Musical hallucinations in schizophrenia

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Musical hallucinations (MH) are complex phenomena that are associated with hearing loss, brain disease (glioma, epilepsy, cerebrovascular disease, encephalitis), and psychiatric disorders such as major depressive disorder, bipolar disease, and schizophrenia. MH are also commonly seen in people without otorhinolaryngological, neurological, or mental illness pathology.[1]

In his novel *Musicophilia*, Oliver Sacks writes that his patients with musical hallucinations *do not speak of themselves imagining the music, but of some strange, autonomous mechanism set off in the brain. They speak of tapes, circuits, radios, or recordings, in their brains; one of [his] correspondents called it his intracranial jukebox.* Additionally, Sacks describes that although they have different meanings to each individual, they also share certain features in *their apparent exteriority, their incessancy, their fragmentary and repetitive character, [and] their involuntary and intrusive nature*.[2]

Musical hallucinations have been most readily described in deaf patients. Saba describes three proposed mechanisms: i) neuronal irritation (an excitatory phenomenon); ii) perceptual release (a release phenomenon); iii) the novel concept of parasitic memories, in which some memories (*e.g.* a song) are never unlearned and thus maintain a fixed and autonomous presence in the memory, and are therefore periodically re-experienced.[3] Musical hallucinations can be differentiated from musical imagery, in which there is the sensation of music in one's mind, but individuals maintain volitional control and are aware that the sound is not a true auditory stimulus in the environment. Musical imagery is often experienced by trained musicians and is almost ubiquitous in the form of *earworms* or the sensation that a song is *stuck* in one's head.

Auditory hallucinations are a common and defining feature of schizophrenia and a variety of types have been described (*i.e.* persecutory, grandiose, command etc.). However, there is sparse literature on patients with schizophrenia whose hallucinations take on a musical quality. Musical hallucinations in schizophrenia have often been described as having religious content. The association between musical hallucinations and religious themes is expected as the delusions of a person with schizophrenia often contain religious themes.[3]

In 1997, Saba and Keshavan surveyed 100 patients with schizophrenia and found that 16 reported having musical hallucinations.[4] Notably the musical hallucinations tended to be sudden in onset, familiar, and mixed instrumental and vocal, with most patients having a soothing affective response to the music (62%). Interestingly, when the musical hallucinations had more religious content, the patients claimed to have less volitional control over them. This suggests that the presence or absence of religious content in the musical hallucination may be useful for differentiating between musical imagery and musical hallucinations.

Baba and Hamada suggest that musical hallucinations in patients with schizophrenia are phenomena that originate as memory representations or pseudo-hallucinations akin to evoked musical imagery, which transition into true hallucinations during the progression of the disease. They describe three stages of every musical hallucination.[4] The first stage occurs when the musical hallucination takes on an obsessive quality and is greatly distressing in nature. The second stage is associated with the *xenopathic experience* in which words or lyrics are added to the melody, and the music is understood as coming from outside the self. The third stage is described as the *autochthonous* experience, in which the musical hallucination is accepted as part of the self and is ego-syntonic. They found that the first and third stages occur in 90% of musical hallucinations and that there were commonly shifts between the first and third stage, from ego-dystonic to ego-syntonic. Lastly, they found that the second stage was a rare transitional period between musical and verbal hallucinations, when the musical hallucination separates from the self and is completely out of volitional control. As suspected, the second stage of musical hallucinations correlated clinically with the greatest disturbance of self and the most severe psychotic symptoms. Notably, first generation antipsychotics greatly reduced and even in some cases eliminated the musical hallucinations in the majority of these patients.[7]

Baba and Hamada's work would serve to suggest that the musical hallucinations as experienced by an individual with schizophrenia may be different from those described by Dr. Sacks in his patients. The musical hallucinations are not singularly ego-dystonic and intrusive, but rather they may shift in quality, character, and meaning corresponding to the severity of disease, particularly the degree to which they are understood as being part of or outside of the self. Additionally, during the course of disease, the musical hallucinations may change in response to medications and psychotherapy.

In a more recent study, Bleich-Cohen *et al.* describe a patient with schizophrenia who developed auditory hallucinations with musical content that were *obsessive-compulsive* in nature in that they were *intrusive, repetitive, senseless, and distressful*.[5] The patient was a 35-year-old professional musician whose psychosis was well managed by olanzapine at a dose of 10 mg/day. The patient's disease had recently taken on a more schizoaffective-like course as the patient had developed multiple episodes of major depressive disorder. Lamotrigine was subsequently added and titrated to 300 mg/day. After the addition of lamotrigine, the patient complained of hearing music, mostly popular songs, which were indistinguishable from outside noise and that which he was unable to ignore. Functional magnetic resonance imaging (fMRI) was performed during the patient's musical hallucination and the researchers found selective response of the right orbitofrontal cortex also known as the right auditory association cortex. A reduction of the dose of lamotrigine significantly lessened the intensity of the musical hallucinations, and after the complete switch to valproate (up to 1000 mg/day), the musical hallucinations disappeared entirely.

This study raises two interesting points. First, the fMRI demonstrates that this patient was experiencing true hallucinations; the increased signal in the right auditory cortex indicates that the brain was perceiving a real auditory stimulus. Second, this study presents evidence that certain antipsychotics might contribute to musical hallucinations or may change auditory hallucinations into those taking on a musical character. Particularly, the evidence that lamotrigine specifically caused this phenomenon may hint at a deeper understanding of lamotrigine's mechanism of action.

The relationship of music to schizophrenia is not new. It has been suggested that individuals with schizophrenia may have impairments in music perception called *amusia*, and researchers have suggested that this may represent a *protolinguistic* impairment critical to the disease process.[6] In addition, there have

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been many reports that music therapy significantly improves outcomes in patients with schizophrenia.[7] However, this effect may be patient-specific. A recent study suggests that music preferences can change after the onset of mental illness. One subgroup of patients, even stop listening to music entirely.[8]

The researches concluded that for those whose preferences changed, music impaired their mental state, while for those whose preferences did not change, music was important for their emotional modulation.[8] At UC Irvine Health Center, a full time music therapist leads group classes two days per week with inpatients on the psychiatric ward. However, the efficacy of music therapy on patients with musical hallucinations has yet to be studied and would be an important topic for further research.

To conclude, there have been few studies on musical hallucinations in the last five years to build on the aforementioned literature in light of improved and more individualized psychotherapy and psychopharmacology. There are many unanswered questions and as many avenues for further research. It is evident that musical hallucinations are a distinct phenomenon in individuals with schizophrenia and it is important to inquire about them in the routine course of a psychiatric assessment in order to provide more patient-centered care.

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