Clinical Reasoning: An 81-Year-Old Woman Who Insisted the Hospital Was Her Home

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Neurology® Published Ahead of Print articles have been peer reviewed and accepted for publication. This manuscript will be published in its final form after copyediting, page composition, and review of proofs. Errors that could affect the content may be corrected during these processes.
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Number of characters in title: 60

Abstract Word count:
Word count of main text: 1498
References: 9
Figures: 1
Tables: 0

Search Terms: [ 290 ] Cardiac, [ 38 ] Assessment of cognitive disorders/dementia, [ 200 ] Aphasia

Study Funding: The authors report no targeted funding

Disclosures: The authors have no disclosures relevant to the manuscript.
SECTION 1

An 81-year-old right-handed white non-Hispanic previously healthy woman with glaucoma presented with acute weakness and slurred speech nearly 10 hours after last seen well. She was found to have new onset atrial fibrillation. Her NIH stroke scale (NIHSS) was 18 with points given for failure to answer questions, left lower facial paralysis, right gaze preference with ability to cross midline, left field cut, left hemiplegia, severe dysarthria, mild aphasia, and severe left sensory neglect.

Question for consideration:

1. What is the localization and differential diagnosis?
SECTION 2

The left-sided hemiplegia, right gaze preference, and left visual and sensory neglect localize to the right hemispheric cortical and subcortical regions. Her acute presentation and new onset atrial fibrillation implicate an embolic stroke in the right middle cerebral artery (MCA), however other non-embolic stroke etiologies and intraparenchymal hemorrhage are also considered. Todd’s paralysis resulting from a focal seizure is possible. Intracranial mass lesions from malignancy or infection as well as inflammatory/demyelinating conditions would also be a consideration, however there was no indication of even subtle prior neurological or systemic symptoms preceding her acute presentation.

CT head with CTA head and neck confirmed an acute thrombus in the distal right M1 and proximal M2 segments with infarction throughout the right MCA territory.

Question for consideration:

1. What are the next steps in management and treatment?
SECTION 3

She was not a candidate for IV tissue plasminogen activator (tPA) given last seen well or intra-arterial therapy (IAT) due to the presence of a large established infarction on initial brain imaging (Figure 1a). She was administered aspirin with the plan to later convert to an oral anticoagulant.

Over 24 hours, her NIHSS improved to 10 with most gains in strength and dysarthria. She was oriented to self, month, and year, but not location despite multiple choices. Adamantly denying being in a hospital, she instead reported being in her home in another city despite evidence provided to the contrary. She pointed out the location of her kitchen, bathroom, living room, and front door with some reproducibility.

She neglected her left extrapersonal space and suffered extinction of bilateral stimulation as well as retrocaudal two-point extinction. Her clock drawing possessed mirrored placement of some numbers, random absence of some numbers, irregular spacing without clear hemineglect, and misplaced hands both in origin and orientation (Figure 1b). She experienced left-right confusion, however without finger agnosia or acalculia. She was adamant she was left-handed while physically referring to her right hand. Her complete right-handedness was confirmed from herself and husband later.
Her language showed a mild mixed aphasia. Her speech continued to be severely
dysarthric, thus communication via writing and reading was utilized. Repetition was
intact to simple phrases with paraphasias. On confrontational naming, she initiated
spelling of high and low frequency words. She could not name a horse by verbal
description of “an animal with a long face, long legs, and hooves with metal shoes
that people can ride,” instead writing “krongroog” and then “kornger” (Figure 1c),
but could identify a horse from picture. In response to a description of a giraffe, she
wrote “grafraf” (Figure 1d) and could choose a giraffe correctly from multiple choice
pictures. She was asked to copy a sentence (Figure 1e), then mimicked a “bunny”
hopping across her tray when asked the meaning. She was also asked to write a
spontaneous sentence (Figure 1f).

Questions for consideration:

1. What is the neurological term for misidentifying one’s location? Can this be
   localized?
2. Is aphasia unusual given the lesion localization?
3. What type of dysgraphia does she have? Can this be localized?
SECTION 4

Her insistence that her hospital room was instead her private home is a delusional misidentification syndrome (DMS), more specifically reduplicative paramnesia (RP) to places (RPP).\(^1\) RPP has also been termed environmental reduplication, environmental RP, foreign RP, topographical delusion, misidentification, disorientation for place, spatial delirium, delusion for place, and Capgras for place. DMS as a category also includes disorders of hypofamiliarity, such as Capgras syndrome (i.e., a familiar person is replaced by an imposter), and disorders of hyperfamiliarity, such as Frégoli syndrome (i.e., a person is replaced by another in disguise), intermetamorphosis (i.e., two people have interchanged their physical appearance and psychological identity), and syndrome of subjective doubles (i.e., self duplication or Doppelgänger).\(^3\)

Cases of RPP frequently localize to the right hemisphere, however commonly have bilateral but right greater than left involvement.\(^3\) Rarely, RPP has isolated left hemisphere involvement.\(^2,4\) Lesions are observed in the frontal lobe more commonly than temporal or parietal lobes, but also with combinations of the aforementioned lobes, occipital involvement, and deeper thalamic, corona radiata, and internal capsule lesions.\(^2,4\) Often single lesions are significant in size,\(^2\) while the “two-hit” theory suggests underlying vulnerability followed by an often right hemispheric lesion causes RPP.\(^4,5\) Prior theories about the underpinnings of RPP
have included purely spatial disorientation, disconnection/disorientation of memories, disconnection of limbic (e.g., self-monitoring and error detection) from frontal regions (e.g., familiarity), and the combination of memory, visuospatial, and executive dysfunction.² Borghesani et al. (2019) propose that a two-factor theory is the most comprehensive, such that a perceptual/affective deficit (the cause variable) and impaired belief evaluation (often from right lateral prefrontal involvement) are both required for the development of RPP.

Due to hemispheric specialization (HS), language is predominantly represented in the left hemisphere.⁶ Importantly, our patient had no evidence of acute or prior left hemispheric injury on imaging. Handedness including familial handedness is a source of variability in language HS, although even 80% of left-handed individuals still display left hemispheric language lateralization.⁶ Although our patient is completely right-handed, her father was left-handed, suggesting a possible source of her right hemisphere dominance for language.

Although complicated by her language disorder, her written language is consistent with an acquired dysgraphia. Acquired dysgraphia following ischemic injury can be due to disruption of orthographic and/or phonological processing.⁷ Dysfunction of orthographic long-term memory (e.g., storage and retrieval of learned word spelling) causing misspelling often of low-frequency words is associated with damage to left inferior frontal and ventral occipitotemporal regions.⁷ Dysfunction of orthographic working memory (e.g., maintaining letter information while actively
spelling a word) causing misspelling of longer words is associated with damage to the left parietal lobe. Phonological processing is localized in the left perisylvian language areas including Wernicke's area, Broca's area, and the supramarginal gyrus. Disruption to phonology-orthography conversion can produce additional phonemic errors of uncommon or irregularly spelled words. Our patient produced other word errors (i.e., sunny = bunny), complex phonological paraphasia or phonologically implausible errors (i.e., giraffe = grafraf), and semantic errors (i.e., horse = possibly kangaroo). In the setting of orthographic long-term memory and phonology-orthography conversion dysfunction, there are a variety of abnormalities including semantic errors, incorrect production of other words, and production of pseudowords. Therefore, there appears to be both orthographic long-term memory and phonology-orthography conversion dysfunction in this case.

Five days after her acute presentation, she was discharged to a rehabilitation hospital. After nearly two months, she became oriented to “hospitalization” but continued to incorrectly report the city as her hometown. Her other neurological deficits, including dysphagia, dysarthria, aphasia, left-sided weakness, and neglect continued to improve.
DISCUSSION

This elderly woman developed a cardioembolic right MCA ischemic stroke resulting in RPP, mixed aphasia, and acquired dysgraphia in addition to left-sided motor and sensory perception deficits.

RPP is rare making it difficult to classify and study in detail. Borghesani et al. (2019) propose a classification system distinguishing whether duplication and/or displacement is present, including reduplication with displacement, reduplication without displacement, and displacement without reduplication. RPP itself is a problematic term as reduplication is not always present nor is memory impairment the only neuropsychological feature present in the disorder. RPP is frequently also accompanied by executive dysfunction, visuospatial deficits, and non-verbal memory impairment with additional features of confabulation, anosognosia, time disorientation, and paranoid personality traits.

RPP is most frequently seen in the setting of an acute neurological event or injury, though also reported in neurodegenerative disorders and neuroinflammatory conditions (i.e., Morvan’s syndrome). The duration of RPP is difficult to assess, as patients may no longer verbalize distress despite ongoing beliefs about location unless questioned directly. The delusion is most often difficult to correct with behavioral modification. Confronting a patient with RPP about the delusion has been successful in one reported case using an unequivocal landmark for place
orientation. Treatment has been attempted with antipsychotic medications, however with mixed results.²

Her injuries were in the right inferior frontal gyrus, insula, precentral gyrus, and supramarginal gyrus and to a lesser extent involving the internal capsule and lentiform nucleus (Figure 1a). Interestingly, RPP has clearly been localized to the right hemisphere, but mixed aphasia and acquired dysgraphia are generally localized to the left hemisphere. If RPP, so often mistaken for “confusion” or simple “disorientation” in the setting of delirium, redirectable (i.e., not fixed) confabulation, or a more generalized delusional or hallucinatory state, were better recognized by performing a thorough mental status examination, it would improve our understanding of the localization and natural disease course.
## APPENDIX 1 Authors

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   doi:10.1177/089198879901100402


doi:10.1093/brain/awv348


doi:10.1310/D4AM-XY9Y-QDFT-YUR0


doi:10.1080/13554794.2012.690428
Figure 1: MR diffusion-weighted imaging (DWI) displaying stroke territory and writing samples displaying dysgraphia.

A) DWI bright signal within the right MCA distribution including the inferior frontal gyrus (IF), insula (I), internal capsule (IC), lentiform nucleus (L), precentral gyrus (PrC), and supramarginal gyrus (SM) in standard radiological orientation with patient left on the right. B) Clock drawing. C) Written response to the description of a horse. D) Written response to the description of a giraffe. E) Copy (below) of an examiner provided written sentence (above). F) Written response when asked to write any sentence.

Key: I = insula, IC = internal capsule, IF = inferior frontal gyrus, L = lentiform nucleus, PrC = precentral gyrus, SM = supramarginal gyrus.
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Neurology published online June 18, 2021
DOI 10.1212/WNL.0000000000012392

This information is current as of June 18, 2021

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