



## Differential Treatment Response of Auditory Hallucination in A Unilateral Hearing Impaired Patient: A Case Report

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### Abstract

Auditory hallucinations may present as a part of the diagnostic symptom profile in hearing impaired with schizophrenia and respond to antipsychotics. Though partial response is observed with inadequate dose of antipsychotics, there is no report that auditory hallucinations respond differently in a patient with a healthy and impaired ear. In this case report, we are reporting differential effect of antipsychotics on auditory hallucinations in a unilateral hearing impaired patient with schizophrenia. Possible underlying neurobiological mechanisms are discussed.

**Keywords:** Impaired hearing and schizophrenia; Differential effect to hearing; Antipsychotics and hearing impairment

### Introduction

The prevalence of schizophrenia among hearing impaired is nearly equal to that of the general population [1]. Both bilateral and unilateral auditory hallucinations in hearing impaired are thought to predispose them to develop schizophrenia [2]. Auditory hallucinations in patients with normal hearing may inadequately respond to antipsychotic medication [3]. There is no report that hallucinations (due to psychiatric disorders) in patients with hearing impairment respond differently to antipsychotics. Similarly there is no report that auditory hallucinations respond to antipsychotics differently in a patient with healthy and impaired ear. Here we are reporting a case of differential response of auditory hallucination to antipsychotics in a unilateral hearing impaired patient with schizophrenia.

### Case Presentation

Forty nine years old married male, educated upto class 10<sup>th</sup>, with a well adjusted premorbid personality and without any family history of mental illness, presented with complaints of hearing voices in both the ears that had suddenly started three months ago. He described that many male voices would talk about him, comment about whatever he does, would often give him instructions but he would never follow them. He was distressed because they would accuse him. He believed that people were against him and wanted to harm him about which he would come to know through these voices. So he started staying back at home and stopped going for work. There was no history of other psychiatric disorders except for occasional alcohol use. The patient had a past history of a fall under the influence of alcohol about two years back, when he had loss of consciousness lasting for about fifteen minutes with right ear bleed. First aid was provided but brain injury was not ruled out then (due to unavailable medical service). Since then the patient developed hearing impairment in the right ear.

There is no history suggestive of other psychiatric disorders currently or in the past. On mental status examination patient was anxious, preoccupied, and at times was found muttering to self. He revealed delusions of persecution and reference as well as 2<sup>nd</sup> and 3<sup>rd</sup> person auditory hallucinations. He scored 58 on Brief psychiatric rating scale (BPRS). Physical examination revealed sensorineural hearing loss. ENT and *audiological* evaluation revealed moderately severe sensorineural hearing loss in the right ear with *Pure tone audiometry*(PTA) -51.6dB, Speech recognition threshold (SRT)-60dB and *Speech identification scores*(SIS)-90%. CT & MRI scan, neuropsychometric tests, and blood investigation were within normal limits. A diagnosis of paranoid schizophrenia was considered based on the International Classification of Diseases - 10<sup>th</sup> edition (ICD-10) [4]. There was no evidence to suggest that the illness was caused by the head injury which had occurred two years back.

After discussion with the patient, tab.risperidone 2 mg/day was started and increased to 6 mg/day over 6 weeks. Patient had overall improvement of symptoms (BPRS =32), except for 2<sup>nd</sup> and

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3<sup>rd</sup> person auditory hallucinations in the impaired ear (right ear). No side effects were observed. Risperidone was further optimised to 9 mg without much improvement but patient developed extrapyramidal symptoms that improved with 4 mg of trihexyphenidyl in two divided doses. Tab. aripiprazole 10 mg was added and patient ceased to experience auditory hallucinations (BPRS =12) at the end of two weeks. This antipsychotic differential response (on deaf and normal ear) is scored as certain on WHO-UMC Causality Categories. Patient was advised to use hearing aid regularly. On follow-up patient maintained improvement.

## Discussion

Although unilateral hallucinations have been reported in persons with an impaired and healthy ear, this case report is unique because of the differential response of auditory hallucinations in impaired ear to risperidone. Studies revealed predominant temporal lobe involvement in patient with schizophrenia who experience auditory hallucinations. Neuroimaging studies found activation or deactivation of parahippocampal gyrus, activation of left superior temporal lobe (Broca's and Wernicke's areas) & auditory association cortex and reduced activation of portions of the brain associated with the monitoring of inner speech [5]. This patient had history of fall with associated unconsciousness that led to right ear hearing impairment. Though there was no objective evidence of temporal lobe damage in this patient, it lies directly above the middle ear and traumatic injuries may play a role in neuropathology of schizophrenia. Temporal lobe epilepsy & pathology is reported to cause schizophrenia like symptoms [6].

The perception of voices as objects in external space depends on filtering by the outer ear [6]. There is a central role of the left hemisphere in auditory imagery [7] and the left planum temporale has a critical role in the perception of voices in external space. It is speculated that imagery arises from activation of a neural substrate shared with perceptual mechanisms, and provides evidence for a right temporal-lobe specialization for this type of auditory imaginal processing [8]. An advantage of the right ear (REA) in auditory processing (especially for verbal content) has been firmly established in decades of behavioral, electrophysiological and neuroimaging research [9]. Hallucinations in impaired hearing is thought to be the result of perceptual deficits, abnormal meta-representational abilities, impaired monitoring of intended speech, discourse failure, disorder of consciousness, misidentification of imagination, weakening of memory storage processes and impairment of the ability to monitor source of willed intentions to act [10]. In this patient with unilateral hearing impairment, hallucinations were probably influenced by combination of factors associated with oto-neurological (sensorineural hearing loss) and neuropsychiatric disorders (schizophrenia) that might have resulted in a differential response of hallucinations to risperidone in impaired and non-impaired ear.

Though hearing loss is commonly associated with anxiety, depression, impaired subjective well-being & social functioning, there is a potential link between ear disease and schizophrenia particularly paranoid delusions and auditory hallucinations, and the use of a hearing aid can reduce psychotic symptoms in patients with deafness. When hearing system is damaged, normal cortical neuronal pattern of band-pass filters of different frequency ranges will be changed to an increase in the bandwidth of the nerve fibers with an expected noise amplification, loss of resolution, and poor specificity of cortical reactions. Spontaneous activity of groups of neurons, which in the absence of external sounds can create a pattern that resembles the one evoked by sound. Thus hearing-impaired individuals could represent the response of a hypersensitive auditory cortex chronically deprived of sensory input [11]. This case highlights the need to keep in mind the neurological deficits like sensory neural hearing deficits in any patient while prescribing antipsychotics.

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