

**LETTER TO THE EDITOR****Musical Mental Imagery as Suspected Migraine Aura in Patient without Psychiatric Disease****Keywords:** Migraine, Auditory aura, Musical memory

Cortical spreading depolarization is presumed to be the underlying mechanism of auras.<sup>1</sup> Auras consist of symptoms such as visual, sensory, motor, brainstem, and language disturbance. They are typically, but not always, stereotyped, progressive, and fully reversible. Other neurological symptoms such as complex auditory perceptions and olfactory sensations are not officially recognized as typical auras.<sup>2</sup> Auditory hallucinations described as unfamiliar human voices or background noise have been reported in association with migraine, in patients with comorbid depression or psychotic disorder.<sup>3,4</sup> Here, we present a case of complex auditory hallucinations preceding the headache phase in a female patient with high-frequency episodic migraines and no history of psychiatric illness.

The patient is a 33-year-old female with history of migraines since early childhood, without symptoms of vestibular or hearing disorders and without history of head trauma. From age 7–12 years old, attacks usually started with severe abdominal pains and vomiting occurring three or four times a year. The patient recalled her first severe headache attacks following menarche and lasting between 24 and 48 h, with complete subsiding of abdominal pain by early adulthood. Family history was positive for migraine without aura in the mother and several uncles on both maternal and paternal side. There was no family history of epilepsy.

Since her late 20s, the patient described new onset auditory hallucinations preceding 10–20% of her migraine attacks. The patient described the symptom sequence as follows: mild nausea accompanied by severe photophobia, mild phonophobia, and right-sided neck stiffness for a duration of up to 4 h, followed by a repetitive 10–12 word repetitive loop of a familiar song for a duration of approximately 20 min, followed by right-sided severe pulsating headache, right periorbital pain, vomiting, and mild rhinorrhea on the right side. There were no other trigemino-autonomic symptoms, and the pain was aggravated by physical activity. The patient successfully treated the headache attacks with intranasal zolmitriptan and prochlorperazine suppository. The patient reported crystal clear days interictally and occupied a full-time high-cognitive demanding job. Attacks with auditory symptoms were triggered by sleep deprivation and prolonged exposure to a source of bright light. Auditory music was described as “a song stuck in my head” and consisted of songs known to the patient with a time tempo of around 120 beats per minute. The song hallucination was associated with an unpleasant feeling of irritability and was unaltered by distracting activities. The patient never experienced other neurological transient symptoms accompanying her headaches, and such bothersome auditory phenomenon did not occur outside of migraine attack.

Frequency of headaches had been significantly improved with nortriptyline 40 mg at bedtime, decreasing from 25 to 10 headache days/month. Previous medication failures included topiramate, propranolol, vitamin B<sub>2</sub>, baclofen, candesartan, magnesium, and onabotulinum toxin A. The overall frequency of auditory symptoms remained unchanged at 2–5 episodes per month, despite an overall headache frequency decrease. Imaging was limited to a normal brain MRI. As epilepsy was thought to be unlikely in this patient, an electroencephalogram was not performed.

Mental imagery of a song is the “imaginary perception of a song when no musical stimulus is present”.<sup>5</sup> Regions of the brain involved in song imagery include the right midposterior superior temporal sulcus (STS) and middle temporal gyrus (MTG).<sup>6</sup> These two structures also communicate with the right basal temporal lobe, which mediates the memory aspects related to song information.<sup>7</sup> Interestingly, studies in patients with advanced neurodegenerative disease have demonstrated musical resiliency, suggesting that musical memory has an independent network that differs from other memory systems.<sup>8</sup> Music also evokes emotions in words that could not be expressed in common verbal speech and is part of the evolutionary development of homosapiens.<sup>9</sup> Emotions evoked by music can be unpleasant and activate areas of the brain such as the left parahippocampal gyrus, hippocampus, and amygdala, while pleasant music activates areas of brain reward circuitry, including the left ventral striatum and dorsomedial midbrain.<sup>10,11</sup> Finally, the left hemisphere is responsible for the recognition of a musical tune or semantic memory.<sup>12</sup>


The case we present corresponds to a complex auditory musical hallucination that precedes headache in a migraine patient without psychiatric comorbidity. We believe that the time frame of her symptom presentation is consistent with the typical polyphasic stages of migraine. We cannot exclude the possibility of cortical spreading depolarization involving areas of the brain responsible for mental musical imagery: the right STS and MTG. This would also be consistent with the patient’s nociception only in the right hemispheres, without side shift. Finally, communication with other areas of the brain in both hemispheres would also explain musical recognition and subjective emotional experience of unpleasantness. We propose that auditory hallucinations be questioned in patients and explored as another form of migraine aura. Functional MRI should then be obtained during the auditory symptoms in order to validate areas involved.

**CONFLICTS OF INTEREST**

Dr. Eghtesadi reports personal fees from Teva Neuroscience, personal fees from Novartis, personal fees from Aralez, personal fees from Eli Lilly, personal fees from Novartis, personal fees from Purdue, outside the submitted work and unrelated to this work. Dr. Leroux reports personal fees from Allergan, personal fees from Teva Neuroscience, personal fees from Novartis, personal fees from Aralez, personal fees from Eli Lilly, outside the submitted work and unrelated to this work.

## STATEMENT OF AUTHORSHIP

ME prepared the manuscript draft with important intellectual input from EL. Both authors approved the final manuscript and agreed to be accountable for the article and to ensure the accuracy and integrity of the article.

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