

Pure agraphia after infarction in the superior and middle portions of the left precentral gyrus: Dissociation between Kanji and Kana



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ABSTRACT

The present study describes a Japanese patient with pure agraphia displaying differential disturbances in processing Kanji (morphogram) and Kana (syllabogram) letters after an infarction in the middle and superior portions of the left precentral gyrus. Kana errors reflected the patient's difficulty with retrieving both motor and visual letter images, whereas Kanji errors included partial letter stroke omissions or additions. This present case suggests that differences in writing disturbances between Kana and Kanji letters are caused by a differential dependency on letter motor images.

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1. Introduction

Neuropsychological studies have shown that writing disorders are caused by several mechanisms and varied brain lesions. Regarding frontal lesions, in 1881 Exner [1] deemed the middle frontal gyrus (Brodmann area [BA] 6) as the “writing center” (graphic motor image center). Patients with damage to this area tend to suffer from writing disturbances specific to phoneme-to-grapheme conversions [2].

The Japanese writing system involves a combination of Kanji and Kana letters. Kana letters are phonograms and syllabograms, which have a grapheme-to-phoneme conversion rule. Kanji letters are logograms and ideograms, which correspond to morphemes in the Japanese language. Thus, previous Japanese language studies have suggested that different neural mechanisms underlie Kana and Kanji orthographic system processing [3,4]. Writing in Kanji is thought to depend strongly on visual image processing, whereas Kana letters are simple shapes, and they may be more associated with kinesthetic images than visual images [5]. Japanese patients with left middle frontal lobe lesions have demonstrated different writing errors between Kana and Kanji letters [4].

Our patient's lesion was localized in the left superior precentral gyrus (BA 4 and BA 6). We discuss how Kana and Kanji letter writing is affected by this type of focal lesion.

2. Case report

The patient was a 60-year-old right-handed Japanese man with a 12th-grade education. After experiencing a sudden-onset headache and slowed speech, he was admitted to a hospital with a diagnosis of cerebrovascular disease. Upon admission, a neurological examination revealed that the patient was alert and well oriented to both time and space. General physical and neurological

examination results were unremarkable. By the next day, the headache and speech disturbances were ameliorated; however, he began experiencing handwriting difficulties. A brain MRI (at onset) revealed an infarct confined to the superior and middle portions of the left precentral gyrus (Fig. 1).

Neuropsychological tests were performed between 5 and 21 days after onset (Table 1). The patient's verbal intelligence quotient was within the normal range. His speech was fluent, and there was no anarthria. Aphasia was not apparent. The patient could copy cubic and Rey–Osterrieth complex figures without any problems. He had no constructional disturbances, and there were no praxis problems, including oral apraxia. He could imitate oral movements and simple finger patterns using either hand.

We tested the patient's ability to take dictation of 25 single Kana letters, 25 Kana words, and 42 Kanji words as agraphia assessments. We used Kana words composed of 2–4 letters and Kanji words composed of 1–2 letters. The patient's characteristic Kana errors were mainly non-responses (73%) (Fig. 2). This error was more frequent than phonological errors (substitution) (27%). His characteristic Kanji errors included the omission or addition of a Kanji stroke (partial omission or partial addition) (64%) and difficulty with retrieving the Kanji letters (36%). Even if he could write a Kanji letter in the correct shape, his stroke order was wrong. His Kana and Kanji letter copying showed a few distorted shapes, which were associated with a minimal abnormal motor pattern.

3. Discussion

Agraphia due to a lesion in the upper portion of the left precentral gyrus has been explained via abnormalities with translating stored writing motor images from the parietal lobe into motor programs in the frontal lobe [6]. A writing model was proposed in which the upper portion of BA 6 was termed the graphemic/motor frontal area, supporting a bridge between orthographic and motor programs specific to handwriting [7].

The present patient's lesion was restricted to the upper and middle portions of the left precentral gyrus. We considered that

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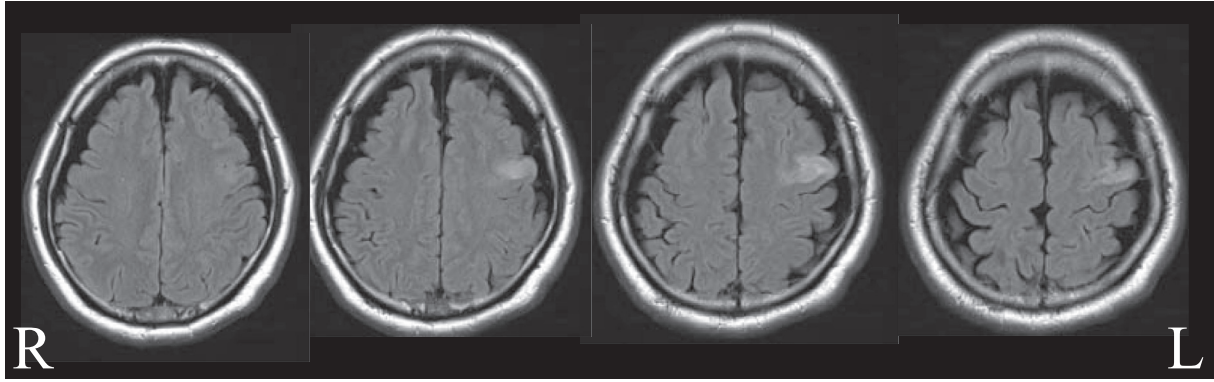


Fig. 1. Axial fluid attenuated inversion recovery brain MRI revealing a high intensity region in the left precentral gyrus.

Table 1
Neuropsychological test results

	Score
Intelligence	
WAIS-III	
Full IQ	77
Verbal IQ	86
Performance IQ	71
Language	
Standard language tests of aphasia	
Auditory comprehension word	10/10
Picture naming	19/20
Repetition word	10/10
Oral reading	
Kana word	10/10
Kanji word	10/10
Reading comprehension	
Kana	10/10
Kanji	10/10
Writing	
Kana word	0/5
Kanji word	4/5
Dictation	
Kana word	1/5
Kanji word	3/5

IQ = intelligence quotient, WAIS = Wechsler Adult Intelligence Scale.

this area would be crucial for performing motor imagery/programs related to Kana and Kanji letters. In the present case, Kana error characteristics included the patient not being able to retrieve both visual and motor images of the letters. For Kana letters, the visual images were strongly connected with motor images that were inadequately retrieved. Kana visual images are strongly associated with motor processing, whereas Kanji visual images are weakly associated with motor processing. The patient’s Kanji errors were “partial” errors, including the partial omission or addition of a stroke due incorrect stroke order. We believed that the patient’s visual Kanji images would be preserved and successfully retrieved. The patient’s Kanji errors suggested that the visual letter images were not sufficiently translated into motor writing responses. The current findings indicate that the dissociation in the patient’s error patterns might be caused by differences in associative strength between motor and visual images in each writing system.



Fig. 2. Sample of writing errors during dictation and copying. (A) Kana. Examiner gives a Kana letter (square brackets) to prompt the patient to write in Kana letters. Phonological errors are underlined. (B) Kanji. Partial omission stroke error (牛: cow, 星: star), partial addition stroke error (音楽: music), as well as shape distortion (時間: time). (C) Copy. Kana and Kanji letter distortion.

Conflicts of interest/disclosures

The authors declare that they have no financial or other conflicts of interest in relation to this research and its publication.

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Metastatic chromophobe renal cell carcinoma to the brain



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ABSTRACT

Metastases represent the most common tumors of the central nervous system, with clear cell renal cell carcinomas showing a particular predilection to involve the brain. This report documents an unusual case of a patient with a chromophobe renal cell carcinoma presenting with a brain metastasis. A 58-year-old man presented with stroke-like symptomatology, including expressive aphasia, right side facial weakness, headaches and vomiting. CT imaging demonstrated a 4.7 cm left frontal lobe hemorrhagic mass. He underwent surgery with excision of the mass, which was marked by sheets of large cells with lightly eosinophilic to clear cytoplasm. PAX8 staining was positive and a diagnosis of clear cell carcinoma of probably renal origin was rendered. Subsequently, CT imaging of the abdomen revealed a 12.9 cm left renal mass. The patient underwent a left nephrectomy and a diagnosis of chromophobe renal cell carcinoma was made. The tumor was noted to extend into the perirenal fat and to have involved a paraaortic lymph node. Re-review of the frontal lobe lesion confirmed the tumor was the same. Chromophobe renal cell carcinomas are far less common than clear cell tumors, are less likely to metastasize, and generally have a more favorable overall prognosis. When they metastasize, they most commonly involve the liver, lung and lymph nodes, in contrast to the more common clear cell carcinomas that typically spread to the lungs, bone and brain.

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1. Introduction

The majority of renal cell carcinomas are of the clear cell type. Approximately 5% of adult renal cell carcinomas represent chromophobe cell carcinoma and they are generally thought to have a slightly better prognosis than clear cell renal cell carcinoma, with a 5 year progression free survival rate around 90% [1,2]. The risk of metastasis is significant with clear cell renal cell carcinomas, with the brain representing a common site of metastasis. Chromophobe renal cell carcinoma is generally less likely to metastasize to the brain. We report an unusual case of a patient who initially presented with stroke-like symptoms and a chromophobe renal cell carcinoma metastasis involving the left frontal lobe.

2. Case report

A 58-year-old man with no significant past medical history presented with an acute onset of expressive aphasia, right-sided facial

weakness, headache and vomiting. Clinically, he was thought to have had a stroke. A CT scan showed a left frontal parenchymal hemorrhagic lesion measuring 4.7 × 4.1 × 3.2 cm and showing focal extension into the ventricular region. He underwent craniotomy and resection of the left frontal lobe lesion. The tumor was comprised of sheets of large cells with abundant clear to lightly eosinophilic cytoplasm; an initial diagnosis of a clear cell neoplasm was made, suggestive of a possible renal cell carcinoma metastasis (Fig. 1). The tumor demonstrated diffuse positive staining with antibody to PAX 8 (dilution 1:200; Protein Tech Group, Chicago, IL, USA), consistent with a renal cell carcinoma metastasis (Fig. 2).

Subsequently, CT imaging of the chest, abdomen and pelvis revealed a left renal mass and evidence of left paraaortic adenopathy. A history of hematuria for the last 2 weeks was elicited. The patient underwent a left nephrectomy which showed a 12.9 × 10.2 × 11 cm mass which was diagnosed as a chromophobe renal cell carcinoma (T3a, N1, M1) (Fig. 3). A metastasis was also identified in a left paraaortic lymph node and extended to involve the perinephric adipose tissue. Subsequent re-review of the brain lesion indicated morphology consistent with that of the chromophobe renal cell carcinoma seen in the kidney rather than a classic clear cell renal cell carcinoma.

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