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ASSESSMENT OF THE AUDIOVESTIBULAR SYMPTOMS IN THE SUBJECTS WITH COVID-19: A CLINICAL STUDY

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ABSTRACT

Background: Hearing difficulties in COVID may range from mild to severe and vary based on COVID-19 severity. They range from the self-manageable at home to the ones needing hospitalization. They include dizziness, vertigo, tinnitus, and/or hearing loss.

Aims: To assess the long-term impact of COVID-19 on the existence of audiovestibular disorders in subjects hospitalized previously for COVID-19.

Materials and Methods: 30 test and 30 control subjects hospitalized in the institution after COVID-19 were assessed for audiovestibular screening Tonal Audiometry was then done to measure bone and air conduction thresholds. Gain threshold was assessed for vestibular loss set at a value less than 0, 6 at 60ms, and vHIT was performed. The collected data were subjected to statistical evaluation and the results were formulated.

Results: Dizziness was seen in 10% (n=3) subjects, tinnitus in 3.33% (n=1) subject, spinning vertigo in 3.33% (n=1) subject, Dynamic disequilibrium/ imbalance in 3.33% (n=1) subject, static disequilibrium/ imbalance in 6.66% (n=2) subjects, and hearing loss in 10% (n=3) subjects. PTA values were statistically non-significant at all frequencies except at 0.25, 0.5, 2, and 4 kHz with respective p-values of 0.003, 0.083, 0.04, and 0.03. In gain values only vHIT significant gain was seen in right anterior canal with values of 0.798±0.257 in cases and 0.949±0.121 in controls and the p-value of 0.004

Conclusion: Within its limitations, the present study concludes that audiovestibular symptoms and components are involved in subjects with COVID-19. No definitive conclusion can be drawn on auditory involvement in subjects with a history of COVID-19 with the previous hospitalization.

Keywords: Audiovestibular disorder, COVID-19, Dizziness, Vertigo, Hearing loss

INTRODUCTION

Since the first COVID-19 case is reported in Wuhan, China, extensive research is being conducted worldwide to assess the signs and symptoms particular to COVID-19. A wide range of clinical signs and symptoms are described by different researchers to allow early identification, awareness, and timely appropriate treatment of the disease in subjects where otherwise it might go unnoticed.[1]

With the commonly known and presented symptoms including fever, fatigue, cough, dyspnea, and breath shortness, various and surprising clinical presentations are seen by different practitioners in COVID-19 subjects. These symptoms include gastrointestinal symptoms (3-4%), neurological symptoms (36%), ophthalmologic symptoms (1%), and audiovestibular impairments (7-15%). Among audiovestibular symptoms, impairment of smell and taste, and dizziness are first reported and evaluated symptoms. Other symptoms are detected in later phases of disease progression. These impairments are detected through specific tests by Otolaryngologists.[2]

In 7-15% reported audiovestibular impairments, tinnitus is seen earlier followed by vertigo and hearing difficulty. Tinnitus is seen in approximately 17% of adults globally. Tinnitus is often associated with hearing loss, linking the two together. Tinnitus in COVID subjects lasts for weeks to months and is commonly seen in long-standing infections. Tinnitus might persist for months after the infection is resolved. The link between COVID and tinnitus is unclear. It can be attributed to virus attacks and damage to the auditory system with added stress.[3]

Hearing difficulties in COVID may range from mild to severe and vary based on COVID-19 severity. They range from the self-manageable at home to the ones needing hospitalization. The presenting symptoms reported in the literature are sudden hearing loss unilaterally along with tinnitus in both the ears. The cases reported are approximately 20 in 1 lakh people/year. Treatment is done with steroids to reduce inflammation. However, treatment is effective only in the initial stages.[4]

A hearing loss like measles can also be seen with SARS-Cov-2. The incidence of hearing loss in SARS-Cov-2 might vary geographically. Also, depicting the true incidence of hearing loss in COVID-19 subjects is difficult owing to the rapid increase and higher cases than reported.[5]

Dizziness is another audiovestibular symptom seen in SARS-Cov-2 subjects. Differentiating dizziness from vertigo is quite difficult. Vertigo is the presentation of balance system damage in the inner ear. Rotatory vertigo is seen in 7% of subjects with COVID-19.[6]

The data concerning the existence of audiovestibular disorders in the subjects with COVID-19 infection are scarce in the literature. Controlled long-term clinical studies in this aspect are lacking. Hence, the present study was conducted to assess the long-term impact of COVID-19 on the existence of audiovestibular disorders in subjects hospitalized previously for COVID-19.

MATERIALS AND METHODS

The present retrospective clinical study was conducted to assess the long-term impact of COVID-19 on the existence of audiovestibular disorders in subjects hospitalized previously for COVID-19. The study was conducted atShyam Shah Medical College And Sanjay Gandhi Memorial Hospital, Rewa, Madhya Pradeshafter obtaining clearance from the concerned Ethical Committee.

The study included a total of 30 subjects from both genders within the age group of 20 years to 50 years and the mean age of 34.64 years who were hospitalized in the institution after COVID-19. The included subjects had two consecutive negative nasopharyngeal swabs for COVID-19 which was not older than the maximum of two weeks. Free audiovestibular screening of all included subjects was done. The subjects were compared against 30 controls that were normal and did not encounter COVID-19.

The inclusion criteria for the study were subjects who had COVID-19 and were hospitalized in the institute, subjects having two consecutive negative nasopharyngeal swabs collected at least at 48 hours intervals, and subjects willing to participate and provide informed consent. The controls were included if they had no previous history of audiovestibular impairment and the ones willing to participate in the study.

After final inclusion, detailed history, general, audiovestibular, and neurological examination was done for controls as well as test subjects. On finding the presence of symptoms, onset was clarified followed by an otologic examination. To rule out any pathology of the middle ear, cochleo-stapedial reflexes tests and tympanometry were performed. Tonal Audiometry was then done using a valid technique to measure bone and air conduction thresholds. For bone, the range used was 250-4000Hz and for air, it was 250-8000Hz.

Gain threshold was assessed for vestibular loss set at a value less than 0, 6 at 60ms, and vHIT was performed with the same instrument by single examiner expertise in the field, and by following the instructions by the manufacturer.

The collected data were subjected to the statistical evaluation using SPSS software and ANOVA to compare vestibular and audiological data between controls and test subjects. The comparison was done using cochleo-stapedial reflexes, vHIT values, PTA (pure tone audiometry), PTA averages at 0.5, 1, 2, and 4 kHz. The level of significance was kept at $p < 0.05$, and the results were formulated.

RESULTS

The present retrospective clinical study was conducted to assess the long-term impact of COVID-19 on the existence of audiovestibular disorders in subjects hospitalized previously for

COVID-19. The study included a total of 30 subjects from both genders within the age group of 20 years to 50 years and the mean age of 34.64±2.28 years who were hospitalized in the institution after COVID-19. 30 controls were compared against these test subjects. The demographic characteristics of the study subjects are described in Table 1. There were 43.33% (n=13) subjects in age group of 21-30 years, 29.03% (n=9) subjects in 31-40 years group, and 26.66% (n=8) subjects in age group of 41-50 years. The study had 53.33% (n=16) females and 46.66% (n=14) males. The presenting symptoms were cough, dyspnea, fever, pain, myalgia, asthenia, sore throat, malaise, diarrhea, ageusia, anosmia, headache, cutaneous rash, and conjunctivitis seen in 43.3% (n=13), 20% (n=6), 33.3% (n=10), 16.6% (n=5), 36.6% (n=11), 43.3% (n=13), 36.6% (n=11), 40% (n=12), 30% (n=9), 40% (n=12), and 53.3% (n=16) study subjects respectively.

On assessing the audiovestibular symptoms in the study subjects, it was seen that dizziness was seen in 10% (n=3) subjects, tinnitus in 3.33% (n=1) subject, spinning vertigo in 3.33% (n=1) subject, Dynamic disequilibrium/ imbalance in 3.33% (n=1) subject, static disequilibrium/ imbalance in 6.66% (n=2) subjects, and hearing loss in 10% (n=3) subjects. Visually exaggerated vertigo and head motion difficulty was not seen in any COVID-19 subject at admission (Table 2).

On audiovestibular assessment, PTA values were statistically non-significant at all frequencies except at 0.25, 0.5, 2, and 4 kHz with respective p-values of 0.003, 0.083, 0.04, and 0.03. Gain values on assessment were normal in all subjects who presented with audiovestibular symptoms, except for one subject who presented with dizziness. In gain values, only vHIT significant gain was seen in the right anterior canal with values of 0.798±0.257 in cases and 0.949±0.121 in controls and the p-value of 0.004 as shown in Table 3.

DISCUSSION

The study was conducted on 30 subjects from both genders within the age group of 20 years to 50 years and the mean age of 34.64±2.28 years who were hospitalized in the institution after COVID-19. 30 controls were compared against these test subjects. The presenting symptoms were cough, dyspnea, fever, pain, myalgia, asthenia, sore throat, malaise, diarrhea, ageusia, anosmia, headache, cutaneous rash, and conjunctivitis seen in 43.3% (n=13), 20% (n=6), 33.3% (n=10), 16.6% (n=5), 36.6% (n=11), 43.3% (n=13), 36.6% (n=11), 40% (n=12), 30% (n=9), 40% (n=12), and 53.3% (n=16) study subjects respectively. These demographics were comparable to what was suggested by Viara LA et al[7] in 2020 and J.F-W et al[8] in 2020 where similar characteristics and symptoms were reported by authors in COVID-19 subjects.

On assessing the audiovestibular symptoms in the study subjects, it was seen that dizziness was seen in 10% (n=3) subjects, tinnitus in 3.33% (n=1) subject, spinning vertigo in 3.33% (n=1) subject, Dynamic disequilibrium/ imbalance in 3.33% (n=1) subject, static disequilibrium/ imbalance in 6.66% (n=2) subjects, and hearing loss in 10% (n=3) subjects. Visually exaggerated vertigo and head motion difficulty was not seen in any COVID-19 subject at admission. These findings were in agreement with the findings of Mustafa MWM[9] in 2020 and Mao L et al[10] in 2020 whereauthors reported similar audiovestibular symptoms in COVID-19 subjects.

On audiovestibular assessment, PTA values were statistically non-significant at all frequencies except at 0.25, 0.5, 2, and 4 kHz with respective p-values of 0.003, 0.083, 0.04, and 0.03. Gain values on assessment were normal in all subjects who presented with audiovestibular symptoms, except for one subject who presented with dizziness. In gain values, only vHIT significant gain was seen in the right anterior canal with values of 0.798±0.257 in cases and 0.949±0.121 in controls, and the p-value of 0.004. These results were similar to those by Krajewska J et al[11] in 2020 and McGravie LA et al[12] in 2020 where the audiological profile in their study was similar to the present study.

CONCLUSION

Within its limitations, present study concludes that audiovestibular symptoms and components are involved in subjects with COVID-19. No definitive conclusion can be drawn on auditory involvement in subjects with a history of COVID-19 with the previous hospitalization.However, the study had few limitations including a small sample size, shorter sample size, and geographical area biases. Hence, more longitudinal studies with a larger sample size and long monitoring period are required to reach a definitive conclusion.

REFERENCES

1. Hu B., Guo H., Zhou P., Shi Z.-L. Characteristics of SARS-CoV-2 and COVID-19. Nat. Rev. Microbiol. 2020:1–14.
2. Lai J., Ma S., Wang Y. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. JAMA Netw. Open. 2020;3:203976.
3. Nalbandian, A. et al. Post-acute COVID-19 syndrome. Nat. Med. 2021;27:601–15.
4. Koumpa FS, Forde CT, Manjaly JG. (2020) Sudden irreversible hearing loss post COVID-19. BMJ Case Reports. 2020;13:e238419.
5. Chen X, Fu Y-Y, Zhang T-Y. Role of viral infection in sudden hearing loss. J Int Med Res 2019;47:2865–72.
6. Lui, F., Foris, L., Willner, K., & Tadi, P. (2019). Central vertigo. Available from https://www.ncbi.nlm.nih.gov/books/NBK441861.
7. L. Angelo Vaira, C. Hopkins, G. Salzano, M. Petrocelli, A. Melis, M. Cucurullo, et al. Olfactory and gustatory function impairment in COVID-19 patients: Italian objective multicenter-study, Head Neck (2020). doi:10.1002/ 347 hed.26269.
8. J.F.-W. Chan, S. Yuan, K.-H. Kok, K.K.-W. To, H. Chu, J. Yang, F. Xing, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster, Lancet. 2020;359:514–23.
9. M.W.M. Mustafa, Audiological profile of asymptomatic 395 Covid-19 PCR-positive cases, Am J Otolaryngol. 2020;396:102483.
10. L. Mao, H. Jin, M. Wang, Y. Hu, S. Chen, Q. He, et al. Neurologic Manifestations of Hospitalized Patients With 386 Coronavirus Disease 2019 in Wuhan, China, JAMA Neurol. (2020). doi:10.1001/jamaneurol.2020.1127.

11. Krajewska J. , Krajewski W. , Zub K. and Zatoński T. , COVID-19 in otolaryngologist practice: a review of current knowledge, European Archives of Oto-Rhino-Laryngology (2020). doi:10.1007/s00405-020-05968-y.
12. McGarvie LA, Martinez-Lopez M, Burgess AM, MacDougall HG, Curthoys IS. Horizontal eye position affects measured vertical VOR gain on the video head impulse test. Front Neurol. 2015;6:58.

TABLES

Characteristics	**Variables**	**%**		**n**	
Mean age (Mean±S.D)		34.64±2.28			
Age Range (years)	21-30	43.33		13	
	31-40	29.03		9	
	41-50	26.66		8	
Gender	Females	53.33		16	
	Males	46.66		14	
		Present		**Absent**	
		%	**n**	**%**	**n**
	Cough	43.3	13	56.6	17
	Dyspnoea	20	6	80	24
	Fever	33.3	10	66.6	20
	Pain	16.6	5	83.3	25
	Myalgia	36.6	11	63.3	19
	Asthenia	43.3	13	56.6	17
	Sore throat	36.6	11	63.3	19
	Malaise	40	12	60	18
	Diarrhea	30	9	70	21
	Aguesia	40	12	60	18
	Anosmia	53.3	16	46.6	14
	Headache	50	15	50	15
	Cutaneous Rash	13.3	4	86.6	26
	Conjunctivitis	6.66	2	93.3	28

Table 1: Demographic and disease characteristics of the study subjects

Audiovestibular symptoms at admission	Present		Absent	
	%	n	%	N
Dizziness	10	3	90	27
Tinnitus	3.33	1	96.6	29
Vertigo (spinning)	3.33	1	96.6	29
Vertigo (visually exaggerated)	0	0	100	30
Head motion difficulty	0	0	100	30
Dynamic disequilibrium/ imbalance	3.33	1	96.6	29
Static disequilibrium/ imbalance	6.66	2	93.3	28
Hearing Loss	10	3	90	27

Table 2: Audiovestibular symptoms in the study subjects at admission

Audiovestibular Parameter	Variables	Cases (Mean±S.D)	Controls (Mean±S.D)	p-value
		10.502±2.832	11.854±2.215	0.043
Pure Tone Audiometry (PTA)	0.25 kHz	11.854±2.946	10.178±0.657	0.003
	0.5 kHz	12.072±3.256	10.892±1.697	0.083
	1 kHz	9.694±3.123	10.267±0.788	0.333
	2 kHz	9.572±2.954	11.249±3.759	0.04
	4 kHz	10.670±4.404	13.928±7.682	0.03
	6 kHz	11.706±6.161	14.463±7.917	0.137
	8 kHz	12.011±7.871	16.342±10.662	0.07
Gain 60ms	LSC left	0.882±0.120	0.837±0.165	0.231
	LSC right	0.855±0.135	0.835±0.212	0.664
	RA	0.798±0.257	0.949±0.121	0.004
	RP	0.919±0.220	0.992±0.095	0.100
	LA	0.972±0.168	0.913±0.178	0.191
	LP	0.856±0.262	0.853±0.199	0.960
CONTRA	0.5 kHz	92.926±8.023	93.749±10.241	0.730
	1 kHz	92.438±6.613	94.553±9.839	0.332
	2 kHz	92.438±6.163	92.231±8.509	0.916
	4 kHz	100.365±10.180	100.713±12.836	0.907
SHIMP Gain 60ms	LSC left	0.817±0.167	0.744±0.258	0.198
	LSC right	0.842±0.168	0.765±0.271	0.191
Ipsi	0.5 kHz	89.609±10.952	89.731±13.564	0.969
	1 kHz	88.658±6.523	90.624±13.082	0.464
	2 kHz	90.609±8.382	91.874±13.535	0.665
	4 kHz	95.548±10.054	95.713±12.246	0.954

Table 3: Audiovestibular assessment in the study subjects