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Neurovascular disease

Lucid dreams, an atypical sleep disturbance in anterior and mediodorsal thalamic strokes $\stackrel{\scriptscriptstyle \bigstar}{}$

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ABSTRACT

Background. – Cognitive, affective, and behavioural disturbances are commonly reported following thalamic strokes. Conversely, sleep disorders are rarely reported in this context. *Observations.* – Herein, we report the cases of two young patients admitted for an ischemic stroke located in the territories of the left pre-mammillary and paramedian arteries. Together with aphasia, memory complaint, impaired attention and executive functions, they reported lucid dreams with catastrophic content or conflicting situations.

Conclusion. – Lucid dreams are an atypical presentation in thalamic strokes. These cases enlarge the clinical spectrum of sleep-wake disturbances potentially observed after an acute cerebrovascular event.

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RÉSUMÉ

Introduction. – Les troubles cognitifs, affectifs et du comportement sont bien connus après un infarctus thalamique. Au contraire, les troubles du sommeil sont plus rarement rapportés dans ce contexte.

Observations. – Nous rapportons les cas de deux jeunes patients ayant présenté des infarctus dans les territoires des artères pré-mamillaire et paramédiane gauches. En plus des troubles phasiques, mnésiques, de l'attention et des fonctions exécutives, des rêves lucides ayant un contenu catastrophique ou de situations conflictuelles étaient rapportés.

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Conclusion. – Les rêves lucides sont une présentation atypique dans les infarctus thalamiques. Ces observations élargissent le spectre clinique des troubles du cycle veille-sommeil pouvant être observés après un événement cérébro-vasculaire à la phase aiguë.

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1. Introduction

Cognitive and behaviour impairment, together with sensitive and motor deficits, are commonly observed following thalamic strokes [1-3]. Cognitive, memory, arousal and mood disorders are mostly observed following stroke involving the anterior and the mediodorsal nuclei, that are respectively supplied by the pre-mamillary and paramedian arteries [1,4]. Despite the strong involvement of the thalamus in the arousal pathways, sleep disorders have been rarely reported after thalamic infarcts, but most frequently after bilateral paramedian lesions [2,5]. The main clinical presentations were hypersomnia, increased daytime sleep and drowsiness, nocturnal awakenings [2,5–7], and in some patients reported by Bassetti et al. [6], unusually frequent nightmares, postarousal confusion, and daytime oneiric states. To our knowledge, lucid dreams, defined by dreams in which the subject is aware that he is dreaming, have never been reported in the context of unilateral thalamic stroke. Herein, we report two cases and discuss the potential pathophysiological mechanisms of this unusual presentation [3,4].

2. Observations

2.1. Patient 1

A 26-year-old woman was admitted to our stroke unit for headache, mild gait ataxia, and binocular diplopia. She had a history of smoking, depression, asthma, spontaneous pneumothorax, and her sole medication was a contraceptive pill. She was right-handed and did not have any history of sleep disturbance. The National Institute Health Stroke Scale (NIHSS) was 1 based on persistent gait ataxia. Brain Magnetic Resonance Imaging (MRI) showed on diffusion weighted imaging (DWI) sequences a recent ischemic stroke located in the left anterior and mediodorsal thalamus, an area supplied by the pre-mamillary artery (Fig. 1). Computed tomography angiography of cervical and intracranial arteries was normal. Electrocardiogram (ECG) and 24 hours ECG-Holter were normal. Transthoracic and transesophageal echocardiography (TTE/TEE) showed a patent foramen oval with a significant right-to-left shunt, suggesting a possible cardioembolic stroke. Biological serum evaluations were normal: there were no inflammatory syndrome, no antiphospholipid antibodies or coagulation factor deficiency. Urine screen for drug abuse was negative. A treatment by antiplatelet was started.

One of her main complaint was sleep disorders with lucid dream sensations, increased nightmares and nocturnal awakenings. Her lucid dreams occurred in the morning hours, she could control them and she distinguished them from nightmares. They were about people she saw during her hospitalisation such as the nursing and medical staff, or about situations she experienced during the daytime, but always in a catastrophic way. For example, she dreamt that "medical staff was aggressive towards patients", or that "the hospital helicopter took off and crashed next to her bedroom window". Besides, it should be noted that the day before her stroke, she witnessed a fight implicating her friend. A post-traumatic

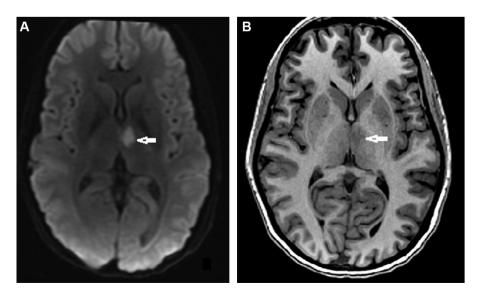


Fig. 1 – Left anterior and mediodorsal thalamic stroke in the pre-mamillary artery territory on DWI (A) and T1 weighed imaging (B) sequences.

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stress disorder linked to stroke was ruled out as she did not have DSM-IV symptoms of trauma reliving, avoidance reaction to stimuli associated to trauma, or persistent neurovegetative symptoms. No sleep recording was performed during the acute phase but we observed that she slept about 12 hours a day, going to bed towards midnight and getting up towards midday. She did not have daytime sleepiness, parasomnia, motor or respiratory sleep disorders.

The neuropsychological evaluation performed four days after stroke identified global intellectual impairment (MOCA was 12 with 5 points lost on memory, deterioration of visuospatial and executive functions, language, attention, abstraction, delayed recall, and orientation). Isaacs Set Test and Number Spans evaluations showed reduction of spontaneous speech, naming problems, and difficulties in categorical word access. Grober and Buschke and Rey Figure Recall showed alteration of encoding as well as anterograde, episodic, historic, semantic and visual memory. Zazzo's Blocking test, Weschler's Codes, Trail Making and Stroop tests respectively demonstrated attention disturbances, low processing speed, impairment of mental flexibility and executive functions. The Hospital Anxiety and Depression (HAD) scale revealed a severe anxiety syndrome (anxiety subscore: 15 and depression subscore: 4) but she did not take any antidepressant medication nor anxiolytics.

Three months later, her sleep improved with fewer nightmares and nocturnal awakenings, and no more lucid dreams. The polysomnography was normal, with a sleep efficiency at 95.6% whereas she was not in sleep deprivation, a Micro-awakenings Index at 11.8 per hour, and no desaturation. Her cognitive performances improved (MOCA 23/30) but there were still language, delayed recall and orientation alterations.

2.2. Patient 2

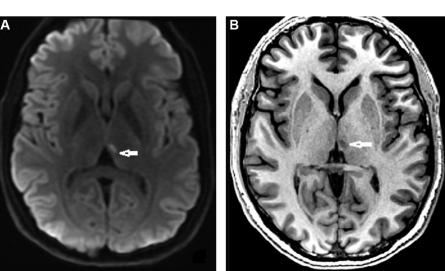
A 36-year-old man was admitted to our stroke unit for headache with sudden right sensorimotor loss and facial paralysis, which improved partially, making the NIHSS to 1 due to a persisting sensory loss. This neurological deficit appeared at his workplace while he was starting his job of bank manager. He had no significant medical history, no history of sleep disturbances, did not take any medication and was right-handed. Brain MRI showed an isolated left mediodorsal thalamic stroke in the paramedian artery territory (Fig. 2). The etiologic investigation, including cervical arteries and polygon of Willis evaluation, ECG, 24 hours ECG-Holter, TTE, TEE, urine screen and CSF examination were normal. Biological serum evaluations were also normal with neither inflammatory syndrome nor thrombophilia. A stroke of undetermined origin was diagnosed and a treatment by antiplatelet was started.

Apart from his persisting right side sensory loss, he complained about a nonrestorative sleep, with lucid dreams and nocturnal awakenings, without increase of nightmares. His lucid dreams occurred mainly in the morning hours, he was able to control them and to wake up spontaneously. The content of his dreams was always difficult situations requiring choices and strategic decision making, similar to situations he had to face in his job. We observed that he went to bed towards 23 hours and he woke up towards 6 hours. He did not have parasomnia, motor nor respiratory sleep disorders. The neuropsychological evaluation performed one day after stroke identified memory, attention and language disturbances, and reduced spontaneous speech and processing speed. The HAD scale revealed a moderate anxiety syndrome (anxiety subscore: 9 and depression subscore: 1) but he did not wish to start a treatment. Three months later, he had no more lucid dreams; the quality of his sleep improved and he felt less tired. His neuropsychological evaluation improved, allowing him to get back to work, despite memory and attention complaints.

3. Discussion

Post-stroke sleep-wake disorders are well known entities, although often neglected [8]. They have a large range of clinical expressions from insomnia, disturbances of wakefulness, sleep-related movement disorders and Rapid Eye Movement (REM) sleep behaviour disorder [8]. Few associations were reported between stroke location and post-stroke sleep

Fig. 2 – Left mediodorsal thalamic stroke in the paramedian artery territory on DWI (A) and T1 weighed imaging sequences (B).



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disorders. Some data suggest a potential association between REM sleep behaviour disorder and small brainstem infarcts [9], while disturbances of wakefulness such as hypersomnia and alternated irregular episodes of sleep and wakefulness during day and night are "typical" features of paramedian thalamic stroke [6,10,11]. These manifestations could be related to the lesion of the reticular and intralaminar thalamic nuclei located in the anterior and mediodorsal thalamus which are part of the arousal system and are strongly involved in the sleep circadian rhythm control through their connexions to the reticular nucleus, the hypothalamus, the striatum, and cortico-limbic structures [3,7,10,12,13].

The thalamus has a crucial role in Non-REM sleep (NREM), especially in spindle formation [13], and in slow-wave sleep generation [12]. Polysomnographic studies performed in patients with thalamic stroke in the acute and post-acute phase (after 2 months, 12 months and beyond) [11] reported increased stage 1 sleep, reduced stage 2 sleep with reduced spindles and K-complexes, reduced slow-wave sleep and reduced REM sleep, which match with a disorganization of sleep [5,6,10,11]. Nevertheless, our first patient's polysomnography was normal.

Our patients complained about lucid dreams and nocturnal awakenings. Lucid dreams are a state of sleep with combined waking and dreaming features where higher cognitive capabilities are regained [12]. Those symptoms have not been previously described in thalamic stroke syndromes. However, symptoms of peculiar oneiric behaviours, dream enactment and oneiric stupor have been described in familial fatal insomnia, that has been associated to specific neuronal loss in anterior and mediodorsal nuclei of the thalamus [12,14,15]. In a functional neuroimaging study, Dresler et al. [16] reported that lucid dreaming was associated with reactivation of cortical regions normally deactivated during REM sleep, in particular the dorsolateral prefrontal cortex. Similarly, Voss et al. [17] suggested that lucid dreaming was a "hybrid state", sharing features of both REM sleep and waking with reactivation of the dorsolateral prefrontal cortex.

Moreover, our patients had post-stroke anxiety syndrome. The disastrous and hospital-linked content of our first patient's dreams were probably related to the emotion created by her hospitalisation and the episode of fight she witnessed the day before her stroke. Likewise, the conflicting situations observed in our second patient's dreams recalled to an emotional participation as his stroke occurred at his workplace. This anxious and emotional context probably influenced the emergence of lucid dreams that could be explained by limbic thalamic nuclei involvement and their connections to other limbic cortical and subcortical structures [2,3,18].

To our knowledge, no specific medication can be used to avoid lucid dreams. They persisted for less than one month in our two patients, but were associated with different evolutions concerning the quality of sleep: the first patient had persisting nightmares while symptoms completely resolved in the second one. Delayed sleep quality improvement remains however possible as demonstrated by Hermann et al. [11], who reported that sleep–wake disturbances continuously improved over one year in unilateral lesions. Interestingly, our two patients had left thalamic stroke, so we could hypothesize a lateralisation of sleep disorders at the thalamic level. Nevertheless, our observations are insufficient to support this hypothesis. In the review of De Witte et al. [2], 7 of the 75 patients with affective-behavioural alterations had sleep disorders and all had bithalamic lesions. The authors confirmed a lateralisation of neurolinguistic processes at the thalamic level, but lateralisation of neurocognitive processes was more uncertain.

4. Conclusion

Lucid dreams represent an unusual and possibly underdiagnosed disorder following thalamic stroke. Its description enlarges the clinical spectrum of sleep-wake disturbances potentially observed after an acute cerebrovascular event.

Disclosure of interest

The authors declare that they have no competing interest.

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