



Reduplicative Paramnesia: A Neuropsychological case analysis

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ABSTRACT

The delusional misidentification syndromes, including reduplicative paramnesia (RP), are relatively rare and very incompletely understood. Reported here is a case of RP that involved strong adherence to a belief in duplication/relocation of a familiar place. Electrophysiological and neuroimaging findings converged with those obtained from extensive neuropsychological testing to identify neuropathology primarily of the right frontal-temporal-parietal region associated with a grade IV astrocytoma. The corresponding in-depth analysis of neuropsychological assessment findings presents a pattern of cognitive functions of potential interest for better understanding RP.

Keywords

Reduplicative paramnesia, Delusional misidentification syndromes, Neuropsychological assessment, Cognitive function

Introduction

Reduplicative paramnesia (RP) is considered a subset of delusional misidentification syndromes [1]. The phenomenon is characterized by strong adherence to a belief in the duplication or relocation of a familiar place [2]. While the extent to which the syndrome reflects a psychological or “organic” disturbance has been debated over the years, RP is generally considered to be primarily neurologic in etiology and falls within the domain of neuropsychiatric disturbances [1-3].

The first case labeled RP in the literature is generally attributed to Pick in 1903 [4], who reported on a woman with a presumed degenerative disease. She maintained unwaveringly that she was being seen in a clinic that was an exact replica of a clinic in her hometown, some distance away. This kind of steadfast belief that one’s current location is in another place is a hallmark of the disorder. While it has been associated with a variety of neuropathologies (e.g., tumor, stroke,

degenerative dementia, traumatic head injury, etc.), the most common lesions have been associated with the right hemisphere and/or frontal (including bi-frontal) regions [3,5,6].

Despite the long-standing awareness of RP in the medical literature, the disorder has been relatively under-studied [1,7]. This is, in part, due to its relatively rare occurrence. However, understanding of mechanisms that underlay the phenomenology has significant implications for better understanding of cognitive mechanisms in general. Indeed, there have been recent calls for more intensive analysis of cases of RP in order to better understand how the brain organizes cognition [1,2].

Herein is reported a case of RP for whom electrophysiological and neuroimaging findings converged with those obtained from extensive neuropsychological testing to address aspects of localization of neuropathology. Further, more in-depth analysis of neuropsychological assessment

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findings presents a pattern of cognitive functions of potential interest for better understanding RP.

Patient Background and Procedures

The patient was a 55-year-old, right-handed man who was consulted by the psychiatry and neurology services after exhibiting a delirium manifested as confusion and disorientation for place following arthroscopy and debridement of both knees four days prior at Mount Sinai Hospital in Houston, Texas (names and place locations changed throughout to protect identity). He had undergone coronary artery bypass grafting at Mount Sinai a few months before having the knee surgery. He was domiciled in San Jose, California, and spent the majority of his time there, although he traveled back and forth on business between California and Texas. He preferred to get his major health care in Houston, given its reputation for world-class care; hence, his reason for first undergoing open heart surgery and subsequently knee surgery at Mount Sinai.

The patient's disorientation for place manifested as he steadfastly maintained that he was in San Jose, California, but admitted he did not know there was a Mount Sinai Hospital there until he was admitted to it. Initially, the possibility of a right hemispheric stroke was entertained, particularly since he had previously relatively recently undergone the coronary artery bypass grafting. During the two weeks prior to knee surgery, he reported having two episodes of time dissociation upon awakening from afternoon naps. For a somewhat longer period of time, he had been having "surrealistic" feelings as if he were in "an Andy Warhol movie," suggestive of depersonalization and derealization. No history otherwise compatible with seizure activity was reported. Having been a collegiate football player, many years prior he had experienced head trauma with brief loss of consciousness. In terms of the current clinical exam, some forgetfulness was reported. His speech manifested some loosening of associations and mild tangential processes. Further, he exhibited minor facial asymmetry with left facial weakness, but no left hemiplegia or visual field cut.

The patient did not appear to be disturbed when he was informed of the discrepancy between his perceptions of being in the two distinct locations simultaneously; rather, at times, he seemed amused by it. He also spoke, on occasion, of a wall of the hospital partially obscuring his view of

other familiar landmarks of San Jose. As lability, agitation, and perceptual illusions persisted on a fluctuating basis he was prescribed antipsychotic medication (thiothixene), which helped to manage these symptoms. Neuropsychological consultation was requested while he was undergoing work-up of his neuropsychiatric symptoms and, in particular, to see how extensive his deficits were given his occupation as a corporation attorney and to aid in determining his return to job potential.

Electroencephalography Findings

The impression from the electroencephalogram (EEG) indicated depression of background activity on the right side and a focus of high voltage quite slow activity mixed with some sharp waves in the right frontal region. Findings were consistent with the presence of an acutely destructive focal process in the right frontal lobe. In addition, the background activity of the left hemisphere was slightly slow for age.

Neuroimaging Findings

Computed tomography (CT) scan of the brain before and after contrast enhancement showed without contrast material considerable shift of the ventricles from right to left. Abnormal radiolucency in the cerebral white matter of the right hemisphere indicated the presence of cerebral edema. With the addition of contrast material, irregular enhancement in the right temporal, frontal, and parietal loops was seen. The overall appearance was that of a rather large and neuritic mass occupying the right frontal temporoparietal region, with the most likely possibility being that of a glioblastoma multiforme.

Four days later, neurosurgical intervention was undertaken, including right frontotemporal craniotomy and gross subtotal excision of the malignant glioma. The surgical report indicated that the tumor extended deep in the Sylvian fissure and surrounded the middle cerebral artery at the Sylvian fissure. The subsequent pathology report confirmed a diagnosis of Grade IV astrocytoma (glioblastoma multiforme).

Neuropsychological Findings

The patient was seen for a neuropsychological examination over the course of three days, due to his inability to remain sufficiently alert when initially seen and given his progressive

improvement in delirium as he was prescribed dexamethasone as his neurological work-up ultimately identified a tumor likely contributing to increased swelling and pressure on his brain. In addition to a clinical interview, the following neuropsychological assessment instruments/procedures were administered: Benton Test of Temporal Orientation; Benton Right-Left Orientation Test; Digit Vigilance; finger gnosis testing; skin number writing; Halstead-Reitan Neuropsychological Test Battery (HRNTB) Reitan-Klove Sensory-Perceptual Examination (RKSPE) tactile single and double simultaneous stimulation (DSS); RKSPE auditory single and double simultaneous stimulation (DSS); HRNTB Seashore Rhythm Test; Benton Judgment of Line Orientation Test (JOLOT); Hooper Visual Organization Test (HVOT); drawings to copy; right and left hand name writing; HRNTB finger tapping; grooved pegboard; motor sequencing and persistence testing with fist-side-palm and alternating sequences; HRNTB Reitan-Indiana Aphasia Screening Test; Boston Naming Test; Multilingual Aphasia Examination (MAE) Sentence Repetition; MAE Controlled Oral Word Association; written word fluency H-words; HRNTB Speech-Sounds Perception Test; design fluency; Wechsler Adult Intelligence Scale-Revised (WAIS-R); Trail Making Test, Parts A and B; Wisconsin Card Sorting Test (WCST); Wechsler Memory Scale (WMS); and Benton Visual Retention Test (BVRT), Administration A. Descriptions of all of these instruments, along with reliability and validity information, are referenced in Lezak et al. [8]. Given his educational background of attainment of a J.D. and M.B.A., and his career as a corporation attorney, his premorbid cognitive functioning was estimated to be at least in the high average range.

On day one of the evaluation (the same day that the EEG and CT scan were performed), the patient was quite lethargic, although he remained cooperative to the extent that he was able to stay awake. He complained of headache described as “heavy” and “in the cavities” behind his eyes, and squinted as if in pain. Further, he acknowledged headaches had been increasing in frequency over the three weeks prior to his hospital admission. A digit vigilance task had to be terminated due to his excessive lethargy and borderline somnolence. Before testing was discontinued, he did complete some measures, including attempts to copy simple pictured stimuli of a square, cross, and triangle. He failed on multiple trials to keep

in mind the instructions to not lift the pencil as he drew his copies; and he lapsed into grossly perseverative responding as he drew increasingly larger connected squares around other squares, increasingly larger connected triangles around other smaller triangles, and did not draw the left side of the cross on one attempt and grossly distorted the left side of it on another. Only a few additional tests were attempted before the assessment was halted. Testing was suspended until he had begun steroid treatment and was reasonably stable two days later. From that point forward he remained alert and cooperative.

As the assessment was resumed, the patient exhibited considerable jocularity and was very talkative. His speech was fluent and sometimes accelerated with an occasional pressured quality, but he remained understandable. He made idiosyncratic plays on words and phrases which were sometimes obscure. His affect was unpredictably labile. As mentioned, he steadfastly maintained that he was in San Jose, California, but admitted he did not know there was a Mount Sinai Hospital there until he was admitted to it. The findings from the time when he was able to sustain alertness and maintain continuous meaningful interaction are summarized in **Table 1**.

The patient could give the calendar date within one day. However, he did not have a good sense of the actual day of the week or time of day, even when telling time from his watch. His performance on a test of right-left orientation to his own body and the confronting examiner, with both simple and more complex, crossed commands was intact without error.

The patient reported a fairly consistent pattern of left extinctions/suppressions to tactile DSS. Although his performances on other tactile sensory-perceptual tests were less consistent, he typically made more errors on the left side of his body versus the right side.

The patient consistently reported left extinctions/suppressions on auditory DSS. In addition, he was severely impaired in his ability to discriminate auditorily-presented rhythmic pairs.

Visual-perceptual-organizational and discrimination skills were mildly to moderately impair. For example, the patient’s ability to judge the orientation of lines (JOLOT) was in evidence at a borderline defective level. His responses on the HVOT were also rather striking in terms of certain qualitative features. The HVOT

Table 1: Neuropsychological assessment/test results following satisfactory stabilization and ability to maintain consistently alert interaction.

Orientation		
Temporal Orientation (tested multiple times)		
Calendar date usually correct within one day		
Day of week off by 2+		
Time of day variable		
Benton Right Left Orientation Test		
All 20 simple and complex crossed responses correct		
Sensory-Perceptual		
	R	L
Tactile		
DSS (errors)	0	4
Finger Recognition (errors eyes open)	0	0
Finger Recognition (errors vision occluded)	2	5
Palm Skin Number Writing (errors vision occluded)	R < L	
Auditory		
DSS (errors)	0	4
Seashore Rhythm Test 14/30 correct (severely impaired)		
Visual-Spatial		
Judgment of Line Orientation Test 20/30 correct (borderline defective)		
Hooper Visual Organization Test 19½ - 23½/30 correct (depending on scoring of fragmented responses; mildly to moderately impaired)		
Constructional		
Simple drawings on Day 1 (cross, square, triangle)		
Grossly distorted and with perseveration		
Simple drawings on Day 2 (cross, square, triangle)		
Improved but with loss of set regarding instructions to not lift pencil		
Motor		
Name Writing	3 sec	27 sec
Finger Tapping	54.4 taps	44.6 taps*
Grooved Pegboard		
Insertion	134 sec**	188 sec**
Removal	29 sec	39 sec
*mildly impaired		
** severely impaired		
Fist-side-palm rapid responding		
Difficulty getting and keeping sequence		
Alternating sequences		
Mild difficulties with difficulty initiating and persistence		
Language		
Aphasia Screening Test		
Articulation – good		
Naming – good		
Reading – one self-correction		
Repetition – good		
Boston Naming Test 58/60 correct		
MAE Sentence Repetition 14/14 correct (83%ile)		
Verbal Fluency		
H-words 14 words (moderately impaired)		
MAE Controlled Oral Word Association 27 words (12-22%ile/Low Average)		
Speech-Sounds Perception Test 9/60 errors (moderately impaired)		
Intellectual-Conceptual-Higher Order		
WAIS-R		

Full Scale IQ	95	
Verbal IQ	108	
Performance IQ	81	
Subtest	Age Scale Score	Scale Score
Information	13	12
Digit Span	8	8
Vocabulary	14	13
Arithmetic	11	10
Comprehension	12	11
Similarities	12	10
Picture Completion	6	4
Picture Arrangement	6	4
Block Design	8	6
Object Assembly	7	5
Digit Symbol	8	5
Trail Making Test Part A 59 sec 0 errors Part B discontinued at 300 sec 5 errors (severely impaired)		
Wisconsin Card Sorting Test 2/6 concepts 42 perseverative errors/57 total errors		
Design Fluency Severely impaired		
Memory		
Wechsler Memory Scale Memory Quotient 99		
Logical Memory Immediate Recall (number correct each story) 7, 6 Delayed Recall (number correct each story) 7, 6½		
Visual Reproduction Immediate Recall (correct) 2 Delayed Recall (correct) 1		
Benton Visual Retention Test Administration A 5/10 correct, with distortions and some figures superimposed		

involves the presentation of cut up pieces of an object that the subject is required to mentally integrate and name. The patient gave a number of unusual responses. For example, the pieces for one item comprise a fish; the patient stated, “fish, flying fish, flying duck.” On another item that is comprised of two pieces that, put together, make a saw; the patient stated, “two saws.” As another example, toward the end of the test, the patient began to perseverate in saying with each “a broken X [item name],” another broken X,” “a broken Y,” “a broken Z,” “Why is everything broken in here? [Answering his own question] So you can put ‘em back together....” Depending on whether credit was given for stating “broken” before naming the item, his total score ranged from mildly to moderately impaired. Of greater interest, though, is the pattern of qualitative responses given by him.

In terms of aspects of motor functioning, the patient exhibited mild difficulties initiating and

maintaining two- and three-step alternating motor sequences with the right hand. Even greater difficulty was observed with the left hand. His speed in writing his name was extremely slow with his left hand, relative to his right hand (by a factor of nine times). A greater than normal discrepancy was in evidence between hands in finger oscillation speed and dexterity, with disproportionate slowness notable for the left versus right hand. The addition of a visual-perceptual component reduced levels of performance bilaterally to the severely impaired range, with even greater dysfunction of the left hand.

In terms of language functions, oral verbal fluency was in evidence at a low average level, while written word fluency was in evidence at a borderline mildly impaired level. Phoneme-grapheme matching was in evidence at a borderline normal level. Language functions

otherwise were relatively well preserved in terms of articulation, reading, and writing, with naming and sentence repetition, in particular, being in evidence at above average and superior levels of performance respectively.

In terms of psychometric intelligence testing with the WAIS-R, given the pattern of performance on the Verbal versus Performance subtests, the patient obtained scores indicative of generally well-preserved verbal abilities relative to significantly compromised visual-spatial abilities. Particularly striking deficits were in evidence on the Picture Arrangement subtest, which required the patient to arrange a series of picture cards that tell a story in temporal sequence. He did especially poorly on this, was able to correctly sequence only the very simplest, first trial, and was entirely unable to correctly sequence on any subsequent trial. Further, he placed some cards on top of each other rather than arranging them, as instructed, in a sequence from left to right. On the Object Assembly subtest, which requires putting together puzzle pieces to make readily identifiable objects, he also put some of the pieces on top of each other instead of adjoining each other. On the Picture Completion subtest, which required the patient to identify the most salient missing features from pictured stimuli, he made a number of errors by identifying features that were hardly salient at all. On the Block Design subtest, which required the patient to put together colored blocks to match a stimulus design laid out in square matrices (either 2x2 or 3x3), he made numerous errors and put blocks in configurations of disjointed elements; he did not appear to perceive the overall gestalt of the square matrix in which they would combine correctly. Indeed, he persisted in this over reliance on low-level detail or “featural” information versus higher-level, “configural,” or contextual information. This was paralleled by deficits in organizing and directing his behavior. There was also a striking discrepancy in evidence on the Digit Span subtest between the patient’s attempts to recite digits forward (digit span of 7) versus digits backward (digit span of only 3).

On formal testing of concept formation skills, the patient was very defective in his ability to benefit from feedback cues to modify his strategies for problem solving. His speed of basic visual scanning and sequencing was in the impaired range, while the additional task demand to engage in set-shifting lowered his performance dramatically into the very severely impaired range. On the other hand, simple verbal abstracting

ability (e.g., extracting features shared by paired items on the WAIS-R Similarities subtest) and proverb interpretations (i.e., items included in the WAIS-R Comprehension subtest) were still quite adequate.

The patient’s performance on memory tests suggested some significant difficulties, particularly regarding visual-spatial material. His verbal memory abilities appeared to be reasonably retained at both immediate free recall and subsequent delayed testing, while visual-spatial recall, both immediate and delayed, was very poor. Further, on one measure of visual retention immediately following stimulus presentation, he obtained a severely defective score, and his actual performance included some smaller peripheral figures drawn superimposed on larger/major figures instead of being placed in the periphery as in the original stimulus figures.

Discussion

The electrophysiological, neuroradiological, and neuropsychological findings converge on identification of a right frontal-temporal-parietal lesion along with (at most) minor involvement of the left hemisphere. More in-depth consideration of the neuropsychological findings highlights potential mechanisms that are congruent with some that have previously been hypothesized or observed in the small extant literature on RP, namely, visual-spatial processing, memory, and executive functioning impairments [3,6]. Key features of this case appear to implicate visual-perceptual fragmentation and overarching impairment in conceptual integration; difficulty filtering out non-essential/irrelevant information and/or not focusing sufficiently on central stimulus elements; difficulty with set-shifting; general perseveration in error; subtle inattention in auditory and tactile modalities to sensory input on the left side of the body (and in evidence on simple copy drawing with subtly impaired awareness of the left side of a cross); some temporal disorientation; extremely poor temporal sequencing, including sequencing of depictions with social and emotional cues within an environmental context; poor visual-spatial memory relative to reasonably intact verbal memory (albeit with verbal working memory strained to a mild extent as noted in Digit Span backwards); relatively impaired left hand versus right hand finger tapping speed; relatively greater impairment in motor sequencing with the left versus right hand; and very impaired visual-perceptual-motor integration. Overall, then, as

previously hypothesized by others [3,9], there are in evidence major error detection and correction malfunctions, disruptions of sensory input/processing, and difficulty with fragmentation of experience and sensory-perceptual and broader conceptual integration. Minor impact on largely left hemisphere functions (but potentially associated with right-left hemisphere imbalance [10,11], was suggested by the convergence of the findings of background slowing of the EEG for the left hemisphere, along with the minor borderline scores on measures of verbal fluency and phoneme-grapheme matching with otherwise relatively well preserved verbal/language abilities.

An explanation for RP that relies on reducing the complexity of the phenomena observed to the effects of localization associated with a single focal lesion is likely doomed. On the other hand, rather than relying on the explanatory power of a single neuroanatomic location, identification of disruption(s) of some aspects of a network or networks that involve connectivity with the frontal lobe likely holds promise for better understanding [12]. Further, while damage may occur specifically with the frontal lobe in many, if not most, cases of RP, more broadly the disruption of pathways associated with the right frontal lobe may be necessary though not

sufficient. The explanation, however, will require more than this, particularly in view of the frequent constellation of visual-perceptual and memory disturbances noted in cases of RP. The heterogeneous manner in which neural circuits may be disrupted to contribute to RP remains an area of active inquiry [6,11,13-15].

Conclusion

This case adds to the observational literature on RP phenomena, particularly in terms of the detailed neuropsychological findings obtained. This patient's profile is largely consistent with right frontal involvement, but implicates potential pathway connections with aspects of the parietal and temporal lobes, as well as a broad array of potential cognitive processes. While a relatively rare occurrence, further elucidation of the mechanisms that underlie RP may contribute to a better understanding in general of the complexity of neural circuitry associated with diverse cognitive mechanisms of RP specifically and integrated brain function more broadly.

Conflicts of Interest

The author declares he has no conflicts of interest related to this paper.

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