Musical Hallucinations: Prevalence in Psychotic and Nonpsychotic Outpatients

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Background: Musical hallucinations have been considered a rare manifestation of psychotic states or brain and hearing abnormalities. However, an obsessive-compulsive disorder (OCD) assessment tool refers to musical hallucinations and our preliminary study showed that about one third of OCD patients experienced musical hallucinations.

Aims: To elucidate the lifetime prevalence of musical hallucinations among psychotic and nonpsychotic psychiatric outpatients.

Methods: Lifetime experience of musical hallucinations was examined with a specially designed structured interview in 190 consecutive outpatients with diagnoses of anxiety, affective, and schizophrenia disorders.

Results: Musical hallucinations occurred in more than one fifth of all diagnoses. The prevalence of musical hallucinations was highest in OCD patients (41%). Musical hallucinations were significantly more frequent with more comorbid disorders, and logistic regression revealed that this finding was mainly due to OCD combined with either social phobia or schizophrenia.

Conclusion: Musical hallucinations are more common among psychiatric patients than previously reported and are more suggestive of OCD than of other mental disorders.

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usical hallucinations are a form of auditory hallucinations with varying musical content and degree of insight.¹ They have usually been associated with brain and hearing abnormalities, old age, and female gender. Only a small body of reports, mostly case reports, links "functional" psychopathologies to musical hallucinations.² These include schizophrenia,^{3,4} depression,⁵ and obsessive-compulsive disorder (OCD).⁶ Musical hallucinations are included in the list of obsessions of the Yale-Brown Obsessive-Compulsive Scale.⁷ In a preliminary survey we conducted in a cohort of 52 OCD outpatients, the prevalence of musical hallucinations was 30% compared with 3% in schizophrenia.8 The present study reexamined the hypothesis that musical hallucinations will be overrepresented in OCD using structured diagnostic and musical hallucination-detecting instruments in a larger cohort of outpatients.

The pathophysiology of musical hallucinations is not clear. Traditionally they were thought to co-occur with hearing loss or deafness, and the vast majority of the literature on musical hallucinations links this phenomenon with significant hearing loss^{9–13} or deafness.^{14–22} Female sex^{1,11} and advanced age, suggesting impaired CNS function,^{11,23} were also thought to predispose to musical hallucinations. Although the precise mechanism that produces musical hallucinations is elusive, it has been proposed that they are the result of a hyperactive state of the peripheral auditory system and that they develop out of rhythmic tinnitus.¹⁴

In a minority of cases, organic brain disease was linked to musical hallucinations. For example, functional abnormality in the right auditory cortex during musical hallucinations was reported in one case.²⁴ Seizure activity was reported in another case of musical hallucinations.²⁵ Occipital meningioma²⁶ and abnormal temporal lobe activity²⁷ were reported in other cases. The literature on CNS factors in musical hallucinations is scarce, and there is a dire need for systematic case series in this area.

Significantly, neither peripheral nor central causes for musical hallucinations seem to be connected to functional psychiatric syndromes or disorders. There is, nevertheless, a body of reports that does link psychopathology to musical hallucinations. A report on 100 schizophrenic patients found the lifetime occurrence of musical hallucinations to be 16%.³ A more recent study reports that the response to

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treatment of musical hallucinations in schizophrenia is similar to the response to treatment of auditory hallucinations,⁴ indicating that musical hallucinations and other auditory hallucinations may be related symptoms in schizophrenia. Both studies^{3,4} suggest that musical hallucinations may be part of the schizophrenia syndrome and that they should be assessed in psychotic patients.

Obsessive-compulsive disorder has also been sporadically linked to musical hallucinations.^{6,28} In the context of OCD, musical hallucinations are viewed as musical obsessions (see the checklist of obsessions and compulsions⁷), and in some OCD cases, are linked with temporal lobe dysfunction and/or brain damage.⁶ As very few cases of OCD patients with musical hallucinations have been described, musical hallucinations as a putative OC symptom merit systematic evaluation in large cohorts of patients with OCD and other anxiety disorders. In a preliminary survey of musical hallucinations in a group of 52 OCD outpatients, we⁸ found a prevalence of 30% compared with less than 3% in schizophrenia. To the best of our knowledge, there are no reports on the occurrence of musical hallucinations in non-OCD anxiety disorders.

A few cases of musical hallucinations connected to major depressive episodes were also reported.^{5,23,29,30} Musical hallucinations tend to disappear with antidepressive pharmacotherapy.^{5,23}

To summarize, musical hallucinations seem to be a relatively frequent phenomenon that was traditionally linked to hearing loss connected with peripheral causes such as otosclerosis¹⁴ or psychotic disorders such as schizophrenia. Recently, however, the role of psychopathology in the occurrence of musical hallucinations has been recognized, and this line of investigation should be continued in order to assess the prevalence of this symptom in different psychopathologies.

Following our preliminary findings, the present study examined the hypothesis that musical hallucinations would be overrepresented in OCD patients. To this end, we evaluated the presence of musical hallucinations in a series of outpatients suffering from diverse mental disorders.

METHOD

One hundred ninety consecutive outpatients participated in the study. All were adult outpatients of the regional community outpatient clinic and the anxiety disorders unit in an urban mental health center in Israel. Ten patients of 200 did not consent to participate in the study. We excluded patients with significant hearing loss, drug abuse, tinnitus, and known brain damage. These disorders were excluded since they are associated with "organicrelated musical hallucinations" while the purpose of this study was to detect musical hallucinations in "functional" mental disorders. None of the present patients were included in our previous report.⁸ Patients underwent a structured interview using the Mini-International Neuropsychiatric Interview (MINI).³¹ Diagnoses of schizophrenia and schizoaffective disorder were made according to the Structured Clinical Interview for DSM-IV Axis I Disorders.³² For the purpose of diagnosis, we also referred to the patients' personal psychiatric files at our clinic and wards. Presence of musical hallucinations was not used as a diagnostic criterion.

Based on our previous experience,8 we devised a 26-item questionnaire for assessing musical hallucinations (Geha Short Interview for Musical Hallucinations, GSIMH). The GSIMH examines lifetime occurrence of musical hallucinations with special emphasis on a false perception of music rather than merely thinking, selfhumming, or recollection of music. It also covers demographic and lifetime relevant clinical characteristics of the participants. The GSIMH is described in Appendix 1. Ten OCD and schizophrenic patients were administered the GSIMH twice, by 2 different blind examiners, at an interval of 3 to 6 weeks. Full agreement between examiners for all items was observed in all cases. Thus, the GSIMH seems to possess high interjudge reliability. GSIMH questionnaires were orally and individually administered by trained clinicians (H.H., S.K.).

In the present study, we considered participant patients as "musical hallucinations positive" if they met the following criteria: (1) Answered positively to the question "Have you ever *heard* music that did not have an external origin? Do not count thinking, self-humming, and recollecting of music" (items 22 and 23) and (2) Provided further confirming information on the nature of musical hallucinations for ascertainment of the presence of musical hallucinations. The first question for musical hallucinations (item 22) is based on a similar screening question for any hallucination. Handedness was determined by interview.

The Geha Mental Health Review Board approved the study and written informed consent was obtained from all participants.

Statistical Analyses

Chi-square and Student t tests were used as appropriate. A logistic regression, in a forward selection procedure, was used to assess the contribution of the various variables and diagnoses to the experience of musical hallucinations. The problem of multiplicity of comparisons was addressed by controlling the false discovery rate (FDR) at the .05 level. Accordingly, based on the design of this study, $p \le .009$ was considered statistically significant after adjusting for multiplicity.³³

RESULTS

Due to comorbidity, the 190 patients of the study met criteria for 270 MINI diagnoses. Of these patients, 26.8% (N = 51) experienced musical hallucinations. Table 1 pre-

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Tradical Hallochia (THT)						
Variable	Presence of MH	Absence of MH	Statistic	df	Odds Ratio	p Value
Male/female, N (%)	33/18 (65/35)	73/66 (53/47)	2.25 ^a	1	2.28	.13
Age, mean \pm SD, y	38.1 ± 12.7	42.4 ± 12.1	2.14 ^b	188		.03
Education, mean \pm SD, y	12.3 ± 3.7	11.5 ± 2.9	-1.63 ^b	188		.10
Dominance [R/L], N (%)	42/7 (86/14)	127/11 (92/8)	1.66 ^a	1	1.54	.20
Musical education, mean \pm SD, y	1.2 ± 2.4	1.2 ± 3.2	< 1 ^b	188		.99
Duration of psychopathology, mean ± SD, y	24.5 ± 12.3	24.4 ± 12.1	< 1 ^b	187		.95
Age at onset of first psychopathology, mean \pm SD, y	13.3 ± 9.6	18.0 ± 12.7	2.39 ^b	187		.008
$^{a}2 \times 2 \chi^{2}$ test.						

Table 1. Demographic and Clinical Variables of 190 Outpatients With (N = 51) and Without (N = 139) Lifetime Experience of Musical Hallucinations (MH)

^bStudent t test for independent samples.

Abbreviation: R/L = right handed/left handed.

Table 2. Lifetime Rates of Musical Hallucinations (MH) Within the Various Mental Disorders,^{a,b} as Compared With All Other Diagnoses Pooled Together

		N	МН	χ^2			р
Disorder	Ν	Ν	%	(df = 1)	OR	95% CI	Value
Obsessive-compulsive disorder	58	24	41.4	8.98	2.75	1.4 to 5.4	.003
Social phobia	43	15	34.9	1.83	1.60	0.8 to 3.4	.18
Panic disorder	31	7	22.6	0.34	0.76		.56
Schizophrenia	66	17	25.8	0.06	0.91		.81
Bipolar disorder	10	2	20.0	0.25	0.67		.62
Schizoaffective disorder	10	4	40.0	0.93	1.89		.34
Major depressive disorder	24	7	29.2	0.08	1.14		.78
^a Diagnoses based on Mini-International Neuropsychiatric Interview. ³¹ ^b Mental disorders diagnosed in less than 10 patients were not included							

in the analyses. Abbreviations: CI = confidence interval, OR = odds ratio.

sents demographic and clinical variables of the 2 groups of patients, those with and without the experience of musical hallucinations. As is evident from the table, the only statistically significant difference between the 2 groups was that the age at onset of first psychopathology was 4 years earlier in the patients reporting musical hallucinations, but the duration of the mental disorders was very similar in the 2 groups. The levels of general and musical education also did not differ between groups (Table 1). There was a nonsignificant overrepresentation of males in the musical hallucinations group compared with the nonmusical hallucinations patients (64.7% vs. 52.5%, respectively). There might be a trend toward a younger age at the time of the interview of the musical hallucinations group.

We next examined the proportion of patients reporting musical hallucinations within each psychopathologic category (Table 2). Noteworthy is the significant overrepresentation of musical hallucinations in OCD, as compared with all other psychopathologies (p = .003), particularly the psychotic disorder of schizophrenia and panic disorder (41.4% vs. 25.8% and 22.6%, respectively).

We next examined the preponderance of musical hallucinations as a function of the number of comorbid diagnoses per patient. There was a significant overrepresenta-

Table 3. Number of Psychiatric Diagnoses per Patient	and
Lifetime Prevalence of Musical Hallucinations (MH) ^a	

				· /		
	1	2	≥ 3	χ^2	р	
History of MH	diagnosis	diagnoses	diagnoses	(df = 2)	Value	
MH, N (%)	23 (18.7)	17 (37.8)	11 (50.0)	12.9	.002	
No MH, N (%)	100 (81.3)	28 (62.2)	11 (50.0)			
^a Diagnoses based on the Mini-International Neuropsychiatric Interview. ³¹						

tion of musical hallucinations in patients with 3 or more mental disorders (Table 3).

As OCD, comorbidity, age at onset, and gender seemed to play a role in the presence of musical hallucinations (Tables 1–3), we performed a stepwise regression analysis with the presence or absence of musical hallucinations as a dependent variable. Predictors included sex and age at onset and presence of OCD, schizophrenia, social phobia, or panic disorder, as well as the 3 combinations of these diagnoses with OCD. The first step of this analysis revealed a significant interaction of the combination of OCD and social phobia (p = .003, r = 0.18), while the second step revealed a significant interaction of the combination of OCD and schizophrenia (p = .005, r = 0.17). Additional steps, including the combination of OCD and panic disorder, were not statistically significant.

In order to further demonstrate the relationship between musical hallucinations and OCD, we looked at the prevalence of musical hallucinations in patients without OCD, patients with a sole diagnosis of OCD, and patients with OCD and 1 additional diagnosis. As seen in Figure 1, there was an increase in the prevalence of musical hallucinations from a rate of about 20% in patients without OCD, through 30% in patients with OCD, to more than 50% in patients with OCD and 1 comorbid diagnosis ($\chi^2 = 13.1$, df = 2, p = .001).

DISCUSSION

Prevalence of Musical Hallucinations

The major finding in the present survey is the higher than usually perceived lifetime prevalence of the musical hallucinations symptom (> 20%) in all the examined

Figure 1. The Effect of Obsessive-Compulsive Disorder (OCD) as a Sole Diagnosis and Its Comorbidity With Other Psychiatric Disorders^a in Relation to Lifetime Rate of Musical Hallucinations (MH)



^aDiagnoses based on the Mini-International Neuropsychiatric Interview (MINI).³¹ No OCD (N = 132), pure OCD without comorbidity (N = 30), OCD + comorbidity (N = 28); $\chi^2 = 13.1$, df = 2, p = .001.

mental disorders. This figure is surprising considering Berrios' conclusion¹ that musical hallucinations are rare among psychiatric patients with psychotic or personality disorder and the fact that reports on musical hallucinations were usually presented as case studies. Our findings suggest that musical hallucinations are a common experience among psychiatric patients. In contrast to Gordon's conclusion,¹⁴ it is not found solely or mostly in neurologic, otorhinolaryngologic, or gerontologic cases. Interestingly, many major textbooks of psychiatry and psychiatric nosological systems do not mention musical hallucinations at all, neither in chapters devoted to general psychopathology and hallucinations nor in any diagnostic category (references 34 and 35, DSM IV, ICD-10). Although we have, in the present study, no healthy control group, a recent study has reported a 2.5% prevalence of musical hallucinations among nonpsychiatric patients of an audiologic clinic.³⁶

To the best of our knowledge, the present report is the first one to use a structured questionnaire for assessing musical hallucinations in mental disorders. One may argue that our findings are inflated primarily due to an oversensitive tool for detecting lifetime musical hallucinations (i.e., the GSIMH). Although such a critique might be correct, it is not in accordance with the relative high interrater agreement on the GSIMH and the good concordance between our current and past findings.⁸ However, only further studies in different series of psychiatric patients, using the GSIMH with other designated tools for musical hallucinations, will clarify this issue.

However, even if other assessment methods would result in different estimates of lifetime prevalence of musical hallucinations among psychiatric patients, such estimates are unlikely to falsify our primary finding of a relative overrepresentation of musical hallucinations in OCD in comparison to other mental diagnoses. This proposition is justified considering the large differences between the rates of musical hallucinations in the various diagnostic groups and the fact that the same musical hallucinations assessment tool was used for all participants.

Underdetection of Musical Hallucinations in Daily Practice

Our current rates of musical hallucinations are in the range reported by us⁸ and others⁴ during the last decade. If these more recent findings are valid and replicable, there is still a need to explain the discrepancy with previous findings and the great delay in estimating the high prevalence of musical hallucinations among psychiatric patients. It is of note that most studies on musical hallucinations are single case reports starting over 120 years ago.¹ Surprisingly, most patients do not volunteer information about musical hallucinations/musical obsessions unless asked specifically about them. Most patients have never been asked about musical hallucinations, in spite of a long history of mental disorder. During the present survey, we formed the impression that this common underreporting stems in some cases from the notion that "hearing something that isn't there" seems to indicate to the patients a bizarre and higher level of "madness" about which they may be worried and ashamed. Alternatively, other patients often consider musical hallucinations to be a totally normal and common experience unworthy of reporting to a mental health professional. Patients usually report musical hallucinations as nagging and ego-dystonic, thereby probably fulfilling yet other criteria of obsessions or compulsions.

It would be appropriate, in view of the present results, to include a specific question about musical hallucinations/musical obsessions in structured diagnostic interviews and to consider a diagnosis of OCD first if the patient reports having musical hallucinations/musical obsessions with full insight.

Musical Hallucinations and OCD

Apparently, OCD patients in particular are prone to experience musical hallucinations. However, it seems that although OCD is a common diagnostic risk factor, namely a major contributor for the development of musical hallucinations, it is not enough on its own. An additional (i.e., comorbid) mental diagnosis that synergistically interacts with OCD appears to markedly increase the likelihood of the occurrence of musical hallucinations.

The pivotal role of OCD, an anxiety disorder (i.e., "a neurosis"), in the overrepresentation of musical hallucinations indirectly supports the possibility that musical hallucinations are intrusive pseudohallucinations,³⁴ and not "true hallucinations." In this sense, musical hallucinations are a form of perceptual obsessions, as already suggested in some reports,^{6–8} and are similar to the visual obsession

described as images in the DSM-IV criteria for OCD. Clinically, it seems advantageous and more accurate to rename musical hallucinations and call the phenomenon *musical obsessions*. In daily clinical practice, musical obsessions is preferred over musical hallucinations since the term suggests that upon encountering musical hallucinations as a presenting symptom, OCD rather than schizophrenia is the most probable diagnosis. In addition, musical obsessions may alert clinicians to look for additional comorbid diagnoses besides OCD. The question of discrimination between musical obsessions and hallucinations was previously addressed.³⁹

To shed more light on the diagnostic value of musical hallucinations/musical obsessions, a field survey that will examine whether the characteristics of musical hallucinations are more compatible with the definition of true hallucination or typical obsession is warranted. Examining the response of musical hallucinations/musical obsessions to antipsychotic versus anti-OCD psychopharmacologic interventions may also help to clarify this dilemma. Recently, for example, musical hallucinations/ musical obsessions were shown to respond well to clomipramine treatment.⁴⁰

A further putative link between musical hallucinations and musical obsessions is supplied by a recent neuroimaging study in a group of nonpsychiatric patients who experienced musical hallucinations.³⁷ The brain regions activated by the experience of musical hallucinations were very similar to the proposed neuroanatomical substrate of OCD, namely, inferior prefrontal cortex and basal ganglia.

Musical Hallucinations and Comorbidity

The association of the presence of musical hallucinations with the number of comorbid diagnoses seems noteworthy. The explanation of this association combined with the almost mandatory role of OCD is elusive. A tentative speculation would posit that in a more impaired CNS function, as manifested by both multiplicity of mental disorders and earlier age at onset of psychopathology, the probability of involvement of musical hallucinations/ musical obsessions-related brain regions is higher.

Musical Hallucinations, Gender, and Age

In contrast to the existing literature¹ that reported 80% female patients in the series of musical hallucinations cases, we found a trend suggesting preponderance of male subjects (65%) among those who reported experiencing musical hallucinations. Moreover, contrary to Berrios,¹ there was no overrepresentation whatsoever of older musical hallucinations patients in our series. However, as our sample did not include subjects in their sixth through eighth decades of life, we could not adequately test previous observations indicating that musical hallucinations are more frequent in this advanced age group.

Functional vs. Organic Musical Hallucinations

Traditionally, musical hallucinations were thought to co-occur with hearing loss or deafness, and the vast majority of the literature on musical hallucinations links this phenomenon with significant hearing loss^{9,38} or deafness.^{1,2,14,17,18,22} Musical hallucinations were also reported to be more frequent in females.¹ Advanced age, suggesting impaired CNS function, was also thought to predispose to musical hallucinations. Although the precise mechanism that produces musical hallucinations is elusive, it has been proposed that they result from a hyperactive state of the peripheral auditory system and that they develop out of rhythmic tinnitus.¹⁴ The relationship between functional and organic (i.e., defined physical impairment) causes is unclear. Nevertheless, our study demonstrates clearly the significant role of functional psychopathology in musical hallucinations.

CONCLUSION

To the best of our knowledge, the present study is the first systematic exploration of musical hallucinations in a large heterogeneous cohort of psychiatric outpatients. It appears that musical hallucinations, which were traditionally linked to hearing loss connected with peripheral auditory causes or to psychotic disorders such as schizophrenia, are a relatively frequent phenomenon. The significant role of functional psychopathology in the occurrence of musical hallucinations has only recently been recognized and is substantiated in the present study. The continuing investigation of the prevalence of musical hallucinations/ musical obsessions in various psychopathologies would lead to a better understanding of the clinical significance of musical hallucinations in psychopathology.

This study has several clinical implications. Systematic examination in psychiatric patients may lead to a much higher detection rate of musical hallucinations. Identification of musical hallucinations raises the likelihood of OCD with or without other comorbid mental disorder as opposed to a psychotic disorder. Additionally, musical hallucinations, especially when meeting criteria for an obsession (i.e., musical obsessions), may justify initiating a psychopharmacologic trial with an anti-OCD agent (e.g., SSRI) rather than an antipsychotic agent.

Possible limitations of the present study should be taken into account. The study interview tool, the GSIMH, although partially validated, may over- or underdetect musical hallucinations in all psychiatric patients, or differentially in some specific mental diagnoses. The possible role of many mental diagnosis candidates besides OCD, associated with musical hallucinations, was not addressed, since the MINI does not contain all DSM-IV mental diagnoses. In addition, due to our current limited sample, we analyzed the role of only the prevalent enough clinical entities in our sample (N \ge 10) and might have Drug name: clomipramine (Anafranil and others).

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Appendix 1 appears on page 197.

Appendix 1. Geha Short Interview for Musical Hallucinations (GSIMH)						
Please	Please circle or fill the space. Do not leave any item empty:					
1)	Interviewer	2) Date	3) Place			
4)	Last name	5) First name	6) I.D			
7)	Date of birth	8) Gender	9) Place of birth			
10)	Date of immigration	11) Origin: Europe/ Asia/ North Africa/other				
12)	Education (years)					
13)	Musical education (years)	Details				
Axis 1 14)	is 1 Diagnoses: 14) Schizophrenia					
15)	5) Obsessive-compulsive disorder (OCD)					
16)	3) Schizoaffective disorder					
17)	7) Other diagnoses (MINI ^a nomenclature)					
18)	18) Date of onset of schizophrenia					
19)	9) Date of onset of OCD					
20)	0) Dates of onset of other diagnoses					
21)	21) Handedness: Right/ Left/ Mixed, assessed by: anamnesis/ test					
22)	22) Have you ever <i>heard</i> music that was not of external origin? Yes/No					
23) Was it <i>hearing</i> or some other experience (e.g., humming, remembering)? Yes/No						
24)	4) Date of beginning of musical hallucinations (MH)		25) Duration of MH			
^a MINI = Mini-International Neuropsychiatric Interview.						