

Case report

Abulia and cognitive impairment in two patients with capsular genu infarct

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Background – An internal capsule genu infarct has been rarely reported to cause cognitive impairment and behavioral changes. This clinical picture can be explained on anatomical and functional basis because important subcortical–cortical pathways traverse the internal capsule genu. We report 2 previously non-demented patients who developed acute confusional state, abulia, and moderate cognitive decline after the occurrence of an infarct in the capsular genu. **Methods** – Clinical, neuropsychological, and MRI evaluation at baseline and 12-month follow-up. **Results** – Abulia and cognitive impairment were still present 1 year after stroke. In 1 patient there were associated multiple lacunar infarcts and leukoaraiosis. In the other an old small left frontal infarct was also present. In both moderate cortical atrophy co-existed.

Conclusions – We hypothesize that co-existing lesions, possibly associated with a sub-clinical reduction of cognitive functions, facilitate the development of a persistent clinically evident mental deficit after the occurrence of an infarct in the capsular genu.

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The term vascular dementia encompasses a wide spectrum of clinical–pathological entities with different pathogenic mechanisms (1). Many vascular dementia cases occur in relation with stroke, but even the stroke-related forms of vascular dementia are heterogeneous from the clinical and pathogenic points of view (2). Different possibilities can explain why stroke patients are more prone to develop dementia (3). Single-strategic infarct dementia defines a clinical picture characterized by the abrupt onset of cognitive impairment and behavioral changes in relation to the occurrence of a single infarct in specific regions of the brain such as the thalamus, the caudate nucleus, and the angular gyrus (4). Cognitive alterations following unilateral infarcts of the genu of the internal capsule have been rarely described (5–9). The clinical picture is that of a frontal lobe syndrome with inattention, apathy, psychomotor retardation and has been interpreted as a thalamocortical disconnection syndrome (5). Madureira et al. (10) recently reported 4 patients with cognitive impairment and

an isolated inferior capsular genu infarction; their patients markedly improved within 12 months. We describe 2 patients with persistent abulia and cognitive impairment following an infarct of the left capsular genu, hypothesizing that in our cases the presence of concomitant cerebral lesions explains the persistence of the disturbance.

Case reports

Patient 1 was a 74-year-old retired, right-handed, man, with a 5-year education level, fully independent in activities of daily living and without any obvious cognitive impairment. He had a 40-year history of smoking (1 pack/day), and no history of diabetes mellitus, hypertension, or alcohol abuse. One day he suddenly became moderately confused and unable to carry out the activities he had planned for that day. On the following day, because of persisting mental confusion, the patient was admitted to the emergency room where the general

examination was unremarkable. A cranial CT showed multiple lacunar infarcts in the basal ganglia and thalami and diffuse hypodensity of the white matter. The genu of the left internal capsule showed mild initial hypodensity (Fig. 1). He was then admitted to the Neurology Unit. On admission, he was afebrile, alert and cooperative, oriented to place and person, but not to time. He did not show any obvious deficit in verbal expression or denomination but appeared abulic and with a tendency to mutism. He presented with slight right facial-brachial motor weakness. No sensory or cerebellar disturbances were present. Lasègue sign and rigor nuchalis were absent. Blood gases analysis, routine blood tests, folic acid, vitamin B₁₂, and thyroid hormones serum levels were within normal values. Blood tests for syphilis were negative. Electroencephalogram showed mildly altered vigilance and frontal-temporal theta component excess. A carotid and vertebral echo-color Doppler study revealed only intimal thickening of both internal carotid artery. A cranial MRI performed 2 days after admission showed moderate cortical atrophy, diffuse white matter alterations on the T₂-weighted images, and one hyperintense lesion of the genu of the left internal capsule compatible with a recent lacunar infarct.

During the following days the patient was somnolent and remained silent in the bed for



Fig. 1. Patient 1. Cranial CT performed in the acute phase showing multiple lacunar infarcts in the basal ganglia and thalami and diffuse hypodensity of the white matter. The genu of the left internal capsule showed mild initial hypodensity (arrowhead).

most of the day-time. A thorough neuropsychological assessment (11–23) performed 8 days after admission showed slight mental deterioration with prevalent impairment of executive and memory functions; Mini-Mental State Examination (24) score was 20/30. The patient was disoriented to time, and uncertain in referring information on relevant facts of actuality. He showed an impairment of performances on tasks exploring abstraction, attention, verbal memory, and fluency. Moreover, he had difficulty in reading, writing, and calculation, while constructional praxis was normal (Table 1). In order to assess the pre-stroke cognitive status, we conducted an informant interview based on current criteria for dementia (25) and validated in a study assessing the incidence of dementia in a stroke registry (26). The interview was administered to the wife and excluded any intellectual deficit. Six months after the event, the patient had moderate memory impairment, a deterioration of emotional control, and an intellectual deficit so severe to heavily affect activities of daily living. This clinical picture was judged to be compatible with a diagnosis of dementia (25, 26). At the 12-month follow-up, the neuropsychological evaluation disclosed slightly worse scores in comparison with the previous one (Table 1). The patient continued to be disoriented to time and showed psychomotor retardation. He was still described by his relatives as hypokinetic and abulic, laying for most of his time on bed. Formally tested, he did not fit the DSM-IV criteria for major depression (27). A cranial MRI clearly showed the lacunar lesion of the genu of the left internal capsule (Fig. 2).

Patient 2 was a 75-year-old retired, right-handed, man, with a 5-year education level, fully independent and without any obvious cognitive impairment. He had a history of hypertension and hypercholesterolemia. One day, while he was driving his tractor, he suddenly developed difficulties to continue the task and became moderately confused and hypoactive. Furthermore, he presented with right-side weakness, including facial paresis, and dysarthria. He was not hospitalized on this occasion. A cranial CT showed a mildly hypodense lesion of the left internal capsule genu; the exam also disclosed a small left frontal cortical hypodense lesion, with well defined limits, related to an old ischemic infarct. Two months later the patient came to our attention. On admission, he was alert and cooperative, but only partially oriented to place, time, and persons. He appeared abulic and with a tendency to mutism. He presented with slight dysarthria, right facial paresis and Babinski sign; he did not show any limb motor weakness nor sensory or cerebellar deficits. Routine blood tests, folic acid,

Table 1. Hospital and 12-month follow-up neuropsychological evaluations

Neuropsychological tests	Cognitive functions	Patient 1		Patient 2		Normative value** mean score ± SD
		Hospitalization assessment score*	Follow-up assessment score*	Hospitalization assessment score*	Follow-up assessment score*	
Blessed's IMCT (12)	Global mental function	28/34	22/34	22/34	22/34	32.5 (1.8)
Weigl test (13)	Abstraction	3	—	—	1	10.1 (3.1) [#]
Visual search (14)	Attention	18	—	—	37	46.7 (8.2) [#]
Digit span forward (15)	Short-term verbal memory	3	3	2.5	3	4.2 (1.2)
Corsi block test (16)	Short-term spatial memory	5	4	2.5	2.5	4 (1.2)
RMT (17)						
Five words acquisition	Long-term verbal memory	7	3	0	0	11.8 (1.9)
Five words 10-min recall	Long-term verbal memory	15	4	0	0	17.6 (1.9)
Five words 24-h recall	Long-term verbal memory	1	4	0	0	15.4 (5.0)
Associated words acquisition	Long-term verbal memory	10	4	0	0	13.3 (2.5)
Associated words 10-min recall	Long-term verbal memory	20	10	0	0	21.2 (2.8)
Associated words 24-h recall	Long-term verbal memory	16	8	0	0	20.3 (3.1)
Babcock story (18)						
Immediate recall	Long-term verbal memory	3	1	3	3	9.1 (4.2)
10-min recall	Long-term verbal memory	3	2	0	0	11.2 (5.0)
Token test (19)	Language	30	28.5	22	24.5	33.1 (2.2)
Set test (category fluency) (20)	Language and executive functions	32	38	26	27	38.5 (1.6)
Letter fluency (21)	Language and executive functions	8	13	6	10	26.0 (9.3)
CAS/ma (22)	Counting, writing, reading, alphabet	8	8	8	10	10.2 (1.2)
Copying drawings (23)	Constructional praxis	15	15	10	10	13.2 (1.9)

* Adjusted for age and education. ** In a series of 146 subjects (11). [#]According to Spinnler & Tognoni (14).

IMCT: Information-Memory-Concentration-Test (12).

RMT: Randt Memory Test (17).

CAS/ma: Clifton Assessment Schedule mental ability (22).

vitamin B₁₂, and thyroid hormones serum levels were within normal values. Blood tests for syphilis were negative. A carotid and vertebral echo-color

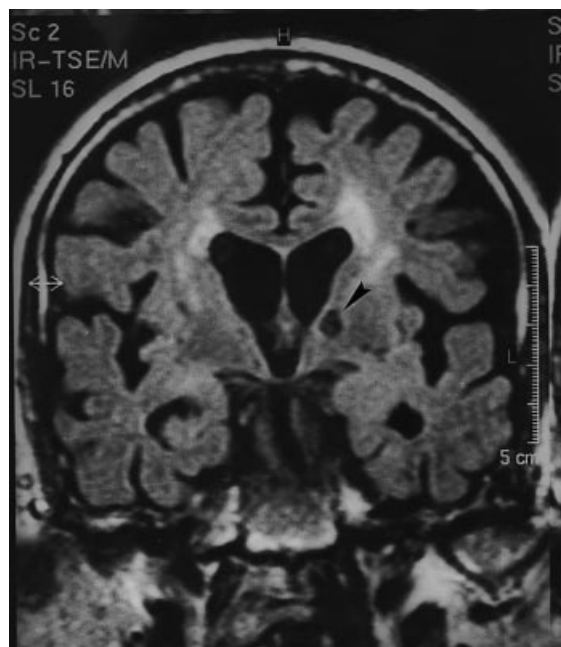


Fig. 2. Patient 1. Cranial MRI performed 1 year after stroke showing a cavitate lesion of the inferior genu of the left internal capsule (arrowhead) on the FLAIR (Fluid Attenuated Inversion Recovery, TR: 6000; TE: 100) sequence compatible with an old lacunar infarct.

Doppler study revealed an occlusion at the origin of the left internal carotid artery with activation of collateral circles. A cranial MRI T₂-weighted study showed a lacunar infarct of the genu of the left internal capsule and confirmed the presence of a small left frontal hyperintense lesion compatible with a watershed infarct between the anterior and middle cerebral artery territories. Mild cortical atrophy was also described (Fig. 3). The neuropsychological assessment showed a moderate mental deterioration with prevalent impairment of attention, acquisition, and comprehension functions; Mini-Mental State Examination score was 20/30. The patient showed a prevalent impairment of performances on tasks exploring verbal memory and fluency. Moreover, he had difficulty in reading, writing, and calculation, while constructional praxis was only partially impaired (Table 1). A neuropsychological assessment performed 12 months after stroke was similar to the previous one and showed moderate mental deterioration with prevalent impairment of attention, shifting of attention, verbal memory, and fluency (Table 1). Mini-Mental State Examination score was 15/30. At this time, he was still described by his relatives as hypokinetic and abulic; however, he was reported to be able to carry out his usual activities of daily living. The informant interview excluded any obvious intellectual deficit before the event.

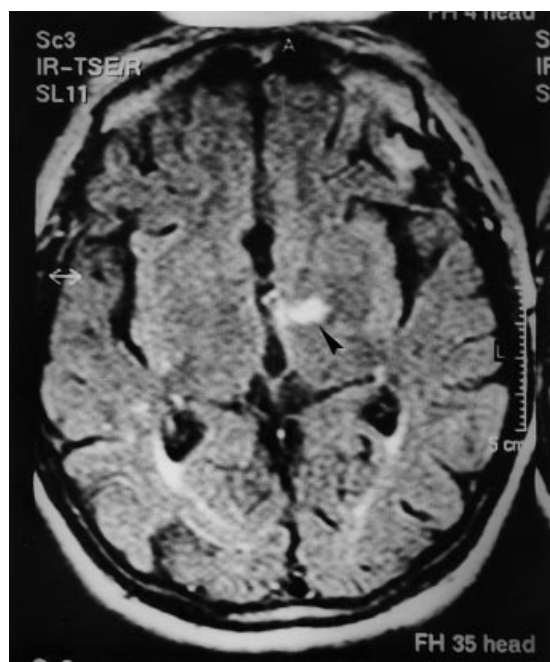


Fig. 3. Patient 2. Cranial MRI performed 2 months after stroke. T₂-weighted images showed a hyperintense lesion of the genu of the left internal capsule (arrowhead) suggesting a lacunar infarct and the presence of a small left frontal hyperintense lesion compatible with a watershed infarct between anterior cerebral artery and middle cerebral artery territories.

Twelve months after, he was reported to have moderate memory deficit that slightly affected everyday life activities. This clinical picture was judged to be compatible with mild cognitive impairment but not with a diagnosis of dementia (25, 26). He was not diagnosed as major depressive by the DSM-IV criteria.

Discussion

We reported 2 patients with persistent abulia and cognitive impairment mainly characterized by deficit in executive functions which occurred after a capsular genu infarct. Lesions localized in the genu of the internal capsule are usually associated with contralateral facial and lingual hemiparesis and dysarthria (28). In his seminal review, Fisher (29) described a patient affected by an internal capsule lacunar infarct presenting with confusion and impairment of attention and memory in addition to pure motor hemiparesis. Other rare instances of cognitive deficit resulting from a lacunar infarct localized in the genu of the internal capsule have been reported (5–10). Cognitive and behavioral alterations in the case of genu infarct can be explained on anatomical and functional bases. Important pathways traverse the internal capsule

genu; among these, are the thalamo-cortical projection fibers that originate from the ventral-anterior and medial-dorsal nuclei of the thalamus and terminate in the frontal lobe. These white matter tracts are part of a complex system of cortical-subcortical-frontal circuits through which the flow of information from the entire cortex, after relay in the basal ganglia and thalami, reaches the frontal cortex (30). According to the review performed by Cummings, executive function deficits occur with lesions of the dorsolateral prefrontal circuit; disinhibition and changes in personality with lesions of the orbitofrontal circuit; and, apathy in cases of injury to the anterior cingulate circuit (31). Despite that in our patients cerebral blood flow could not be evaluated, previous studies have confirmed that in the case of capsular genu infarct the disruption of the thalamic projection fibers determines a functional deactivation of the ipsilateral frontal cortex (thalamocortical disconnection syndrome) (5, 8).

To explain the occurrence of cognitive deterioration in cases of capsular genu infarct at least two hypotheses can be put forward: 1) only capsular genu infarcts that, because of their inferior location or bigger size, affect the inferior and anterior thalamic peduncles (thalamo-frontal connection) result in cognitive deficits; 2) co-existing lesions interact with the capsular genu infarct in determining the clinical picture. In both our patients the infarct was placed in the lower portion of the genu and both had associated lesions. In our first patient, the lesion was obviously located in the genu of the internal capsule. In patient 2 the lesion was bigger and partially involved the anterior thalamus. As far as associated lesions are considered, patient 1 showed diffuse white matter alterations (leukoaraiosis) and multiple lacunar infarcts. Leukoaraiosis has been described in association with subtle cognitive deficits, in particular in frontal lobe tasks (32), but it remains to be definitely established its net contribution to cognition particularly in respect of the role of concomitant lesions such as lacunar infarcts. In this regard, it should be underlined that leukoaraiosis has been shown to be an independent predictor of post-stroke dementia in hospital-based series (33, 34). Although not formally tested before the occurrence of the capsular genu infarct, we are confident that patient 1 could not be defined as overtly demented at that time; the family emphasized that before the stroke he was able to properly and independently carry out all his usual activities. This was formally verified by means of a structured informant interview (26). Thus, the occurrence of the capsular genu infarct seems to be relevant in relation to the post-stroke cognitive profile of this patient. In patient 2, a small

cortical infarct was also detected by MRI evaluation. This lesion appeared to have remained silent until the time of the stroke. This is in agreement with Godefroy et al.'s (35) observation that small frontal lesions are frequently associated and may contribute to the clinical picture of patients with subcortical infarcts.

We hypothesize that in our patients the presence of pre-existing lesions was associated with a subclinical reduction of residual cognitive functions and that the occurrence of a strategically seated infarct led the subjects to develop a clinically evident mental deficit. The presence of associated lesions could also explain why our patients, differently from those described by Madureira et al. (10), did not recover at follow-up. We suggest that in cases of strategic-infarct dementia the coexistence of other cerebral lesions should be carefully sought in order to assess a possible synergist effect. Along with vascular lesions, both our patients showed cortical atrophy on MRI, a sign that might suggest the presence of neurodegenerative changes in their brains. Thus, also these alterations could have contributed to the clinical picture. The hypothesis that the strategic infarct could have disclosed a subtle cognitive impairment related to Alzheimer's type changes is in line with recent data (36).

Finally, another issue of interest deriving from the observation of our 2 patients is their behavior change after stroke. A considerable number of patients develop depression after stroke (37). This could obviously be linked with the functional deficit resulting from stroke (38, 39). On the other hand, Alexopoulos et al. (40) coined the term vascular depression to describe patients with late-onset depression and underlying silent vascular brain lesions. Recently, attention has been directed on the distinction between apathy syndromes and vascular depression (41). The main difference would be the absence of low mood in pure apathic syndrome. Our patients did not show any functional deficit at follow-up, were not depressed as defined by current criteria, and showed marked apathic behavior. Thus, our cases support the hypothesis that apathy may exist, independently of depression, as a syndrome caused by lesions affecting subcortical brain structures.

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