Turkish Archives of Otorhinolaryngology
Türk Otorinolarengoloji Arşivi

Turk Arch Otorhinolaryngol 2017; 55: 158-61

Comparison of Audiological Findings in Patients with Vestibular Migraine and Migraine

Vestibüler Migren ve Migren Hastalarının Odyolojik Bulgularının Karşılaştırılması

Günay Kırkım[1], Başak Mutlu[1], Yüksel Olgun[2], Tural Tanriverdizade[3], Pembe Keskinoğlu[4], Enis Alpin Güneri[2], Gülden Akdal[5]

[1]Department of Otorhinolaryngology, Hearing-Speech and Balance Unit, Dokuz Eylül University School of Medicine, İzmir, Turkey
[2]Department of Otorhinolaryngology, Dokuz Eylül University School of Medicine, İzmir, Turkey
[3]Department of Neuroscience, Dokuz Eylül University School of Medicine, Science of Health Institute, İzmir, Turkey
[4]Department of Biostatistics and Medical Information Technologies, Dokuz Eylül University School of Medicine, İzmir, Turkey
[5]Department of Neurology, Dokuz Eylül University School of Medicine, İzmir, Turkey

Original Investigation
Özgün Araştırma

Abstract

Objective: The aim of this study was to investigate and compare the auditory findings in vestibular migraine (VM) and migraine patients without a history of vertigo.

Methods: This study was conducted on 44 patients diagnosed with definite VM and 31 patients diagnosed with migraine who were followed and treated between January 2011 and February 2015. Also, 52 healthy subjects were included in this study as a control group. All participants underwent a detailed otorhinolaryngological examination followed by audiological evaluation, including pure tone audiometry, speech reception threshold, speech recognition score, and acoustic immitancemetry.

Results: In the VM group, there were 16 patients (36.4%) with tinnitus, while in the other groups we did not observe any patients with tinnitus. The rate of tinnitus in the VM group was significantly higher in comparison to other groups ($p<0.05$). None of the groups had any patients with permanent or fluctuating sensorineural hearing loss.

Conclusion: We conclude that patients with VM should be closely and longitudinally followed up for the early detection of other otological symptoms and possible occurrence of sensorineural hearing loss in the long term.

Keywords: Vestibular migraine, migraine, audiology, tinnitus

Öz

Amaç: Bu çalışmanın amacı vestibüler migren (VM) ve vertigo öyküsü olmayan migren hastalarındaki odyolojik bulguların araştırılması ve karşılaştırılmasıdır.

Yöntemler: Bu çalışma Ocak 2011 ve Şubat 2015 tarihleri arasında izlenip tedavi edilen 44 VM ve 31 migren hastası üzerinde gerçekleştirildi. Ayrıca 52 sağlıklı kişi de kontrol grubu olarak çalışmaya alındı. Bütün katılımcılara detaylı bir kulak burun boğaz muayenesi ve saf ses odyometrisi, konuşmayı alma eşikleri, konuşmayı tanıma skorları ve akustik immitansmetreyi içeren odyolojik değerlerlendirme yapıldı.

Bulgular: VM grubunda 16 hastada (%36.4) tinnitus varken diğer gruplarda tinnitus yakınması olan bir hasta izlemedik. VM grubundaki tinnitus oranı diğer gruplara göre anlamlı derecede yüksekti ($p<0.05$). Grupların hiçbirinde kalıcı veya fluktuan sensörinöral işitme kaybı olan hasta yoktu.

Sonuç: VM hastalarının otolojik semptomların erken saptanması ve uzun dönemde olası sensörinöral işitme kaybı gelişimi açısından yakın izlenmesi gerektiğini düşünmekteyiz.

Anahtar kelimeler: Vestibüler migren, migren, odyoloji, tinnitus

Cite this article as: *Kırkım G, Mutlu B, Olgun Y, Tanriverdizade T, Keskinoğlu P, Güneri EA, Akdal G. Comparison of Audiological Findings in Patients with Vestibular Migraine and Migraine. Turk Arch Otorhinolaryngol 2017; 55: 158-61.*

Address for Correspondence/Yazışma Adresi: Yüksel Olgun
E-mail: yuksel.olgun@deu.edu.tr

Received Date/Geliş Tarihi: 15.06.2017
Accepted Date/Kabul Tarihi: 24.07.2017
Available Online Date/ Çevrimiçi Yayın Tarihi: 02.10.2017

DOI: 10.5152/tao.2017.2609

Introduction

Vestibular migraine (VM) is one of the most common causes of episodic vertigo in adults, with a lifetime prevalence of 1% (1, 2). Although there are some reports about hearing problems in migraineurs, cochlear symptoms in VM patients have not been widely investigated. This could be due to the recent description criteria of VM in 2001 in which an update took place in 2012 or the fact that the awareness of VM among physicians is low (3, 4).

Auditory symptoms are generally considered to be less common than vestibular symptoms in migraine (5). Fluctuating or permanent sudden sensorineural hearing loss has been described in patients with migraine, and these patients typically

have other neurological phenomena attributable to vasospasm (6). Cochlear symptoms have also been reported in vertigo-free migraine patients (7).

Especially in the early stages of the vestibular disease, the presence of spontaneous and recurrent vertigo attacks accompanying cochlear symptoms might lead to some confusion about the diagnosis. The diagnosis of VM is mainly based on the patient's history, including the main and accompanying symptoms, because currently there is no gold standard and confirmatory test for VM. Definition of the audiological profile of patients with VM might help to solve the diagnostic problems. On the other hand, it is necessary to analyze the audiological profile differences of VM and migraine only (MO) patients.

The aim of this study was to investigate and compare the auditory findings in VM, migraine patients without a history of vertigo (MO patients) and healthy controls.

Methods

This study was approved by the local ethics committee for non-invasive research (2211-GOA). This is a prospective interdisciplinary cross sectional study. Written informed consent was obtained from all patients at the beginning of the study. This study was conducted on 44 patients diagnosed with definite VM according to the modified Neuhauser criteria by Lempert et al. (4) and 31 patients diagnosed as MO according to the International classification of Headache Disorders, 3rd edition-Beta version who were followed and treated between January 2011 and February 2015 (8). Also, 52 healthy subjects were included in this study as a control group. Healthy subjects were selected from volunteers with normal hearing thresholds who had no history of vestibular/otological and/or neurological problems. All participants underwent a detailed ENT examination. Before the audiological evaluation, a detailed medical history, interrogating the presence and fluctuation of hearing loss, tinnitus, vertigo, and the relationships of headache and vertigo, was taken from all of the participants. Tinnitus diagnosis was based on patient's anamnesis. For all patients with a tinnitus hemogram, thyroid function tests, lipid panel, vitamin B12 and zinc levels were obtained. Patients with a minimum follow-up time of 6 months were included in the study, and all patients were asked to return if they had any newly developed cochlear symptoms during the follow up period, otherwise all audiological tests were repeated biannually.

The audiological test battery consisted of pure tone audiometry, speech reception threshold, speech recognition score, and acoustic immitancemetry. All audiological examinations were performed during an attack-free period. Air conduction hearing thresholds were evaluated between 250 Hz and 8000 Hz, and bone conduction hearing thresholds were evaluated between 500 Hz and 4000 Hz. The speech reception thresholds and speech discrimination scores were also evaluated (Interacoustics AC 40 Clinical Audiometer; Assens, Denmark). Acoustic immitancemetry tests were performed in all patients (Interacoustics AZ 7 Immitancemeter; Assens, Denmark). Patients with abnormal acoustic immitancemetry findings were excluded from the study.

Statistical analysis

In the descriptive analysis, continuous data were presented as the mean±standard deviation for each of the three groups (VM, MO, and control group). According to Goodman's classification a 0-25 dB HL threshold was accepted as normal hearing (means of 0.5-2 kHz) (9). One-way analysis of variance (ANOVA) and Bonferroni honestly significant difference (HSD) post-hoc tests for multiple comparisons were performed to analyze the audi ological test results between groups. All data were collected and analyzed using the Statistical Package for the Social Sciences version 20.0 (IBM Corp.; Armonk, NY, USA), and $p<0.05$ was accepted as the level of statistical significance.

Results

There were 44 patients (8 males and 36 females; mean age=36.9±9.2 years) with a mean follow-up time of 3.79±0.59 years (6-48 months) in the VM group. The MO group consisted of 31 patients (3 males, 28 females; mean age=34.5±9.2 years) with a mean follow-up time of 3.85±1.46 years (6-48 months). In the control group there were 13 male and 39 female patients with a mean age of 33.1±13.8 years.

In the VM group, there were 16 patients (36.4%) with tinnitus, while in other groups we did not observe any patients with tinnitus. The rate of tinnitus in the VM group was significantly higher in comparison to the other groups ($p<0.05$). The mean age of the patients with tinnitus was 37.8 years (18-60 years). All 16 patients had subjective tinnitus, and none of the patients had a history of otologic surgery or acoustic trauma or had recently worked in a noisy environment. For all tinnitus patients, hemograms, thyroid function tests, lipid panels, vitamin B12 and zinc levels were within normal limits. Tinnitus was unilateral in 11 patients and bilateral in 5 patients. None of the patients in any of the groups had permanent or fluctuating hearing loss. Statistical analyses showed that there were no significant differences between the groups in terms of frequency-specific air conduction hearing thresholds or speech recognition scores (Table 1, 2) ($p>0.05$).

Discussion

There are only a few studies and case reports that mention cochlear problems and hearing loss in migraineurs (6, 10). Fluctuating or permanent sudden sensorineural hearing loss has been described in migraineurs, and these patients typically had accompanying neurological phenomena (such as retinal migraine, hemiplegia, and/or visual aura) that were attributable to vasospasm. Thus, in these patients it is possible to speculate that the sensorineural hearing loss is due to vasospasm occurring in the labyrinthine arteries (6, 10). In a study conducted on 58 migraineurs and 40 healthy control subjects, no differences were found between the groups in terms of hearing thresholds, but some minor electrophysiological changes, like lowering of the transient evoked otoacoustic emissions (TEAOEs) amplitudes and prolongation of wave III latencies in auditory brainstem response (ABR) were encountered in migraine patients (11). In a population-based cohort study, it was demonstrated that migraine was a risk factor for the development of sudden sensorineural hearing loss and that the risk was 1.8 times higher than in controls (12). In our study, no cochlear symptoms were found among migraine patients, and none of them developed any cochlear symptoms during their follow-up period.

Table 1. Pure tone audiometry findings for each group

Ears		Right						Left					
Groups		250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
VM group	Mean	9.32	7.84	6.25	5.23	6.86	9.31	9.43	7.95	5.56	5.11	8.75	7.84
(n=44)	SD	5.96	4.74	5.07	4.3	5.33	7.51	6.75	6.4	5.3	4.63	7.81	6.85
MO group	Mean	7.90	6.50	5.00	5.81	6.77	8.23	7.9	6.45	5.32	5	7.42	8.35
(n=31)	SD	5.74	4.18	3.42	4.30	4.92	5.71	4.96	4.68	4.26	4.28	5.14	6.68
Control group	Mean	10.48	8.08	6.17	6.25	5.83	7.10	10	7.98	6.59	5.86	6.81	7.88
(n=52)	SD	3.87	3.45	3.84	4.41	4.21	4.30	4.43	3.47	4.02	4.17	5.02	5.26
p (One-way ANOVA)		0.09	0.229	0.083	0.519	0.225	0.319	0.238	0.336	0.058	0.595	0.132	0.232
Bonferroni Sig.		0.729	0.816	0.087	0.514	0.292	0.626	0.084	0.76	0.424	0.256	0.71	0.197

SD: standard deviation; VM: vestibular migraine; MO: migraine only

Table 2. The means (0.5, 1 kHz, 2 kHz) of air conduction hearing thresholds and speech recognition scores of all groups

		The means (0.5, 1, 2 kHz) of air conduction hearing thresholds at (dB HL)		Speech recognition scores (%)	
Ears		Right	Left	Right	Left
VM group	Mean	6.47	6.2	97.5	97.4
(n=44)	SD	4.11	4.79	2.2	2.8
MO group	Mean	5.54	5.64	98.1	98.73
(n=31)	SD	2.82	3.75	1.74	2.16
Control group	Mean	5.87	7.32	97.92	97.69
(n=52)	SD	4.93	4.36	2.56	2.89
p (One-way ANOVA)		0.078	0.062	0.083	0.079
Bonferroni Sig.		0.454	0.232	0.133	0.186

SD: standard deviation; VM: vestibular migraine; MO: migraine only

The exact mechanism of VM is unknown. Vasospasm in internal auditory arteries, disruption of ion channels in the brain, and cortical spreading depression theory are the main theories on this issue (13). The most accepted theory is that migraine-induced vasospasm seen in the brain might also occur in the internal auditory arteries causing a decrease in blood flow to the inner ear. Vertiginous symptoms seen in those patients are mostly explained by this event. One might easily speculate that the reduced blood flow in the inner ear might also lead to some cochlear symptoms in those patients, especially over long periods.

The otological symptoms of VM have been reported to include tinnitus, aural fullness, and hearing loss. These symptoms can be unilateral or bilateral, and the hearing loss patterns can vary from stable to fluctuating, predominantly being low-frequency hearing loss (14). Hearing loss and tinnitus are not common symptoms of VM, but have been reported in individual patients (15, 16). In patients with definite VM, the rates of hearing loss vary from 11% to 18% and the rates of tinnitus vary from 20% to 53% (2, 17-19).

Differential diagnosis between Meniere's disease and VM with cochlear symptoms is a significant challenge for otolaryngologists due to the overlapping diagnostic criteria. In a study by Gurkov et al. (20), the authors were able to demonstrate endolymphatic hydrops in 4 of 19 VM patients with cochlear symptoms. Similarly, in another study conducted on 30 VM patients cochlear but no vestibular hydrops was seen in three patients (21). Therefore, the reason behind sensorineural hearing loss seen in VM patients might be attributable to cochlear hydrops, but it is possible to speculate that these patients might have Meniere's disease and VM simultaneously.

Dieterich and Brandt (22) reported that 16% of 90 patients with VM had auditory symptoms, including hearing loss and tinnitus. In an another study by Radtke et al. (23), the authors claimed that cochlear symptoms were present in 17 of 47 definite VM patients, and in 8 of these patients symptoms were accompanied with vertigo episodes. In one study, the VM patient group was longitudinally followed for 9 years and it was reported that the rate of cochlear symptoms in these patients was increased from 15% to 49% as time went by. It was also noted that half of the patients had cochlear symptoms with vertigo attacks and that seven of the patients developed bilateral hearing loss during the follow-up period (24).

In our study, we did not observe any hearing loss in any of the VM patients during their follow up, but 16 (36.4%) of them had tinnitus. Therefore, we thought that the increased incidence of tinnitus in VM patients could be an indicator of cochlear and/or auditory nerve involvement in these patients. We did not have any patients who had or developed hearing loss during the follow up period. One possible explanation for this might be our relatively short (6-48 months) follow up time, which we see as a potential weakness of our study. Therefore, we think that patients, especially those with tinnitus, should be closely followed up for the development of possible hearing loss or other cochlear symptoms in the future.

Conclusion

In our study, we did not find any cochlear problems in migraine patients, however a significant rate (36.4%) of tinnitus was seen in the VM group. Even though we did not encounter any VM patients with hearing loss, further studies with longer follow up

time are needed to justify the occurrence of possible hearing loss in those patients in the long term.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Dokuz Eylül University School of Medicine Non-Invasive Research (2211-GOA).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - G.K., B.M., G.A., Y.O.; Design - G.K., B.M., G.A., Y.O.; Supervision - E.A.G., G.A., Resource - G.K., B.M., E.A.G., P.K.; Materials - B.M., G.K., T.T., G.K.; Data Collection and/or Processing - B.M., T.T., G.K., G.A.; Analysis and/or Interpretation - B.M., G.K., T.T., Y.O.,P.K.; Literature Search - B.M., Y.O., G.K.; Writing - B.M., Y.O., G.K.; Critical Reviews - E.A.G, P.K., G.A.

Acknowledgements: The authors thank Assoc. Prof. Birgül Dönmez Balcı and Audiologist Fulya Koçyiğit for their assistance in the data collection.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

Etik Komite Onayı: Bu çalışma için etik komite onayı Dokuz Eylül Üniversitesi Tıp Fakültesi Girişimsel Olmayan Etik Kurul'undan alınmıştır (2211-GOA).

Hasta Onamı: Yazılı hasta onamı bu çalışmaya katılan hastalardan alınmıştır.

Hakem Değerlendirmesi: Dış bağımsız.

Yazar Katkıları: Fikir - G.K., B.M., G.A., Y.O.; Tasarım - G.K., B.M., G.A., Y.O.; Denetleme - E.A.G., G.A.; Kaynaklar - G.K., B.M., E.A.G., P.K.; Gereçler - B.M., G.K., T.T., G.K.; Veri Toplanması ve/veya İşlemesi - B.M., T.T., G.K., G.A.; Analiz ve/veya Yorum - B.M., G.K., T.T., Y.O., P.K.; Literatür Taraması - B.M., Y.O., G.K.; Yazıyı Yazan - B.M., Y.O., G.K.; Eleştirel İnceleme - E.A.G., P.K., G.A.

Teşekkür: Yazarlar verilerin toplanmasındaki yardımlarından ötürü Doç. Dr. Birgül Dönmez Balcı ve Uzman Odyolog Fulya Koçyiğit'e teşekkür ederler.

Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

References

1. Neuhauser HK, Radtke A, von Brevern M, Feldmann M, Lezius F, Ziese T, et al. Migrainous vertigo: prevalence and impact on quality of life. Neurology 2006; 67: 1028-33. [CrossRef]
2. Dieterich M, Obermann M, Celebisoy N. Vestibular migraine: The most frequent entity of episodic vertigo. J Neurol 2016; 263: 82-9. [CrossRef]
3. Neuhauser HK. The interrelations of migraine, vertigo and migrainous vertigo. Neurology 2001; 56: 436-41. [CrossRef]
4. Lempert T, Olesen J, Furman J, Waterston J, Seemungal B, Carey J, et al. Vestibular migraine: diagnostic criteria. J Vestib Res 2012; 22: 167-72.
5. Dash AK, Panda N, Khandelwal G, Lal V, Mann SS. Migraine and audiovestibular dysfunction: is there a correlation? Am J Otolaryngol 2008; 29: 295-9. [CrossRef]
6. Evans RW, Ishiyama G. Migraine with transient unilateral hearing loss and tinnitus. Headache 2009; 49: 756-8. [CrossRef]
7. Neuhauser H, Lempert T. Vertigo and dizziness related to migraine: a diagnostic challenge. Cephalalgia 2004; 24: 83-91. [CrossRef]
8. Headache Classification Commitee of the International Headache Society (IHS). The international classification of headache disorders, 3rd edition (Beta version). Cephalalgia 2013; 33: 629-808.
9. Goodman A. Reference zero levels for pure tone audiometer. J American Speech and Hearing Association 1965; 7: 262-63.
10. Lee H, Lopez I, Ishiyama A, Baloh RW. Can migraine damage the inner ear? Arch Neurol 2000; 57: 1631-4. [CrossRef]
11. Hamed SA, Youssef AH, Elattar AM. Assessment of cochlear and auditory pathways in patients with migraine. Am J Otolaryngol 2012; 33: 385-94. [CrossRef]
12. Espinosa-Sanchez JM, Lopez-Escamez JA. Migraine, sudden sensorineural hearing loss and autoimmune ear disease. Cephalalgia 2013; 33: 1206-7. [CrossRef]
13. Sohn JH. Recent advances in the understanding of vestibular migraine. Behav Neurol 2016; 2016: 1801845. [CrossRef]
14. Battista RA. Audiometric findings of patients with migraine-associated dizziness. Otol Neurotol 2004; 25: 987-92. [CrossRef]
15. Lempert T, Neuhauser H. Epidemiology of vertigo, migraine and vestibular migraine. J Neurol 2009; 256: 333-8. [CrossRef]
16. Johnson GD. Medical management of migraine-related dizziness and vertigo. Laryngoscope 1998; 108: 1-28. [CrossRef]
17. Salviz M, Yuce T, Acar H, Karatas A, Acikalin RM. Propranolol and venlafaxine for vestibular migraine prophylaxis: A randomized controlled trial. Laryngoscope 2016; 126: 169-74. [CrossRef]
18. Morganti LO, Salmito MC, Duarte JA, Bezerra KC, Simões JC, Ganança FF. Vestibular migraine: clinical and epidemiological aspects. Braz J Otorhinolaryngol 2016; 82: 397-402. [CrossRef]
19. Lopez-Escamez JA, Dlugaiczyk J, Jacobs J, Lempert T, Teggi R, von Brevern M, et al. Accompanying symptoms overlap during attacks in Menière's disease and vestibular migraine. Front Neurol 2014; 15; 5: 265.
20. Gürkov R, Kartner C, Strupp M, Krause E, Ertl-Wagner B. Endolympathic hydrops in patients with vestibular migraine and auditory symptoms. Eur Arch Otorhinolaryngol 2014; 271: 2661-7. [CrossRef]
21. Sun W, Guo P, Ren T, Wang W. Magnetic resonane imaging of intratympanic gadolinium helps differantiate vestibular migraine from Meniere disease. Laryngoscope 2017; 127: 2382-8. [CrossRef]
22. Dieterich M, Brandt T. Episodic vertigo related to migraine (90 cases): vestibular migraine? J Neurol 1999; 246: 883-92. [CrossRef]
23. Radtke A, Neuhauser H, von Brevern M, Hottenrott T, Lempert T. Vestibular migraine--validity of clinical diagnostic criteria. Cephalalgia 2011; 31: 906-13. [CrossRef]
24. Radtke A, von Brevern M, Neuhauser H, Hottenrott T, Lempert T. Vestibular migraine: long-term follow-up of clinical symptoms and vestibulo-cochlear findings. Neurology 2012; 79: 1607-14. [CrossRef]