities. His complete blood tests and clinical chemistry were within normal limits. A head CT scan showed a large mass near the convexity of the brain in the left parietal lobe, along with edema and a shift of the midline structures to the right. This was confirmed on the T1W1 MR images with contrast, where DTS was clearly shown. Following surgical resection and tumor excision, histopathology analysis revealed GBM with malignant cell infiltration to the dura in the vicinity of the neoplasm. **Conclusion:** Here we showed a DTS in GBM as a malignant infiltration marker into the dura

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INTRODUCTION

Neoplasms of the central nervous system (CNS) could be sourced from the encephalon and/or the spinal cord, as well as from the meninges. There are primary and secondary malignancies in this system, i.e., glioblastoma multiforme and meningioma.¹ It was reported that in meningioma, one of the pathognomonic signs observed from magnetic resonance imaging (MRI) is the dural tail sign. This sign is reported to have a sensitivity and specificity of 58.6% and 94.02%, respectively, for detecting meningioma.

Dural tail sign (DTS) is a thickening of the dura adjacent to an intracranial pathology, generally associated with convexity meningiomas.^{2,3} This flare sign can be seen on the contrast T1-weighted magnetic resonance (MR) images, with unclear pathophysiology and clinical significance.^{1,4} Even though several peripherally located intra- and extra-axial lesions associated with the DTS have been reported, i.e., schwannomas, adenoma, adnohypophysitis, granulomatous disorders, neuromas, lymphomas, choromas, chordomas, metastases, cerebral Erdheim-Chester disease, syphilitic gumma, cerebral aspergillosis, and arterial malformations, they are rarely observed in gliomas. The DTS, however, have been reported to appear in the T1-enhanced MRI of Hodgkin Lymphoma in the central nervous system, prostate and neuroblastoma metastasis, bronchogenic tumors, papillary adenocarcinoma, and nasopharynx neoplasma.^{1,5,6} The DTS appearance in the radiography of a glioblastoma multiforme case is rare; it is an intraparenchymal tumor of the central nervous system and thus has a different tissue origin from DTS. This calls for caution from every clinician who deals with DTS, not only to carefully consider the pathology and anatomy test results and hence the treatment plan, but also to be more aware that this sign could also be found in various CNS tumors. As it has been reported, a more blatant DTS seen in the contrast-enhanced MRI is more likely to be found in meningiomas than in malignant tumors.^{7,8}

In this paper, we report the DTS finding in a GBM that is rarely seen. The main objective of this paper is to report that DTS has not always indicated a meningioma.⁹ Clinicians should do further evaluation and probably employ other methods of diagnosis, i.e., histopathology, prior to definitive therapy.

CASE

A 61-year-old Javanese male patient presented with a gradually worsening headache two months prior to hospital admission. His vital signs were within normal limits, with a pain scale of 6 out of 10. His

Glasgow Comma Scale was 4-4-5; he suffered from bradypsychia. Both of his pupils were isochoric with normal reflexes. The sensory examination showed right hemiparesis. He also suffered from paralysis of his right extremities. There was a declining physiological reflex on his right side. He had a central type of right facial palsy and right glossae palsy. His cardiorespiratory function, complete blood tests, blood gas analysis, fasting glucose level, electrolytes, and liver and kidney function tests were within normal limits.

A head computerized tomography (CT) scan with contrast revealed a slight enhancing solid mixed cystic-intraaxial lesion (55 HU) in his left parietal lobe of 4.6x3.5x4.5 cm with wide perifocal edema causing an approximately 1.5 cm midline shift to the contralateral side. This was confirmed on the T1W1 MR images with contrast, where the dural tail sign was clearly shown in three different planes (Figure 1). From the MR angiography, the circulus arteriosus was patent; increased choline/creatinin and choline/N-acetylaspartate were shown from the MR spectroscopy; and increased rCBV (relative cerebral blood volume) was found from his MR perfusion.^{10,11}

The patient was diagnosed with malignant melanoma with glioblastoma multiforme as the differential diagnosis and then planned for surgery. Surgical resection followed by tumor excision was performed while the dural thickening was extirpated cautiously with IOM (intraoperative neuromonitoring).^{12,13} The pathological anatomy could not determine whether it was a grade IV glioblastoma or a grade III anaplastic meningioma (World Health Organization classification). However, the histopathology analysis confirmed for GBM NOS (not otherwise specified, grade IV WHO), with cellular infiltration to the dura in the vicinity of the neoplasm, increased cellular proliferation, and angiogenesis (Figure 2).¹⁴ One week after surgery, the patient was discharged with significant improvement in his general condition. A cycle of chemotherapy using temozolomide (150x body surface area) and radiotherapy combination for 25 times has been done and will be followed by a control head MRI for further planning. A routine follow-up has been scheduled to monitor his signs and symptoms; three weeks post-surgery, his motor and sensory skills improved significantly, and the patient can manage daily life with minimal help (the Karnofsky performance index score was 90%).¹⁵

DISCUSSION

In the current case, the DTS resulted from the grade IV glioblastoma muliforme invasion into the dura. Other pathophysiologies of DTS include fibrous

tissue with proliferation of loose connective tissue, hypervascularity, or vascular dilatation to extend the extracellular space.¹⁶ In the current case, GBM was established from the histopathology study of the tumor, which showed GBM extension to the dura, vascular proliferation, and tissue necrosis. Based on the age and onset of the signs and symptoms of the current patient, the potential diagnosis is primary GBM, which is the more common form than the secondary one (approximately 95% of all cases).^{17,18} Primary GBM was especially found among elderly, while secondary GBM is reported to be more common in younger patients. In primary GBM, the aberrations of the epidermal growth factor receptor (EGFR) with the amplification of the mouse-double minute 2 homolog (MDM2) gene that encodes an inhibitor of the p53 tumor suppressor would lead to the dysregulation of the growth factor-mediated signaling pathways and the cell cycle. These would then result in the upregulation of cell proliferation, invasion, angiogenesis, and the inhibition of the apoptosis pathway.^{13, 14, 15}

We observed a dural thickening during surgery, with some attachment of the tumor to the dura, although it is not common that gliomas are fertilized from the arteries of the dura mater. Glioblastoma multiforme as a grade IV malignancy is seldom associated with DTS, although it may expand to the subarachnoid space or leptomeninges.^{7,8} In meningioma, however, the infiltration to the dura shown as DTS would arise from the arachnoid meningotheelial cells.^{3,16}

The DTS resulted in metastases being reported to occur in approximately 9% of patients with the highest grade malignancy; and about 5% as a single representation of intracranial metastases, i.e., breast cancer, prostate cancer, bronchial adenocarcinoma, mediastinal adenocarcinoma, nasopharyngeal carcinoma, and carcinoma of the unknown primary site.^{1,19, 20}

The flare sign found in our patient was determined to be DTS as it was present on more than three adjacent 5 mm sections through the mass and seen in the axial, sagittal, and coronal planes. Furthermore, the greatest thickness was seen close to the tumor and tapering away from it with more enhancement than the tumor itself. All these are specific to the DTS. Together with all of the other examinations, it looks like in this case the DTS was due to the infiltration of the GBM into the dura rather than just the tissue reaction.^{2, 20}

In the current study, the patient had undergone surgery after the diagnosis was upheld. We obtained the patient's legal guardian's signature on the informed consent for publication of his case prior to the paper's submission due to his weak condition post-surgery. His general health status, however, was improving days after the operation. Although we have yet to find the follow-up report due to the absence of the patient's visit

in the follow-up controls, thus, the outcome of this case could not be reported thoroughly.

CONCLUSION

Here we showed a dural tail sign as a flare sign of infiltrated dura in the patient with glioblastoma multiforme.

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Conflict of Interest

The authors have no conflicts of interest.

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Author Contribution

R contributed to the collection of data, data analysis, and writing the manuscript; KEP contributed to data interpretation, supervisor of study, and writing the manuscript; VPK contributed to the conception of data, data analysis, data interpretation, supervisor of study, and writing the manuscript. RIS and AM contribute to the collection of data, data interpretation, and supervision of the study.

REFERENCES

1. Sotoudeh H. A review on dural tail sign. *World J Radiol.* 2010;2(5):188.
2. Wilms G, Lammens M, Marchal G, Calenbergh F Van, Plets C, Fraeyenhoven L Van, et al. Thickening of dura surrounding meningiomas: MR Features. *J Comput Assist Tomogr.* 1989;13(5).
3. Guermazi A, Lafitte F, Miaux Y, Adem C, Bonneville J-F, Chiras J. The dural tail sign—beyond meningioma. *Clin Radiol.* 2005;60(2):171–88.
4. Doddamani RS, Meena RK, Sawarkar D. Ambiguity in the dural tail sign on MRI. *Surg Neurol Int.* 2018;9(1).
5. Hadidchi S, Surento W, Lerner A, Liu C-SJ, Gibbs WN, Kim PE, et al. Headache and brain tumor. *Neuroimaging Clin N Am.* 2019;29(2):291–300.
6. Alentorn A, Hoang-Xuan K, Mikkelsen T. Chapter 2 - Presenting signs and symptoms in brain tumors. In: Berger MS, Weller MBT-H of CN, editors. *Gliomas*. Elsevier; 2016. p. 19–26.
7. Brandão LA, Castillo M. Adult brain tumors: Clinical applications of magnetic resonance spectroscopy. *Magn Reson Imaging Clin N Am.* 2016;24(4):781–809.
8. Alifieris C, Trafalis DT. Glioblastoma multiforme: Pathogenesis and treatment. *Pharmacol Ther.* 2015;152:63–82.
9. Patel M, Nguyen HS, Doan N, Gelsomino M, Shabani S,

- Mueller W. Glioblastoma mimicking meningioma: Report of 2 cases. *World Neurosurg.* 2016;95:624.e9.
10. Tamrazi B. Advanced Imaging of Cranial Meningiomas. *Physiol Behav.* 2016;27(1):137–43.
 11. Li C, Xi S, Chen Y, Guo C, Zhang J, Yang Q, et al. Clinical significance of histopathological features of paired recurrent gliomas: a cohort study from a single cancer center. *BMC Cancer.* 2023;23(1):1–9.
 12. Mujagić S, Bećirević-Ibrišević J, Vržuljević-Martić V, Ercegović Z, Korkut D, Moranjković M. Dural tail sign adjacent to different intracranial lesions on contrast-enhanced MR images. *J Heal Sci.* 2011;1(2):96–102.
 13. Rayi A, Kobalka PJ. Histopathology of adult and pediatric glioblastoma. In: Otero JJ, Becker AP, editors. *Precision Molecular Pathology of Glioblastoma.* Cham: Springer International Publishing; 2021. p. 67–89.
 14. Picot J, Cooper K, Bryant J, Clegg AJ. The clinical effectiveness and cost-effectiveness of bortezomib and thalidomide in combination regimens with an alkylating agent and a corticosteroid for the first-line treatment of multiple myeloma: A systematic review and economic evaluation. *Health Technol Assess.* 2011;15(41):1-104.
 15. Pochettino F, Visconti G, Godoy D, Rivarola P, Crivelli A, Puga M, et al. Association between Karnofsky performance status and outcomes in cancer patients on home parenteral nutrition. *Clin Nutr ESPEN.* 2023;54:211–4.
 16. Zhou K, Zhao Z, Li S, Liu Y, Li G, Jiang T. A new glioma grading model based on histopathology and bone morphogenetic protein 2 mRNA expression. *Sci Rep.* 2020;10(1):1–14.
 17. Whitfield BT, Huse JT. Classification of adult-type diffuse gliomas: Impact of the World Health Organization 2021 update. *Brain Pathol.* 2022;32(4):e13062.
 18. Mikkelsen VE, Solheim O, Salvesen Ø, Torp SH. The histological representativeness of glioblastoma tissue samples. *Acta Neurochir (Wien).* 2021;163(7):1911–20.
 19. D'Alessio A, Proietti G, Sica G, Scicchitano BM. Pathological and molecular features of glioblastoma and its peritumoral tissue. *Cancers (Basel).* 2019;11(4).
 20. Hanif F, Muzaffar K, Perveen K, Malhi SM, Simjee SU. Glioblastoma multiforme: A review of its epidemiology and pathogenesis through clinical presentation and treatment. *Asian Pacific J Cancer Prev.* 2017;18(1):3–9.

TABLES AND FIGURES

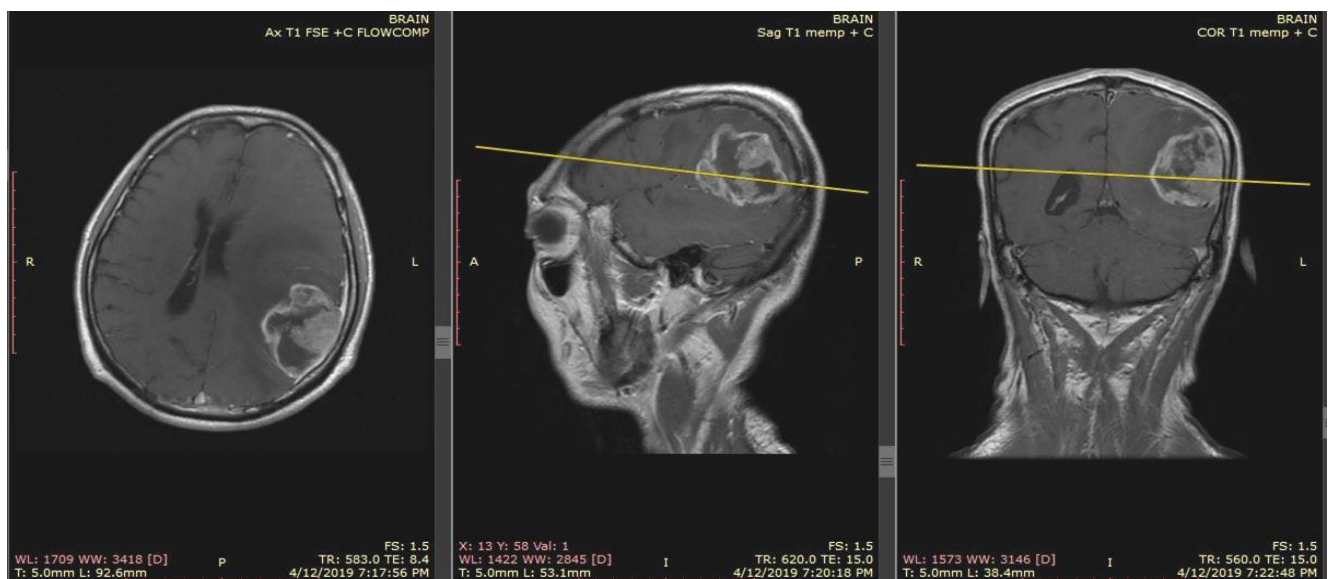


Figure 1. The T1W1 MR images of the glioblastoma multiforme of the left parietal lobe with dura tail sign observed in 3 different planes, axial, sagittal and coronal planes (arrows). The contrast MRI showed a greater enhancement of the DTS compared to the primary tumour as a specification of this flare sign.

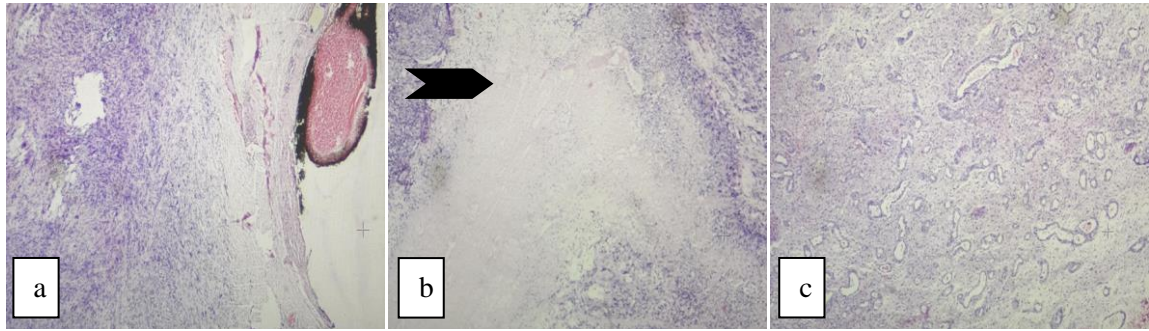


Figure 2. Histopathology sections of the GBM showed (a) malignant invasion to the dura, (b) necrotic area of the tumour (arrowhead), and (c) vascular proliferation at the affected area (100x of light microscope magnification).