Case Report

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Mucin-Rich Brain Metastasis May Show the T2-FLAIR Mismatch Sign: A Case Report and Literature Review

T2-FLAIR Mismatch Sign을 나타내는 점액성 뇌전이암: 증례 보고 및 문헌 고찰

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This study describes a unique case of single mucin-rich brain metastasis in a patient with breast cancer, mimicking the T2-fluid attenuation inversion recovery (FLAIR) mismatch sign and masquerading as an isocitrate dehydrogenase-mutant astrocytoma. This case highlights the importance of considering mucin-rich lesions in the differential diagnosis of intracranial tumors exhibiting T2-FLAIR mismatch. Clinicians must recognize the potential convergence in imaging characteristics between these metastases and gliomas to guarantee prompt and accurate patient care.

Index terms Brain Metastasis; Glioma; T2-FLAIR Mismatch; Breast Cancer; Mucin

INTRODUCTION

Previous studies have hypothesized that the hypointense appearance of brain metastasis (BM) originating from adenocarcinoma on T2-weighted images (T2-WI) may be attributable to the presence of mucin. However, this hypointensity may have been induced by the intrinsic properties of the primary tissue rather than mucin. In contrast, intra-tumoral mucin may demonstrate BM as a hyperintense signal mimicking a cyst, thus, causing a diagnostic dilemma (1). Furthermore, a recent development in the field is the identification of the T2-fluid attenuation inversion recovery

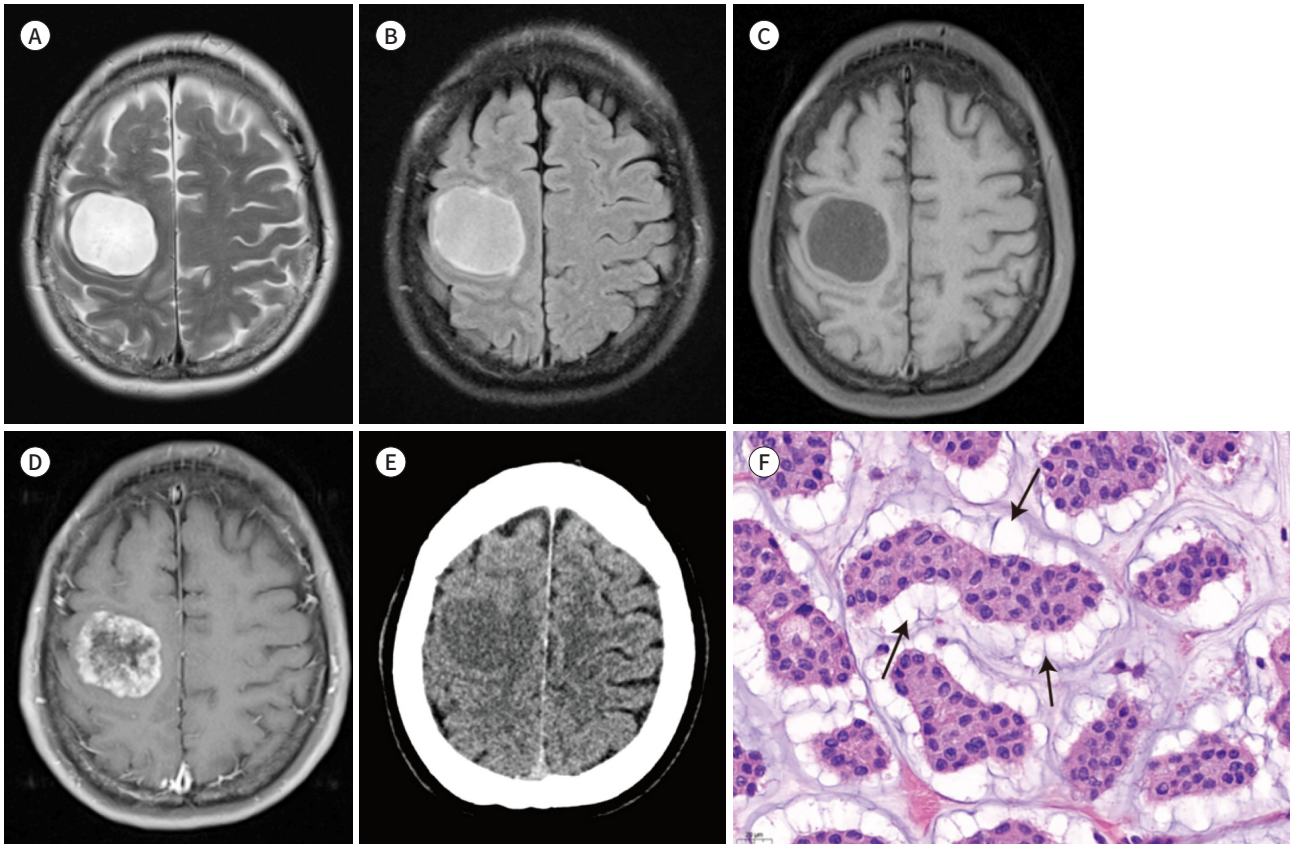
(FLAIR) mismatch sign, which has shown high specificity in predicting isocitrate dehydrogenase (IDH)-mutant astrocytoma (2). Herein, we report the case of a patient with BM originating from breast cancer with a mucin pool mimicking the T2-FLAIR mismatch sign.

CASE REPORT

A 53-year-old female presented with weakness in the left hand without trauma a month before admission. The patient had no medical history but had a family history of breast cancer. After visiting the emergency room, she was admitted to the Department of Neurosurgery for further evaluation. Physical examinations revealed grade 2 left-hand weakness on the hand grip test and laboratory results were predominantly normal, except for increased serum levels of the tumor markers carcinoembryonic antigen and cancer antigen 15-3.

Brain MRI examination revealed a well-defined mass measuring 3.7 cm in the right parietal

Fig. 1. A 53-year-old female with a right frontal lobe mass.
A. T2-WI displays a striking, near-uniform hyperintense signal throughout the lesion.
B. On fluid attenuation inversion recovery, the lesion manifests a predominantly hypointense signal across the majority of the lesion when compared to T2-WI, except for a peripheral rim exhibiting a hyperintense signal.
C. The lesion demonstrates a hypointense signal on the T1-WI.
D. On contrast-enhanced T1-WI, peripheral enhancement is seen in this lesion.
E. On non-contrast CT images, low attenuation is observed in the corresponding region.
F. Histologic specimen (hematoxylin and eosin stain, × 40) shows the appearance of metastatic carcinoma with nuclear atypia and pleomorphism in the background of an abundant mucin pool (arrows).
WI = weighted image



lobe accompanied by minimal peritumoral edema. The lesion showed fairly homogeneous and strikingly high signal intensity on T2-weighted images (T2-WI) and low signal intensity on T1-WI. On FLAIR images, the tumor displayed a relatively hypointense signal, except for a hyperintense peripheral rim, mimicking a T2-FLAIR mismatch sign. Contrast-enhanced T1-WI demonstrated peripheral enhancement of the lesion (Fig. 1). Collectively, these findings led to a diagnostic dilemma.

Craniotomy and brain tumor removal were successfully performed, achieving complete resection with intraoperative neuromonitoring. The tumor was friable without adhesion to surrounding tissue. Histopathological examination revealed a metastatic carcinoma with mucin pool formation, most likely of breast origin. The lesion showed positive estrogen receptor immunostaining, and negative progesterone receptor and human epidermal growth factor receptor 2 expression. PET-CT revealed a primary breast cancer in the left breast. Lymph node metastasis was also observed in the left axilla, subcarinal region, and hilum, along with bone metastasis in the sternum. A biopsy of the left breast confirmed the presence of an invasive ductal carcinoma at cT3 + N3M1 stage IV.

DISCUSSION

A history of primary malignancy or multiple malignancies may aid in the diagnosis of BM. Thus, when a single enhancing lesion of an unknown primary malignancy is encountered, BM cannot be easily included in the differential diagnosis. Particularly, a single BM mimicking a T2-FLAIR mismatch sign has rarely been reported.

In this case, the tumor showed striking hyperintensity on T2-WI, while presenting hypointensity on T1-WI, thereby resembling a cyst. However, the presence of peripheral thick enhancement indicated a solid tumor rather than a cyst. Previous studies have noted that BM with a mucin pool also displays intense hyperintensity on T2-WI and variable degrees of contrast enhancement, aligning with the imaging characteristics observed in our case (1, 3).

Notably, this case mimics the T2-FLAIR mismatch sign, originally characterized by a nearly homogenous hyperintense signal on T2-WI, coupled with a central hypointense signal and a bright rim on FLAIR images. The significance of FLAIR imaging lies in its widespread accessibility and its uncomplicated nature, making it a potential imaging marker with high specificity for identifying IDH mutant astrocytoma (2). However, recent work found that 73% of dysembryoplastic neuroepithelial tumors presented the mismatch sign, questioning its specificity for IDH-mutant astrocytomas (4). Thus, recent studies have recommended the application of stringent inclusion and exclusion criteria for this observation (5, 6). Additional imaging features crucial for accurately identifying this sign include the typical absence or minimal presence of contrast enhancement, a characteristic not observed in our case. Nevertheless, when radiologists encounter non-contrast MR scans, it is crucial to be mindful that BM with a mucin pool may also imitate the T2-FLAIR mismatch sign.

In conclusion, the T2-FLAIR mismatch sign has near-perfect specificity for diagnosing IDH-mutant astrocytomas. This case illustrates mucinous BM in a patient with breast cancer imitating a T2-FLAIR mismatch sign. According to the peripheral thick enhancement pattern, the possibility of IDH-mutant astrocytoma might be very low for differential diagnosis.

Author Contributions

Data curation, K.C.J., Y.J.; formal analysis, C.S.H.; supervision, A.S.J.; visualization, C.Y.J.; writing—original draft, K.H.J.; and writing—review & editing, A.S.J.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

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T2-FLAIR Mismatch Sign을 나타내는 점액성 뇌전이암: 증례 보고 및 문헌 고찰

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T2-fluid attenuation inversion recovery (이하 FLAIR) mismatch sign은 isocitrate dehydrogenase-mutant 성상세포종을 시사하는 영상 소견으로 알려져 있다. 이 증례 보고에서는 유방암 환자의 뇌에 생긴 점액성 뇌전이암이 T2-FLAIR mismatch sign처럼 보이는 사례를 소개한다. 특히 비조영증강 MRI에서 T2-FLAIR mismatch sign을 보이는 경우, 성상세포종뿐만 아니라 뇌전이암을 감별진단에 염두에 두어야 한다.

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