Neuropsychiatry, Neuropsychology, and Behavioral Neurology
Vol. 11, No. 1, pp. 40–44

Persistent Recurrence of Hypomania and Prosopoaffective Agnosia in a Patient With Right Thalamic Infarct

*‡Patrik Vuilleumier, M.D., †Florence Ghika-Schmid, M.D., †Julieu Bogousslavsky, M.D., *Gil Assal, M.D., and †Franco Regli, M.D.

**Division of Neuropsychology and †Department of Neurology, Centre Hospitalier Universitaire Vaudois, Lausanne, and ‡Department of Neurology, Hôpital Cantonal Universitaire de Genève, Geneva, Switzerland.*

Summary: The authors report a 63-year-old man with a history of brief isolated manic episodes who became persistently hypomanic after a small right thalamic infarct. Detailed behavioral and neuropsychologic assessment were performed 18 months after the stroke and revealed a prosopoaffective agnosia as the foremost cognitive disorder, i.e., an impairment in the identification of emotional facial expressions with preserved discrimination of facial identity. Difficulties in reasoning on humorous material and other signs of mild right hemisphere dysfunction were present, but other perceptual, frontal, and abstract-reasoning cognitive functions were unimpaired. Prosopoaffective agnosia has not been reported previously in thalamic lesions or in primary or secondary mania. The authors discuss the hypothetical relationships between a right hemisphere deficit in processing emotions and relapsing of the patient's hypomanic behavior. **Key Words:** Mania—Thalmic stroke—Face—Emotional expressions. **NNBN 11:40–44, 1998**

Several cases of mania have been reported after right hemisphere damage involving either the basal frontal and temporal lobes, the medial thalamus, or the head of the caudate (1–4). Cerebral blood flow studies in patients with primary mania also showed evidence of frontal and temporal abnormalities that were predominantly right-sided (5,6). Furthermore, because mania is characterized by affective and behavioral disturbances, such as elation, increased talkativeness, grandiose ideation, lack of insight, and social disinhibition (2), it has been proposed to be associated with frontal lobe dysfunction (1,7). However, whereas a few studies in patients with primary mania found signs of frontal cognitive disturbances (7), others found signs of right hemisphere disturbances (8), and still others more global (9) or no cognitive impairment (10). Cognitive functioning in patients with mania after brain damage has rarely been investigated (1).

We report here a patient who became persistently hypomanic after a small right thalamic infarct. We studied his cognitive functioning while he was untreated in search of a disorder in frontal lobe functions or a disorder in right hemisphere functions and emotional processing.

CASE REPORT

This 63-year-old right-handed engineer sustained hearing problems from acoustic trauma in his thirties and had three manic episodes requiring psychiatric hospitalization from age 30 to 55 years. Each episode had been brief (~4 weeks) followed by complete remission. Since the last episode in 1987, his behavior and mood had been unremarkable. He had no known depressive episode. In December 1993, he abruptly developed left hemihypesthesia, hemiataxia, and hemianopsia. A magnetic resonance imaging showed a right lateral thalamic infarct. Changes in mood became increasingly evident during the next 3 months, and they were unchanged when we saw him again 2 years later. Although he had persistent left-sided clum-

Received April 14, 1997; first revision July 14, 1997; second revision October 3, 1997; accepted October 7, 1997.

Address correspondence and reprint requests to P. Vuilleumier, Neurology Department, 127, Building E, VA Medical Center, 150 Muir Road, Martinez, CA 94553.

Part of this work was presented at the 19th Annual Meeting of the International Neuropsychological Society, Veldhoven, June 1996.

siness and numbness, the patient stated his stroke had brought him "a definitive spiritual elevation." Inquiries from his relatives established that his expansive mood was unremitting since the stroke, with elation, jocularity, restlessness, talkativeness, grandiose ideation (e.g., he theorized about artistic emotions using sophisticated mathematical formulas), lack of criticism and inflated self-esteem (only shrewd minds could appreciate his theoretical ideas), and decreased need for sleep. He behaved with much theatricality and used frequent puns or spoonerisms. He boasted to be sexually active "in spite of the loss of sensation on half of the body." There were no modified dietary habits, high-risk activities, or foolish purchasing. Social and familial functioning remained good.

All reported investigations took place 18 months after the stroke. At this time, neurologic examination showed decreased sensation for all modalities on left hemibody and face, in addition to mild hemiparesis with ataxia and slight dystonia of the left hand, and impaired perception in the left visual hemifield without true hemianopia. A repeat brain magnetic resonance imaging showed an old infarct in the right posterolateral thalamus (Fig 1.). A partial involvement of the pulvinar nucleus was suspected and was likely to account for the visual disturbances in the absence of extrathalamic damage.

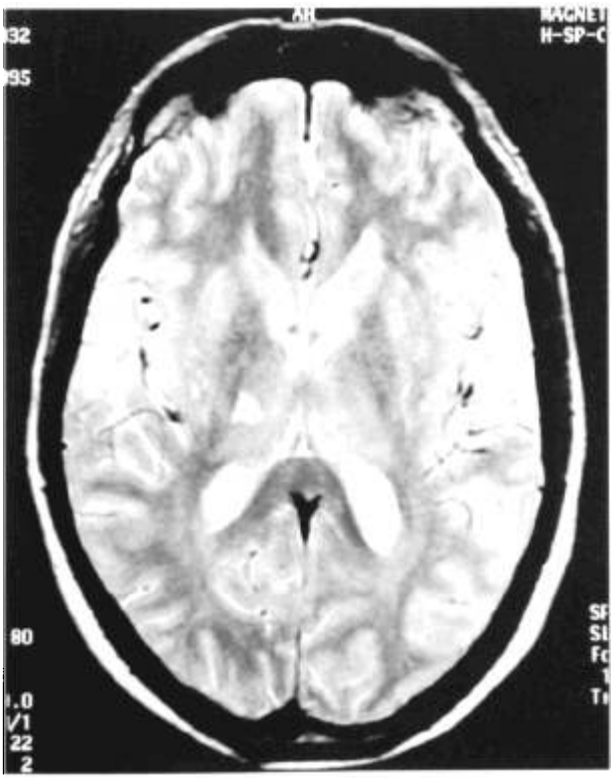

FIG. 1. Brain magnetic resonance imaging at the time of examination (July 1995) showing a small right lateral thalamic infarct in the territory of the inferolateral/thalamo-geniculate artery.

BEHAVIORAL AND PERSONALITY ASSESSMENT

The patient scored 21 points on a Mania Rating Scale (11), which is well in the manic range. On the Minnesota Multiphasic Personality Inventory (MMPI) (12), the Psychopathic, Schizophrenia, and Mania scales yielded the highest scores (T-scores: 62, 61, and 58, respectively), whereas Depression, Psychasthenia, and Social Introversion scales conversely yielded the three lowest scores (42, 44, and 28, respectively), a profile consistent with exaltation and impulsiveness (13). Moderately elevated K-score (T-score: 64) reflected his inflated self-esteem and tendency to present himself in a favorable light.

NEUROPSYCHOLOGICAL ASSESSMENT

Methods

General cognitive functions were assessed using a standardized battery of neuropsychologic tests (14).

Recognition of Emotional and Nonemotional Visual Material

Visual perceptual and organizational abilities were assessed with several object- and face-recognition tasks known to be sensitive to right hemisphere dysfunction (Table 1) (15–18). Visual recognition of emotions was assessed using three tasks: free naming of facial expressions posed by actors, seven being "positive" (e.g., happiness), seven "negative" (e.g., fear), and six "neutral" (e.g., wonder); matching pairs of similar expressions across male and female faces (two positive, two negative, and one neutral in each gender); free naming of gestural expressions pantomimed by actors (e.g., scolding, imploring, pretending to slap one's face). In both free naming tasks the patient's responses were scored as incorrect only when they were not given by any of 10 control subjects and not basically equivalent (e.g., responses such as "this guy is ready to do a battle" for anger was considered as correct). Responses produced by the controls were always consistent with the intended posed expressions.

Reasoning and Frontal Lobe Functions

A number of tasks known to be sensitive to frontal lobe dysfunction were administered (Table 2) that tapped response inhibition, resistance to interference, cognitive flexibility, abstraction and concept formation in the verbal domain and about visually presented material (18–27).

Results

General Cognitive Functions

The patient was cooperative throughout all testing sessions. Spontaneous speech was abundant and voiced loudly, with normal prosody. However, he was aprosodic

TABLE 1. *Results on visual and emotional recognition tests*

	Patient's scores	Cutoff scores in controls*
A. Recognition of nonemotional visual material		
Benton Facial Recognition Test (Benton & Van Allen, 1968)	25/27	19/27
Famous Faces Recognition	8/10	7/10†
Famous Faces Naming	7/10	7/10†
Famous Places Recognition	10/10	9/10†
Foreshortened View Object Matching (Riddoch & Humphreys, 1993)	25/25	16/25
Hooper Visual Organization Test (Hooper, 1958)	18.5/20	14/20
WAIS-R Object Assembly subtest (Wechsler, 1981): raw score:	32/41	
standard note:	10	11.4 (± SD 2.3)‡
B. Recognition of emotional visual material		
Facial Expressions Naming	10/20	15/20§
Facial Expressions Matching	10/10	10/10§
Gestural Expressions Naming	8/10	8/10§

*Results are compared to those of age- and education-matched normal controls (Assal, 1985). Shortened versions were used for the Benton Facial Recognition Test and the Hooper Visual Organization Test (Assal, 1985).

†Famous Faces Recognition and Naming were compared to a group of 10 25- to 65-year-old normal subjects.

‡Results on the WAIS-R subtests are compared to the mean standard note (SD, standard deviation).

§On the Emotional Expression Naming tasks, the patient's responses were considered incorrect when given by none of 10 20- to 60-year-old normal subjects; to compare, his scores are thus to be considered as if 20/20 of the responses given by the controls were correct.

when singing. Naming, writing, reading, calculation, ideomotor limb, and constructional praxis were all intact. There was a slight left spatial neglect in the copy of the Rey-Osterreith Complex Figure (score, 24.5/36) and in the bisection of horizontal lines (mean rightward shift, 6.8%), but a letter cancellation task was normal (56/60 targets cancelled: 1 left-sided, 1 central, 2 right-sided omissions). Digit span was 5 and block span was 4. Rey Auditory Verbal Learning Test was normal (total learning score 58/75; recognition 15/15; delayed recall 13/15), but memory for the Rey-Osterreith Complex Figure was poor (Immediate Saving score, 14%; 40-minute Delayed Forgetting score, 29%).

Recognition of Emotional and Nonemotional Visual Material

The patient scored in the normal range on all nonemotional tasks, but was strikingly impaired in judging facial affective expressions (Table 1). Half of his judgments differed from the controls and were basically inappropriate (e.g., "questioning" for sulkiness, "attentive" for worry, "reproving" for fear). His judgment was incorrect for six of the seven negative expressions and three of the six neutral expressions, whereas it was incorrect for only one of the positive expressions. Incorrect judgments were emotionally neutral in most instances. However, the matching task was executed properly. Recognition of gestural expressions was good and did not significantly differ from the controls (Fischer's exact probability test, $p = 0.95$).

Reasoning and Frontal Lobe Functions

The Wechsler Adult Intelligence Scale–Revised Picture Arrangement subtest was the only task he failed significantly (Table 2). The patient succeeded in completing only three of the ten stories (first, fifth, and sixth) in whatever time allowed. When requested to tell his arrangement's stories, he described the cartoons literally according to the sequence he had chosen and stated he found it amusing this way. All other frontal lobe functions were within normal range, except for a moderately high number of repetitions in the nonverbal fluency task.

DISCUSSION

Two points are of interest in this patient. First, whereas he had brief isolated manic episodes in the past, he became persistently hypomanic after a small right thalamic infarct. Although we cannot totally exclude that mania recurred independently, we suspect that the stroke might have favored a persistent recurrence of his mood and behavioral disorder. Because mania is a rare event after a stroke and because a family history of psychiatric disease has been observed repeatedly in reported cases, it has been supposed that predisposing factors might be present in such cases (3,28). Furthermore, all previous episodes in this patient had been very brief, full-blown manic psychoses requiring medication and hospitalization, whereas the new episode was unremitting and did not lead to a major social handicap, thus being more appropriately diagnosed as hypo-

TABLE 2. *Results on frontal lobe functions tests*

	Patient's scores	Cutoff scores in controls*
A. Verbal reasoning		
Cognitive Estimation Test (Shallice & Evans, 1978)	3	6
Proverbs Definition (Lezak, 1983)	5/5	NA
WAIS-R Similarities subtest (Wechsler, 1981): raw score:	26/28	- -
standard note:	16	8.9 (± SD 2.4)†
B. Reasoning on visual material		
Raven Progressive Matrices (Raven, 1938)	19/30	15/30
Kramer's Sorting Task (Regard, 1980): Number of categories achieved	3	3
Number of perseverations	0	0
Columbia Mental Maturity Test (Burgemeister et al, 1954)	12/12	9/12
WAIS-R Picture Arrangement subtest (Wechsler, 1981): raw score:	6/20	
standard note:	4	9.6 (± SD 2.4)†
C. Other executive functions		
Verbal Fluency (Benton 1968): Letter "M" (1')	15	10
Animals (1')	25	15
Five Points Test (Regard et al, 1982): Total score (3')	60	20
	Repetitions	25% 10%
Stroop's Test (Stroop, 1935): Completion time	49 seconds	62 seconds
Number of errors	0	3
Luria's alternating tasks (Luria, 1966): Hand Gestures sequencing	4/30 seconds	4/30 seconds
Graphic Pattern sequencing	6/20 seconds	4/90 seconds
Go-No Go Task (Lezak, 1983)	24/25	23/25

*Results are compared to those of age- and education-matched normal controls (Assal, 1985). Shortened versions were used for the Raven Progressive Matrices and the Columbia Mental Maturity Test (Assal, 1985). NA, normative datas for controls not available.

†Results on the WAIS-R subtests are compared to the mean standard note (SD, standard deviation).

mania according to Diagnostic and Statistical Manual of Mental Disorders–4th Edition criteria (29).

The second point of interest is that neuropsychologic investigations revealed a striking difficulty in judging emotional expressions in faces in contrast with a preserved discrimination of facial structural traits and identity, a disorder termed prosopoaffective agnosia by Kurucz and Feldmar (30). This also contrasted with a normal judgment of gestural affective attitudes, probably because the latter involve more symbolic conventions than true emotions (31). Other noticeable deficits were aprosodia, poor visuospatial memory, and slight left spatial neglect, which suggests remote dysfunction in the right hemisphere (32). This is consistent with single photon emission computed tomography findings of direct or indirect (diaschisis) involvement of the right temporal lobe in patients with primary or secondary mania (4–6). However, despite disinhibited behavior and undue elation we found no signs of frontal lobe dysfunction, except in the Picture Arrangement subtest of the Wechsler Adult Intelligence Scale–Revised. Because failure in this task stood out against other tasks of visual and verbal reasoning, we suspect this occurred because of its humorous content, which requires the use of appropriate affective representations for successful solving (21,33). Prosopoaffective agnosia can be caused by focal lesions in the right hemisphere (34,35), especially with damage to temporal cortical areas (36,37). It has also been found in patients with ventral frontal lobe damage in whom it correlated with disturbances of emotional and social behavior (38). Interestingly, ventral frontal lobe damage has consistently been associated with secondary mania and affective disorders (2–4). As far as we know, there are no data on small thalamic lesions as in our case. Thus, we believe our patient's deficit reflected secondary remote (diaschisis) effects in the right hemisphere.

It is also intriguing that most of the patient's errors in recognizing facial expressions concerned "negative" emotions. This would be consistent with the controversial hypothesis of a hemispheric valence-specialization for emotional processing, i.e., negative emotions associated with the right hemisphere and positive emotions associated with the left (39,40). Alternatively, this valence-effect could reflect a response bias congruent with the patient's elevated mood. Considered together with his good performance in matching similar facial expressions, it also suggests that the patient's deficit may be one of judgment of the appropriate emotions, i.e., misidentification of emotions, rather than lack of perception of emotions.

One can only speculate on the relationships between the patient's hypomania and his prosopoaffective agnosia. In

the first place, it is possible that hypomania recurred independently of impaired processing of facial emotions. The thalamic infarct may have disrupted specific but distinct neural systems, or a preexisting abnormality in processing emotions might have been associated with the history of previous manic episodes. However, it can be asked whether right hemisphere dysfunction leading to impaired processing of emotions after the stroke in the presence of some predisposing factor may have favored the relapse or the persistency of the patient's manic behavior. To our knowledge, the only study that investigated the recognition of facial expression in patients with primary mania found a normal, though increased, left-sided (right hemisphere-mediated) bias in the perception of chimeric faces (41). However, impairment for both facial and gestural expressions has been found in patients with schizophrenia (42). There are no such studies in affective disorders secondary to brain damage. Further studies of recognition of facial and other emotional expressions in both patients with thalamic damage and patients with mania are clearly needed.

REFERENCES

1. Bogousslavsky J, Ferrazzini M, Regli F, Assal G, Tanabe H, Delaloye-Bischof A. Manic delirium and frontal-like syndrome with paramedian infarction of the right thalamus. *J Neurol Neurosurg Psychiatry* 1988;51:116–9.
2. Cummings JL. *Clinical Neuropsychiatry*. Orlando: Grune and Stratton, 1985.
3. Starkstein SE, Boston JD, Robinson RG. Mechanisms of mania after brain injury, 12 case reports and a review of the literature. *J Nerv Ment Dis* 1988;176:87–99.
4. Starkstein SE, Mayberg HS, Berthier ML, et al. Mania after brain injury, neuroradiological and metabolic findings. *Ann Neurol* 1990;27:652–9.
5. Migliorelli R, Starkstein SE, Teson A, et al. SPECT findings in patients with primary mania. *J Neuropsychiatry Clin Neurosci* 1993;5:379–83.
6. O'Connell RA, Van Heertum RL, Luck D, et al. Single-photon emission computed tomography of the brain in acute mania and schizophrenia. *J Neuroimaging* 1995;5:101–4.
7. Gruzelier J, Seymour K, Wilson L, Jolley A, Hirsch S. Impairments on neuropsychologic tests of temporohippocampal and frontohippocampal functions and word fluency in remitting schizophrenia and affective disorders. *Arch Gen Psychiatry* 1988;45:623–9.
8. Taylor MA, Abrams R. Cognitive dysfunction in mania. *Compr Psychiatry* 1986;27:186–91.
9. Hoff AL, Shukla S, Cook BL, Aronson TA, Ollo CL, Pass HL. Cognitive function in manics with associated neurologic factors. *J Affect Disord* 1988;14:251–5.
10. Dewan MJ, Haldipur CV, Lane E, Donnelly MP, Boucher M, Major LR. Normal cerebral asymetry in bipolar patients. *Biol Psychiatry* 1987;22:1058–66.
11. Bech P, Kastrup M, Rafaelsen OJ. Mini-compendium of rating scales for states of anxiety, depression, mania, schizophrenia, with corresponding DSM-III syndromes: Mania Scale. *Acta Psychiatrica Scandinavia* 1986;73(suppl 236):29–31.
12. Hathaway SR, McKinley JC. *Booklet for the Minnesota Multiphasic Personality Inventory (MMPI)*. French translation and adaptation. 3rd ed. Paris: Editions de Psychologie Appliquée ed. NY: Psychological Corporation, 1943.
13. DeMendonca M, Elliott L, Goldstein M, McNeill J, Rodriguez R, Zelkind I. An MMPI based behaviour descriptor/personality trait list. J Pers Assess 1984;48:483–5.
14. Assal G. *Batterie des examens neuropsychologiques du CHUV*. Lausanne: Centre hospitalier universitaire vaudois, 1985.
15. Benton AL, Van Allen MW. Impairment of facial recognition in patients with cerebral disease. *Cortex* 1968;4:344–68.
16. Hooper HE. *The Hooper Visual Organization Test*. Beverly Hills, CA: Western Psychological Service, 1958.
17. Riddoch MJ, Humphreys GW. *Birmingham Object Recognition Battery*. Hove: Lawrence Erlbaum Associates, 1993.
18. Wechsler D. *Wechsler Adult Intelligence Scale—Revised*. NY: Psychological Corporation, 1981.
19. Benton AL. Differential behavioral effects of frontal lobe disease. *Neuropsychologia* 1968;6:53–60.
20. Burgemeister BB, Hollander-Blum L, Lorge I. *Manual for the Use of the Mental Maturity Scale of Columbia*. NY: World Book Company, 1954.
21. Lezak MD. *Neuropsychological Assessment*. NY: Oxford University Press, 1983.
22. Luria AR. *Human Brain and Psychological Processes*. New York: Harper & Row, 1966.
23. Regard M. Assessment of frontal lobe deficits in man with special attention to the right nondominant side. Zurich, Switzerland: University of Zurich, 1980. PhD thesis.
24. Regard M, Strauss E, Knapp P. Children's production on verbal and non-verbal fluency tasks. *Percep Mot Skills* 1982;55:839–44.
25. Raven JC. *Progressive Matrices, A Perceptual Test of Intelligence, Individual Form*. London: HK Lewis, 1938.
26. Shallice T, Evans ME. The involvement of the frontal lobes in cognitive estimates. *Cortex* 1978;14:294–303.
27. Stroop JR. Studies of interference in serial verbal reactions. *J Exp Psychol* 1935;18:643–62.
28. Robinson RG, Boston J, Starkstein SE, Price TR. Comparison of mania and depression after brain injury, causal factors. *Am J Psychiatry* 1988;145:172–8.
29. *Diagnostic and Statistical Manual of Mental Disorders*. Washington, DC: American Psychiatric Association, 1994.
30. Kurucz J, Feldmar G. Prosopo-affective agnosia as a symptom of cerebral organic disease. *J Am Geriatr Soc* 1979;27:225–30.
31. Grüsser OJ, Landis T. Visual agnosia and other disturbances of visual perception and cognition. London: MacMillan, 1991.
32. Hublet C, Demeurisse G, Paternot J, Colson C, Capon A. Remote cortical dysfunction as a possible cause of subcortical neglect? A regional cerebral blood flow study. *Eur Neurol* 1995;35:254–8.
33. Gardner H, Ling PK, Flamm L, Silverman J. Comprehension and appreciation of humorous material following brain damage. *Brain* 1975;98:399–412.
34. Bowers D, Bauer RM, Coslett HB, Heilman KM. Processing of faces by patients with unilateral hemispheric lesions. I: Dissociations between judgments of facial affect and facial identity. *Brain Cogn* 1985;4:258–72.
35. De Kosky S, Heilman K, Bowers D, Valenstein E. Recognition and discrimination of emotional faces and pictures. *Brain Lang* 1980; 9:206–14.
36. Prigatano GP, Pribram KH. Perception and memory of facial affect following brain injury. *Percep Mot Skills* 1982;54:859–69.
37. Cancelliere AEB, Kertesz A. Lesion localization in acquired deficits of emotional expression and comprehension. *Brain Cogn* 1990;13:133–47.
38. Hornak J, Rolls ET, Wade D. Face and voice expression identification in patients with emotional and behavioral changes following ventral frontal lobe damage. *Neuropsychologia* 1996; 34:247–61.
39. Borod JC, Koff E, Lorch MP, Nicholas M. The expression and perception of facial expression in brain-damaged patients. *Neuropsychologia* 1986;24:169–80.
40. Mandel M, Tandon S, Ashtana H. Right brain damage impairs recognition of negative emotions. *Cortex* 1991;27:247–53.
41. David AS, Cutting JC. Affect, affective disorder and schizophrenia, a neuropsychological investigation of the right hemisphere function. *Br J Psychiatry* 1990;156:491–5.
42. Berndl K, von Cranach M, Grüsser OJ. Impairment of perception and recognition of faces, mimic expression and gestures in schizophrenic patients. *Eur Arch Psychiatry Neurol Sci* 1986; 235:282–91.