DOI: https://doi.org/10.54393/pjhs.v4i10.1192

PAKISTAN JOURNAL OF HEALTH SCIENCES

https://thejas.com.pk/index.php/pjhs

Volume 4, Issue 10 (October 2023)

Original Article

Impact of SARS-Cov-2 Virus and The Pandemic on Tinnitus Patients: A Comparative Cross-sectional Study

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ARTICLE INFO

Key Words:

COVID-19, Bothersome, Mental conditions, Pandemic, Tinnitus

How to Cite:

Awais, A., Awan, N. U., Saqulain, G., Azmat, S., Zaman, S., Laraib, P., & Shahzad, S. (2023). Impact of SARS-Cov-2 Virus and The Pandemic on Tinnitus Patients: A Comparative Cross-sectional Study: Impact of SARS-Cov-2 Virus on Tinnitus. Pakistan Journal of Health Sciences, 4(10). https://doi.org/ 10.54393/pjhs.v4i10.1192

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Received Date: 1st October, 2023
Acceptance Date: 21st October, 2023
Published Date: 31st October, 2023

ABSTRACT

The WHO declared Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2) a "Public Health Emergency" before the end of January 2020. Over 6M people have died out of 593 million recorded cases. **Objective:** To determine the effect of the COVID-19 and the pandemic on tinnitus patients. **Methods:** Comparative Cross-sectional study was conducted at Mayo Hospital, Lahore. Total 110 patients with tinnitus were included in this study using convenience sampling. Sample included both genders, aged 17 and above with Group A including patients who were inflicted from SARS-COV-2 and group B who did not encounter the virus. Tinnitus Severity Index and a questionnaire was used for data collection. A relationship between the tinnitus severity scale scores obtained before suffering from the coronavirus and after suffering from it. Similarly, a relationship between tinnitus severity scale scores obtained before the occurrence of pandemic and after it, was determined in COVID-19 negative group. T-test, Chi-square and ANOVA statistics were utilized to determine difference between groups with $p<0.05$ considered significant. **Results:** Tinnitus was significantly ($p=0.000$) more bothersome during pandemic compared to before COVID-19 became pandemic, however having COVID-19 infection or not before ($p=0.067$) and during ($p=0.234$) pandemic did not reveal significant difference. TSI scores were higher in patients who picked COVID-19 infection compared to living in pandemic though not significant ($p=0.375$), however there was differences in characteristics of tinnitus. **Conclusions:** COVID-19 pandemic has produced a significant impact on tinnitus patients with more impact resulting from COVID-19 infection compared to pandemic itself, however this was not significant.

INTRODUCTION

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2) was designated "Public Health Emergency" by WHO by the end of January 2020. There have been 593 million reported cases with more than 6 million deaths [1]. Survivors suffered from varying degree of symptoms from being asymptomatic to severely symptomatic with ICU admissions and invasive ventilation maneuvers [2] with clinical features divided into three phases as enlisted by "The UK National Institute for Health and Care Excellence", including i) Acute i.e., up to 4 weeks; Ongoing from 4 to 12 weeks and; post-COVID syndrome, continuing for more than 12 weeks. The latter two phases are often grouped and referred to as 'long COVID' [3]. The current study's focus i.e., "Tinnitus" is a distressing condition explained as a sensation of ringing or noise in one or both ears. It may sound roaring, whistling, buzzing, hissing, both intermittently or continuously [4], with around 12 to 30% of adult population experience tinnitus in their lifetime [5]. The exact mechanism of causation remains not well understood with risk factors like psychological problems,

DOI: https://doi.org/10.54393/pjhs.v4i10.1192

systemic diseases and viral infections affecting hearing function like human immune deficiency virus, cytomegalovirus, herpes, measles and mumps have been implicated [6]. SARS-COV-2, a virus that took over the present world as a pandemic, is also thought of as leaving its impact on the audio-vestibular system. An Italian study involving fifteen hospitals revealed that 23.2% COVID-19 patients reported with tinnitus, 7.6% with both tinnitus and balance disorders [7]. A meta-analysis by Jafari et al., noted an event ate of 4.5% for tinnitus in patients having COVID-19 disease [8]. While a systemic review revealed a pooled prevalence of 14.8% [9]. It is possible that the virus attacks the auditory nerve and damages the auditory system. Literature reveals that SARS-COV-2 virus can be a possible causative factor for audio-vestibular symptoms including tinnitus [10] with effect of SARS-COV-19 on audio-vestibular system being a recent finding requiring further research [11]. Other possible cause, claimed to act as trigger for tinnitus is mental as well as stress and depression due to the pandemic [12, 11]. Stress can result from varying factors including loneliness due to the pandemic which can also be a risk factor for tinnitus, since tinnitus is related to stress and anxiety with a bidirectional relationship [13]. The pandemic has affected mental wellbeing as well as the stress resilience of population [14]. Keeping in view the high prevalence of tinnitus, possible impact of viral infections like SARS-COV-2 on audio-vestibular system in affecting mental wellbeing, stress and depression, as well as gap in literature, current study was conceived to determine the effect of COVID-19 pandemic on initiation and enhancement of tinnitus for those who were infected with SARS-COV-2 and those who were not infected in the pandemic. The study was of significant importance, since study of impact of such viral infections will help give clinicians better insight into the impact of viral infections and their management strategies required to be adopted to cater to the impact of such pandemics. Keeping in view the high prevalence of tinnitus, possible impact of viral infections like SARS-COV-2 on audio-vestibular system in affecting mental wellbeing, stress and depression, as well as gap in literature, current study was conceived to determine the effect of COVID-19 pandemic on initiation and enhancement of tinnitus for those who were infected with SARS-COV-2 and those who were not infected in the pandemic. The study was of significant importance, since study of impact of such viral infections will help give clinicians better insight into the impact of viral infections and their management strategies required to be adopted to cater to the impact of such pandemics.

METHODS

This comparative cross-sectional study recruited N=110 patients with tinnitus using convenience sampling. Study was conducted at Mayo Hospital, Lahore. Sample included patients with tinnitus, of both genders, aged 17 and above who were either experiencing tinnitus during the period of COVID-19 pandemic or suffered COVID-19 disease. Cases with comorbidities were excluded from the study. Sample was divided into two groups. Group A included n=55 participants who were inflicted from SARS-COV-2 virus (COVID Positive) group and Group B included n=55 tinnitus participants who did not encounter the virus the during the Pandemic (COVID Negative) group. Sample of 126 was calculated using sample size formula for cross sectional studies, n=16 patients who did not consent for inclusion in study were excluded leaving behind a sample of N=110 which was our sample of study. Basic demographic sheet including 10 basic questions about tinnitus, Tinnitus Severity Index (TSI) to quantify the severity of tinnitus (14 questions) and 10 questions about COVID-19 symptoms & treatment, social distancing & health related queries, affecting their tinnitus were used for data collection [15]. Google forms was used to generate an online portal for the purpose. Questionnaire was distributed through various social media platforms to reach out to tinnitus communities online and was filled from local patients presented with tinnitus complaints in the Out Patient Department of Mayo Hospital, Lahore, Pakistan. Study was initiated after obtaining ethical approval of from AMS Mayo Hospital Lahore. With registration number 1709-M. Phil SLP-002 on 17th June 2019 along with informed consent of participation. Data thus collected using Google Forms was analysed using SPSS - Version 26. Descriptive statistics were utilized. T-test and ANOVA statistics were utilized to determine difference between groups. Chi-square association was determined for tinnitus, illnesses, COVID-19 and effects on tinnitus characteristics with $p<0.05$ considered significant.

RESULTS

Current study sample N=110 was characterized with mean age of 38.70±18.28 years with most 69(62.7%) of age group 17-40 years, mostly 77(70%) females and majority 87(79.1%) were citizens of Pakistan (table 1). Majority 62(56.4%) had bilateral tinnitus and no other illness 83(75.5%) with 95(86.4%) were mentally normal. 86(78.18%) got their COVID-19 tests done of which 55(63.95%) were reported positive. Most 57(51.8%) revealed persistent tinnitus and 60(54.5%) had tinnitus all day with tinnitus of <5 years duration in most 74(67.4%) cases. COVID-19 symptoms were present in 55(50%) cases Table 1.

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Table 1: Clinicodemographic variables versus Mean Scores for Before COVID-19 and during COVID-19. Cross Tabulation. T-test and ANOVA Statistics(N=110)

Demographic & Clinical Variables	Group [n (%)]	Timing			
		How Bothersome was tinnitus before COVID-19 Outbreak		How Bothersome was Tinnitus during COVID-19 Pandemic	
		mean± SD	t, p-value	mean± SD	t, p-value
Age	17-40 [69(62.7)]	1.45±1.16	0.827, 0.440	1.94±1.35	0.615, 0.543
	41-60 [24(21.8)]	1.17±1.13		2.13±1.26	
	>60 [17(15.5)]	1.12±1.45		1.65±1.54	
Gender	Male [33(30)	1.36±1.29	0.156, 0.877	2.15±1.39	1.09, 0.278
	Female [77(70)]	1.32±1.16		1.84±1.34	
Country	Pakistan [87(79.1)]	1.34±1.14	0.143, 0.886	1.87±1.33	-0.944, 0.347
	Non-Pakistan (23(20.9)]	1.30±1.43		2.17±1.47	
Laterality of tinnitus	Unilateral [48(43.6)]	1.58±1.25	1.925, 0.057	1.87±1.42	-0.416, 0.678
	Bilateral [62(56.4)]	1.14±1.13		1.98±1.31	
Other illness	Yes [27(24.5)]	1.33±1.49	-015, 0.988	2.15±1.51	0.933, 0.353
	No [83(75.5)]	1.34±1.10		1.87±1.30	
Tested for COVID-19	Yes [86(78.18)]	1.39±1.22	0.977, 0.331	2.05±1.34	1.801, 0.75
	No [24(21.82)]	1.12±1.11		1.50±1.35	
COVID-19 test result	Yes [55(63.95)]	1.13±1.09	-2.82, 0.006	2.09±1.31	0.300, 0.765
	No [31(36.05)]	1.87±1.31		2.00±1.41	
Tinnitus type	Continuous always [10(9.1)]	1.60±1.26	2.068, 0.075	2.50±1.35	5.047, 0.000
	ConFlu [5(4.5)]	1.80±1.48		1.80±1.48	
	Occasional [27(24.5)]	1.48±1.09		1.22±0.93	
	Persistent [57(51.8)]	1.16±1.24		2.30±1.40	
	Pulsatile [3(2.7)]	3.00±0.00		3.00±0.00	
	Recurrent [8(7.3)]	0.88±0.64		0.75±0.71	
Duration of Disturbance (hours per day)	< 60 [35(31.8)]	1.09±0.95	7.848, 0.001	1.23±0.88	8.341, 0.000
	> 6 [15(13.6)]	2.40±1.35		2.53±1.46	
	All day [60(54.5)]	1.22±1.17		2.20±1.41	
Tinnitus duration	<5 Years [74(67.4)]	1.47±1.35	2.051, 0.093	2.04±1.42	1.977, 0.103
	6-17 Years [17(15.5)	1.25±0.58		1.88±1.15	
	18-35 Years [17(15.5)]	0.88±0.70		1.65±1.11	
	36-60 Years [2(1.8)]	0.00±0.00		0.00±0.00	
Mental Condition	No [95(86.4)]	1.24±1.18	1.668, 0.178	1.82±1.29	5.693, 0.001
	Depression [10(9.1)]	1.90±1.10		3.30±1.25	
	Anxiety [2(1.8)]	1.50±2.12		0.00±0.00	
	Others [3(2.7)]	2.33±1.15		2.33±1.15	
COVID-19 Symptoms	Yes [55(50)]	1.05±1.04	3.865, 0.024	2.09±1.27	3.435, 0.036
	No [36(32.7)	1.75±1.40		2.08±1.48	
	UNSURE [19(17.3)]	1.37±1.01		1.21±1.18	

Results in table 2 revealed that during COVID-19 pandemic, tinnitus was significantly (p=0.000) more bothersome with score of (1.94±1.36) compared to prior to pandemic (1.34±1.20). However, comparison between bothersomeness of having COVID-19 infection or not just before COVID-19 became a pandemic did not reveal significant difference (p=0.067), similarly during COVID-19 pandemic there was not significant difference of bothersomeness of having COVID-19 or not with p=0.234. Tough TSI scores were higher for having COVID-19 infection, however there was not significant (p=0.375) difference in scores of having COVID-19 infection or living in pandemic.

Table 2: Timing of COVID-19 Pandemic versus Tinnitus Severity & Bothersome Impact of Tinnitus. Cross tabulation. T-test statistics.

Variable	Group	Score	T-test
		Mean± SD	t, P-value
Bothersomeness	Before Pandemic	1.34±1.20	-5.22, 0.000
	During Pandemic	1.94±1.36	
Bothersomeness Before	COVID-19	1.13±1.09	-1.850, 0.067
	Pandemic	1.55±1.27	
Bothersomeness During	COVID-19	2.09±1.31	1.197, 0.234
	Pandemic	1.78±1.40	
Tinnitus Severity Index	COVID-19	37.62±14.74	0.891, 0.375
	Pandemica	35.31±2.34	

DOI: https://doi.org/10.54393/pjhs.v4i10.1192

Frequency wise there was no significant difference in the bothersome impact of tinnitus for those who suffered with COVID-19 or remained in the pandemic both prior to COVID-19 pandemic (p=0.102) and during pandemic (p=362), however tinnitus severity correlated significantly with the severity of bothersomness of tinnitus both prior to pandemic (p=0.000) and during pandemic (p=0.000) (Table 3). When asked about how bothersome was tinnitus before and during COVID-19 outbreak on a scale of 0 to 4, there was no significant difference as regards different age groups, gender, country, laterality of tinnitus, other illness, testing for corona virus and tinnitus duration, however for COVID-19 test result just before COVID-19 became a pandemic there was significant difference (p=0.006) with those who got a positive test having less bothersome tinnitus; while during the pandemic there was no significant difference. On the other hand, as regards type of tinnitus there was no significant difference before pandemic, while a significant difference (p=0.000) was noted after pandemic and it was more bothersome when tinnitus was pulsatile, followed by continuous and least in recurrent cases. Duration of disturbance revealed significant difference both before and after tinnitus (p<0.000) being more bothersome when it was >6 hours. Mental conditions did not reveal significant difference before pandemic, while it was significant after pandemic(p=0.001) being more bothersome for cases with depression. Presence of COVID-19 symptoms made tinnitus more bothersome both before COVID-19 became pandemic and during pandemic. (table 1). As regards tinnitus characteristics (table 3), laterality of tinnitus did not reveal association with being affected with COVID-19 or remaining unaffected in pandemic and severity of tinnitus with p=0336 and p=0.669 respectively. Type of tinnitus was significantly associated with Group (p=0.000) with more cases of persistent tinnitus in the COVID-19 group compared to pandemic group; and TSI category (p=0.000). Duration of tinnitus did not correlate with COVID-19 / pandemic group; however, it revealed significant association with TSI with maximum cases < 5 years' duration in the catastrophic category (p=0.009). Duration of disturbance per day also revealed significant association with COVID-19 / pandemic group with maximum cases in COVID-19 group having disturbance throughout the day (p=0.000); and TSI (p=0.003). Other illnesses, diseases and mental conditions did not reveal any association with COVID-19/ pandemic group, however there was significant association with TSI with p=0.027 and p=0.000 and 0.007 respectively. COVID-19 symptoms, testing for coronavirus, test positive, suspicion of corona infection in household, medicines taken for COVID-19, and medicines affecting hearing all revealed significant association with COVID/pandemic group with p<0.05, while no significant association was noted with TSI except for medication affected hearing (p<0.023). As regards effects on tinnitus, impact of medication, COVID-19 symptoms revealed significant association with COVID/ pandemic group with p=0.014 and p=0.000 respectively, while COVID-19 symptoms also revealed association with TSI (p=0.000).

Table 3: Clinical and demographic variables versus COVID Group & TSI Category Cross Tabulation. Chi-Square Association (n=110)

Category	Item	Group (n)	COVID Group			TSI Category				
			COVID-19 (n=55)	Pandemic (n=55)	P-value	Mild (13-24) (n=25)	Moderate (25-36) (n=35)	Severe (37-48) (n=20)	Catastrophic (49-60) (n=30)	P-value
Tinnitus	Laterality	Unilateral (48)	27	21	0.336	10	13	10	15	0.669
		Bilateral (62)	28	34		15	22	10	15	
	Type	Continuous (10)	6	4	0	0	0	7	3	0
		Fluctuating (5)	0	5		0	4	1	0	
		Occasional (27)	9	18		6	10	3	8	
		Persistent (57)	40	17		14	19	5	19	
		Pulsatile (3)	0	3		0	0	3	0	
		Recurrent (8)	0	8		5	2	1	0	
	Duration	<5 Years (74)	35	39	0.407	16	19	14	25	0.009
		6-17 Years (16)	7	9		1	10	1	4	
		18-35 Years (17)	10	7		6	6	5	0	
		36-60 Years (2)	2	0		2	0	0	0	
		>60 (1)	1	0		0	0	0	1	
	Duration of Disturbance per day	Less than or equal to 6 hours (35)	9	26	0	11	15	4	5	0.003
		More than 6 hours (15)	3	12		0	2	3	10	
		Throughout the day (60)	43	17		14	18	13	15	
	Other illness	Yes (27)	16	11	0.376	9	3	8	7	0.027
		No (83)	39	44		16	32	12	23	
	Disease	Cancer (2)	0	2	0.88	2	0	0	0	0
		Allergy (3)	3	0		3	0	0	0	
		Migraine (6)	3	3		0	0	4	2	

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Illnesses		Diabetes (2)	2	0		0	0	2	0	
		Hypertension (9)	5	4		1	3	2	3	
		Hypertension & Diabetes (3)	3	0		3	0	0	0	
		Osteoarthritis (2)	0	2		0	0	0	2	
		No (83)	39	44		16	32	12	23	
	Mental Condition	No (95)	48	47	0.085	23	35	15	22	0.007
		Depression (10)	7	3		0	0	3	7	
		Anxiety (2)	0	2		1	0	0	1	
		Other Psychiatric Condition (3)	0	3		1	0	2	0	
Illnesses	COVID-19 Symptoms	Yes (55)	46	9	0	13	16	10	16	0.674
		No (36)	3	33		8	11	9	8	
		Unsure (19)	6	13		4	8	1	6	
	Tested for Coronavirus?	Yes (86)	55	31	0	15	29	14	28	0.018
		No (24)	0	24		10	6	6	2	
	Tested positive for coronavirus?	Yes (55)	55	0	0	10	19	7	19	0.075
		No (31)	0	31		5	10	7	9	
	Suspicion of anyone in household Infected by the coronavirus?	No (67)	26	41	0.003	16	18	11	22	0.301
		Yes (43)	29	14		9	17	9	8	
	Taken any medication for COVID-19?	No (76)	21	55	0	15	23	17	21	0.008
		Yes, at Home (28)	28	0		10	12	0	6	
		Yes, at hospital (6)	6	0		0	0	3	3	
	Did the medication affect your hearing?	No (104)	49	55	0.042	25	32	20	27	0.023
		Yes, for short time (3)	3	0		0	3	0	0	
		Yes, worsened one Ear (3)	3	0		0	0	0	3	
Effects on Tinnitus	Did the medication cause or affected your tinnitus?	No (104)	49	55	0.014	25	32	20	27	0.216
		Yes (6)	6	0		0	3	0	3	
	Do you suspect COVID-19 or its symptoms affected your tinnitus?	No (82)	29	53	0	21	23	13	25	0
		Yes, better (4)	4	0		4	0	0	0	
		Yes, worse (24)	22	2		0	12	7	5	
	Have health-related worries related to your coronavirus situation, affected your tinnitus in some way?	No (98)	49	49	0.301	24	32	19	23	0.026
		Yes, better (2)	0	2		0	2	0	0	
		Yes, worse (10)	6	4		1	1	1	7	
	Have lifestyle changes associated with coronavirus affected your tinnitus?	No (91)	46	45	0.355	24	30	19	18	0.001
		Yes, better (2)	0	2		0	2	0	0	
		Yes, worse (17)	9	8		1	3	1	12	
	Have the requirements of social distancing affected your tinnitus in any way?	No (95)	49	46	0.213	23	30	19	23	0.152
		Yes, better (3)	0	3		1	2	0	0	
		Yes, worse (12)	6	6		1	3	1	7	
	Prior to the coronavirus, how bothersome is your tinnitus on scale of 0-4	Not at all (32)	20	12	0.102	13	9	2	8	0
		Slightly (38)	17	21		10	16	8	4	
		Moderately (16)	9	7		1	10	5	0	
		Very (16)	9	10		0	0	3	16	
		Extremely (5)	0	5		1	0	2	2	
	At present, following the coronavirus out break how bother some is your tinnitus on scale of 0-4?	Not at all (21)	9	12	0.362	13	3	0	5	0
		Slightly (24)	9	15		7	12	0	5	
		Moderately (23)	13	10		4	15	4	0	
		Very (25)	16	9		0	5	13	7	
		Extremely (17)	8	9		1	0	3	13	

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DISCUSSION

To evaluate the difference between the impact of SARS-COV-2 infection and the Pandemic on tinnitus experience of patients, a sample of N=110 was utilized with mean age of 38.70±18.28 years with most (62.7%) of age group 17-40 years and (70%) females. Literature revealed no significant difference as regards gender, ethnic origin, between cases with chronic tinnitus before COVID-19 and post COVID-19 tinnitus cases [16]. This is in compliance to our study. Literature revealed no significant difference as regards comorbid conditions, anxiety and depression between cases with chronic tinnitus before COVID-19 and post COVID-19 tinnitus cases [16]. However, in contrast, in the current study there was significant (p=0.001) association of tinnitus with mental conditions. Stress has been shown to induce changes in the auditory system. Prenatal stress becomes the cause of postnatal low- frequency hearing loss [17]. In one of the types of research, it was demonstrated that significant temporary reductions in auditory evoked potentials were caused by an effect of psychological stress [18]. In terms of stress, tinnitus can be defined as a 'Negative and emotional auditory experience associated with actual or potential physical or psychological harm [19]. Also, according to Lasheen & Tomoum, tinnitus that developed after COVID-19 infection might be due to stress and anxiety and the Quality of life in patients with tinnitus revealed positive relation with severity of anxiety. Duration of tinnitus also revealed positive correlation with anxiety severity and THI [20], which is in contrast to our study. Though usage of medication revealed association with COVID-19/ pandemic as well as TSI category in the current study, however, Figueiredo et al, reported no effect of medication on post COVID-19 tinnitus [17]. Literature revealed that COVID-19 cases with chemosensory affections suffered hearing impairment in 10.7%, tinnitus in 16.4% of which 30% recovered from tinnitus and remaining recovered only partially [21]. Hence, keeping in view that viral infections involving audio-vestibular system [10], & stress [14] can result in tinnitus, hence SARS-COV-2 infection and pandemic affected tinnitus experience of patients in the current study in compliance with literature which reveals that tinnitus can result from COVID-19 infection as well as exacerbation of tinnitus can occur due to infection as well as the pandemic [15] & as an after-effect of COVID-19 [22]. Saraf et al., in a study, reported that 20% population developed tinnitus during pandemic of which 23.3% developed symptoms of COVID-19 [23]. Also worsening of chronic tinnitus which existed before COVID-99 was reported after COVID-19 in 30.8% cases [17]. Current study revealed that Tinnitus during COVID-19 pandemic was significantly (p=0.000) more bothersome with score of (1.94±1.36) compared to prior to pandemic (1.34±1.20). However, there was no significant difference in bothersomeness of tinnitus with having COVID-19 infection or not before pandemic as well as during pandemic. Frequency wise there was no significant difference in the bothersome impact of tinnitus for those who suffered with COVID-19 or remained in the pandemic both prior to COVID-19 becoming a pandemic (p=0.102) and during pandemic (p=362), however tinnitus severity correlated significantly with the severity of bothersomness of tinnitus both prior to pandemic (p=0.000) and during pandemic (p=0.000). In contrast, Saraf et al., in their study reported that 80% patients had chronic tinnitus of which in 56.9% in remained unaffected by pandemic, while in 36.1% it become more bothersome, while in 6.9% it improved [23]. Also, Literature revealed that perception of stress, frustration, grief and nervous feeling of patient in pandemic condition had increased the tinnitus associated distress [24]. Similarly, a German study in pre and during COVID-19 pandemic lockdown situations, revealed small increment of tinnitus associated distress/bothersomeness during COVID-19 pandemic and THI score revealed significant difference [24]. Current study revealed that tough TSI scores were higher for having COVID-19 infection, however there was not significant (p=0.375) difference in scores of TSI for having COVID-19 infection or living in pandemic. According to Beukes et al., in their systemic review there was absence of any consistency in pattern as regards presentation of tinnitus and associated factors which might increase the chances of development of tinnitus in studies which studied the impact of COVID-19 disease [25]. Similarly, Floretti et al., in their study reported no homogenous course followed by tinnitus with tinnitus severity which was not impacted by changes in lifestyle due to pandemic [26]. However, in the current study as regards tinnitus characteristics in the current study, laterality of tinnitus did not reveal association being affected with COVID-19 or remaining unaffected in the pandemic. While type of tinnitus there were significantly (p=0.000) more cases of persistent tinnitus in the COVID-19 group compared to pandemic group & was also associated with TSI category (p=0.000). Duration of disturbance per day also revealed significant more cases in COVID-19 group having disturbance throughout the day (p=0.000) and associated with TSI (p=0.003). Duration of tinnitus it revealed significant association with TSI with maximum cases < 5 years duration in the catastrophic category (p=0.009). Other illnesses, diseases and mental conditions revealed significant association with TSI with p=0.027 and p=0.000 and 0.007 respectively. COVID-19 symptoms, testing for coronavirus, COVID-19 test positive, suspicion of corona infection in household, medicines taken for

DOI: https://doi.org/10.54393/pjhs.v4i10.1192

COVID-19, and medicines affecting hearing all revealed significant association with COVID-19/ pandemic group with p<0.05. As regards effects on tinnitus, impact of medication, COVID-19 symptoms revealed significant association with COVID 19/ pandemic group with p=o.014 and p=0.000 respectively, while COVID-19 symptoms also revealed association with TSI p=0.000. On the other hand, Figueiredo et al., [16] reported that cases with pre-COVID-19 tinnitus and those who developed tinnitus after COVID-19 did not show any significant variation in clinical characteristics including laterality with bilateral being prevalent in both groups. Chronic tinnitus was mostly gradual and post-COVID-19 tinnitus of sudden onset. As regards type, whistling tinnitus was prevalent in chronic tinnitus (30.8%) and wheezing was prevalent in post-COVID-19 tinnitus (45.5%). According to Aydogan et al., there was significant increase in THI scores of patients before and during pandemic and the loudness of tinnitus was also significantly increased during pandemic compared to before it. [27] in compliance with our study. These are two contrasting facts. The underlying pathology is not determined yet. The worsening of tinnitus and improvement in tinnitus during pandemic. Figueiredo et al., in their study reported a prevalence of 22.8% for chronic tinnitus existing before COVID19 and 19.3% for post-COVID-19 tinnitus. [16]. A systemic review by Bukes et al., noted that there was anxiety and stress in the pandemic, which was suggested to impact suffering of tinnitus in the studies to see pandemic impact on tinnitus with pooled prevalence of 8% [25]. With frequent reports of tinnitus developing post-coivd-19 infection [28] and worsening of chronic tinnitus, researchers have highlighted the importance of audiological investigations in cases of COVID-19 who report tinnitus and hence the pandemic of COVID-19 needs to be kept under monitoring [28].The online questionnaire method adopted due to COVID-19 lockdown conditions limited the collection of evidence-based data that could have been obtained using various audiological testing. No appropriate measure of stress could be done. Data of the COVID-19 patients admitted in hospitals and at home taking any medications should be collected and studied to check the link between various medications used to treat COVID-19 and their effect on hearing and tinnitus.

CONCLUSIONS

COVID-19 pandemic has produced a significant impact on the tinnitus experiences of tinnitus patients with more impact resulting from COVID-19 infection compared to pandemic itself, however this was not significant.

Authors Contribution

Conceptualization: AA
Methodology: GS, SA
Formal analysis: SZ
Writing, review and editing: NUA, GS, PL, SS
All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

Acknowledgement

The authors would like to acknowledge the Medical Affairs Department of Getz Pharma for their technical support and assistance in the publication process.

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