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ENT Manifestations of COVID-19 in a Dedicated Covid Hospital: Prospective Observational Study

 Anuja Santosh Kulkarni^{1*} and Merlin Babu²
¹M.S.(E.N.T.), DNB, Fellowship (Head and Neck Oncology and Plastic Micro Vascular Surgery), PGDMLE(Medical Law), Senior Divisional Medical officer, Selection Grade and Consultant, Department of ENT and Head and Neck Surgery, Jagjivan Ram Hospital, Western Railway, Mumbai Central, Mumbai, India

²DNB (ENT), Ex-DNB Trainee, Department of ENT and Head and Neck Surgery Jagjivan Ram Hospital, Western Railway, Mumbai Central, Mumbai, India

ABSTRACT

Background: The Coronavirus disease (COVID-19) is global challenge to public health. The study investigates all possible manifestations and their prevalence pertaining to ENT in COVID-19 in our cohort.

Methodology: Admitted laboratory-confirmed COVID-19 positive patients who fulfilled the inclusion and exclusion criteria will be randomly selected for a cross-sectional observational study. On the day of admission, various ENT symptoms are assessed and patients were prospectively studied by detailed ENT examination by using specific and measurable parameters like smell and taste sensation, vertigo, swallowing, voice, and hearing, using scoring scales. The patients were followed up on day 1, 3 and 7, 14, 21 and 28 days.

Results: There were 308 number of patients, 211(68.5%) were of male gender while 97(31.5%) number of patients were of female gender. In our cohort 256(83.1%) patients were of mild severity and 52(16.9%) patients were of moderate severity of COVID 19. 269(87.34%) patients had ENT manifestations and 39 (12.66%) had non-ENT manifestations. Most of these patients are having occult ENT manifestations, 263(97.77%). Association of ENT manifestations with COVID 19 severity is significant with a p value of 0.001. Greater the COVID 19 severity, greater was the ENT manifestations except for sore throat and vertigo. The prevalence of loss of taste is 250 (81.97%) is higher comparing to other occult symptoms. A colour coded check list has been proposed considering the COVID 19 severity and frequency of ENT manifestation.

Conclusion: Based on our study results, it implies that the overall prevalence of ENT manifestations in COVID 19 in our cohort is very high upwards of 87.3 % (269 patients in 308) and most of these patients are having occult ENT manifestations 263(97.77%) where in the patients themselves have not come with these chief complaints but on detailed enquiry and examination these manifestations have been detected. Hence it is prudent to include these symptoms in routine history taking and examination screening in fever clinic and at triage sites for early detection and appropriate COVID 19 directed treatments. The frequency of ENT manifestations in order of occurrence in mild COVID 19 cases were loss of taste 207(80.86%), loss of smell 142(55.47%), change of voice 32(12.50%), vertigo 17(6.64%), hearing deficit 1 (0.39%). The frequency of ENT manifestations in order of occurrence in moderate COVID 19 cases were loss of taste 46(88.46%), loss of smell 36(69.23%), swallowing difficulty 18(34.62%), hearing deficit 9(17.3%), change of voice 7(13.46%), vertigo 5(9.62%).

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***Corresponding author**

Anuja Santosh Kulkarni, Senior Divisional Medical officer, Selection Grade and consultant, Jagjivan Ram Hospital, Western Railway, Mumbai Central, Mumbai, India. Tel: 9819464115.

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Introduction

COVID-19 pandemic is a global challenge to public health. So far there is no 'Standard of Care' in view of inadequate evidence on existing medicines and their limitations. The treatment protocol keeps on evolving based on broadening of knowledge and understanding with regards to wisdom gained from sharing of experience gained while treating these patients.

Based on personal experience in COVID wards, it was observed that there is variation in presentation of patients in the form of certain ENT manifestations ranging from deafness, vertigo, loss of smell and taste to voice change and difficulty in swallowing

apart from sore throat, fever, and dry cough. However, since it was not so far prospectively studied with concerted effort, the present study has been carried out .

The number of patients infected with SARS-CoV-2 and deaths due to infection were rapidly increasing which placed a major burden on the healthcare systems of countries struggling with the disease. Although this virus can cause severe respiratory failure and even death in infected patients, it has spread rapidly and continues to spread among people because it can cause mild or no symptoms in most cases. The most effective method for preventing the spread of the virus is the early detection and isolation of infected individuals [1,2]. COVID-19 manifests with a wide clinical spectrum ranging from no symptoms to septic shock and multi-organ dysfunctions

[3]. It most commonly manifests as fever, dry cough, shortness of breath, sputum production, fatigue, and musculoskeletal pain. Less common symptoms include headache, sore throat, nausea, vomiting, and diarrhoea. However, it has been reported that infection with SARS-CoV-2 may cause loss of smell and taste without nasal discharge and/or nasal congestion or any other symptoms in some patients, unlike other viruses that infect the upper respiratory tract.

The behaviour of SARS-CoV-2 in some patients is contrary to observations in other patients. This prevents suspicion of the disease clinically, delays diagnosis and isolation of patients infected with the virus and, therefore, makes it difficult to deal with the disease. Therefore, knowing the full spectrum of possible symptoms associated with the virus is the first and most important step in identifying infected patients.

It is imperative to diagnose the disease at its mild form when it is limited to upper respiratory tract rather than diagnosing it later when lower respiratory tract is involved, causing pneumonia, ARDS, or septic shock. A significant proportion of patients have ENT manifestations which may go unnoticed, making it necessary to screen all COVID patients for ENT manifestations so that high quality care can be provided for patients. This also helps the care givers to take necessary precautions to protect themselves

Methods

A prospective observational study was considered. The study was conducted at state covid centre. Trial was approved by institutional scientific and ethical committee of Jagjivan Ram Railway Hospital and supported by Jagjivan Ram Railway Hospital.

Study Duration

One and a half year with effect from January 2021 to June 2022.

Study Population

Laboratory confirmed COVID-19 positive patients admitted at Jagjivan Ram Railway Hospital, a designated COVID-19 hospital. 308 patients were included in the study.

Sample Size

From a previous study done in India, the prevalence of otorhinolaryngological manifestations in COVID-19 patients was found to be 23%. Based on this, sample size was calculated using the formula,

$$N = \frac{Z^2 P(1-P)}{d^2}$$

Z = Z statistic for a level of confidence, P = expected prevalence or proportion (in proportion of one; if 20%, P = 0.2), and d = precision (in proportion of one; if 5%, d = 0.05). Z statistic(Z): For the level of confidence of 95%, which is conventional, Z value is 1.96.

Approximate sample size is around 273 patients.

(* Ref: Daniel WW (1999). Biostatistics: A Foundation for Analysis in the Health Sciences. 7th edition. New York: John Wiley & Son)

Trial Procedure

A prospective observational study with a sample size of 308 patients was considered.

Inclusion Criteria

Laboratory confirmed COVID-19 positive patients admitted in Jagjivan Ram Hospital, aged >18 years and ≤ 99 years irrespective of gender and comorbidities.

Exclusion Criteria

- Pregnant women
- Those who are not able to communicate and intubated patients
- Unconscious patients, mentally challenged patients.
- A history of chronic ENT problems and recent head injury.

Withdrawal Criteria

Patient withdrawn from the study if

- Patient is unwilling to continue or is unconscious.
- Require mechanical ventilator with room air spo₂<80% and progressive de-saturation

Exclusion Criteria

- Unconscious patients
- Mentally challenged patients
- Pregnant Women
- Children below age of 18 years
- Those requiring mechanical ventilator with room air spo₂<80% and progressive de-saturation were be excluded from study

Withdrawal Criteria

Patient was withdrawn from the study if

- Patient is unwilling to continue or is unconscious.
- Require mechanical ventilator with room air spo₂<80% and progressive de-saturation

End Points

Primary end Point

Resolution of symptoms-Complete relief from disease

Secondary End Points

All-cause mortality: Symptom specific mortality

Outcome Assessment

Outcome assessment have been done with respect to following parameters:

- Length of time for alleviation of symptoms pertaining to ENT manifestations (measured at time points: on day 1, 3, 7 and optionally on day 14, 21 and 28 if the patient remains hospitalised and if symptoms persist after one week, wherever feasible and applicable.) [By using taste score, odour awareness score, voice recording, visual analogue scale, auditory assessment scale, visual analogue scale for swallowing]
- Length of time for alleviation of symptoms pertaining to non-ENT manifestations (measured at Time points: on day 1, 3, 7 and optionally on day 14, 21 and 28 if the patient remains hospitalised and if symptoms persist after one week, wherever feasible and applicable.)
- Length of time to clinical improvement-(Normalisation of respiratory rate, oxygen saturation, alleviation of cough) [measured at Time points: on day 1, 3, 7 and optionally on day 14, 21 and 28 if the patient remains hospitalised and if symptoms persist after one week, wherever feasible and applicable]
- Duration of clinical progression from mild moderate to severe stage (Time frame up to. 28 days)
- Duration of hospitalisation (at time point up to 28days)
- Length of time to clinical progression (Time frame: up to

- 21 days)
- Length of time of normalisation of oxygen saturation (Time frame up to 28 days)
- Duration of Supplemental Oxygen (Time frame: Up to 28 days)
- Number of patients requiring newer therapy: plasma, Remdesvir, Tocizulimab

Statistical Analysis

Data entered in the MS OFFICE –Excel sheet and statistical analysis was done. All the categorical variables are reported using frequency and percentages, all the continuous variables are reported using mean (SD) or median (IQR). Association between two categorical variables are assessed using Pearson chi square test or Fisher exact test. Comparison of continuous variables such as duration of hospitalization etc. with presence/absence of ENT, non- ENT manifestations is done using independent sample t test or Mann Whitney U test. The rate of change of respiratory rate and oxygen requirement of patients experienced ENT manifestations with time comparing to patients didn't experience ENT manifestations is assessed using Generalized Estimating Equations (GEE), the coefficient with 95% CI is reported. All the p value less than 0.05 was considered as statistically significant. All the analysis was performed using statistical software STATA version 16.0.

Ethical Consideration

The study has been conducted after obtaining the approval of the Institutional Ethics Committee (Reg no. ECR/1238/Inst/MH/2019). The purpose of the study was explained to the participants and an informed written consent was obtained and only those participants who give consent for the study have been included.

Results

The data obtained prospectively. Around 350 patients were screened for eligibility of which around 308 patients were included in the study and remaining 42 were excluded from the study due to being not eligible as per exclusion criteria.

Table1: Clinical Profile of Patients in Study

Variables	ENT manifestations		P value
	Yes (n = 269)	No (n = 39)	
Gender			
Male	184 (68.40%)	27 (69.23%)	
Female	85 (31.60%)	12 (30.77%)	
Age			
18-20	7 (2.60%)	3 (7.69%)	
20-40	78 (29.00%)	8 (20.51%)	
40-60	145 (53.90%)	24 (61.54%)	
>60	39 (14.50%)	4 (10.26%)	
COVID -severity			
Mild	220 (81.78%)	36 (92.31%)	
Moderate	49 (18.22%)	3 (7.69%)	
Duration of hospitalization (days)	7.01 (1.82)	7.21 (1.64)	

The study cohort consist of 308 COVID patients admitted in hospital of which 256(83.12%) patients were having mild stage of illness whereas 52 patients (16.88%) had moderate stage of illness.

Prevalence of ENT Manifestations:

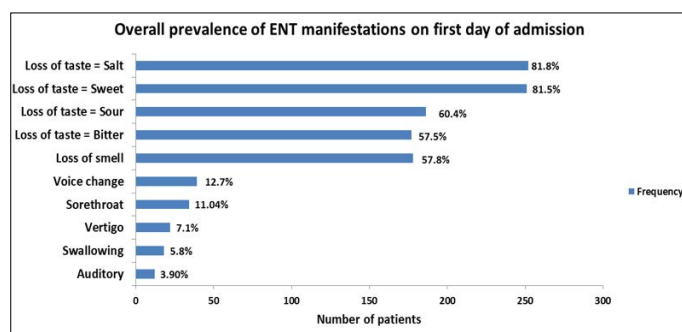


Figure 1: Overall Prevalence of Various ENT Manifestations in Study Patients

In the current study, 87.34% (269) patients had ENT manifestations and 12.66% (39) had only non-ENT manifestations. It is pertinent to note that most of these patients (263, 97.77%) had occult ENT manifestation i.e. patients had not come with ENT manifestations as chief complaints but on detailed enquiry and examination these manifestations have been detected. Most common ENT manifestation was loss of taste (253, 82.14%) followed by loss of smell (178, 57.79%). The frequency of ENT manifestations in order of occurrence in mild COVID 19 cases were loss of taste (207, 80.86%), loss of smell (142, 55.47%), change of voice (32, 12.50%), Vertigo (17, 6.64%), hearing deficit (1, 0.39%). The frequency of ENT manifestations in order of occurrence in moderate COVID 19 cases were loss of taste (46, 88.46%), loss of smell (36, 69.23%), swallowing difficulty (18, 34.62%), hearing deficit (9, 82.69%), change of voice (7, 13.46%) and Vertigo (5, 9.62%). It was further evident that greater the severity of COVID 19 greater was the severity of ENT manifestation.

Overlapping of Symptoms

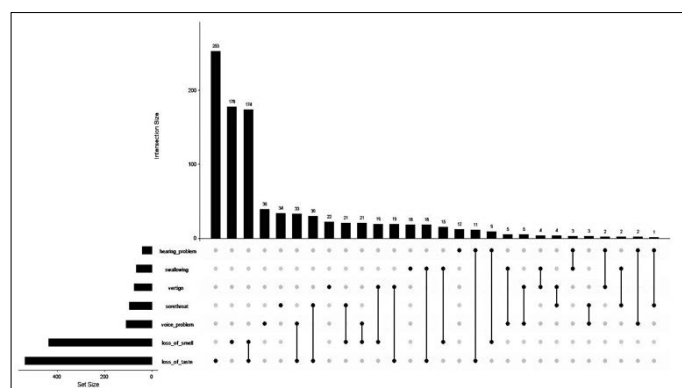


Figure 2: Plot for Overlapping Symptoms (UPSET PLOT)

It was observed that there was simultaneous occurrence of these symptoms. Of 253 patients in our cohort having taste disturbance 174 i.e., 68.7% patients had loss of smell. Similarly, 34 patients out of 253 patients of taste disturbance i.e., 13.4% also had change of voice.

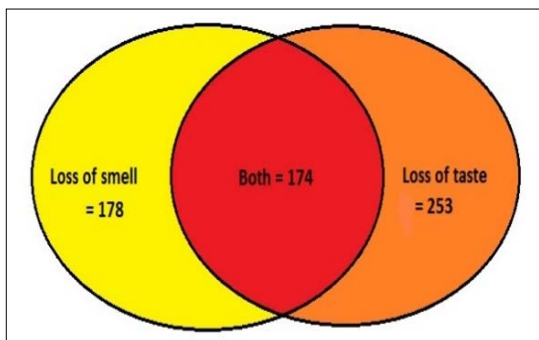


Figure 3a: Overlap of Loss of Taste with Loss of Smell

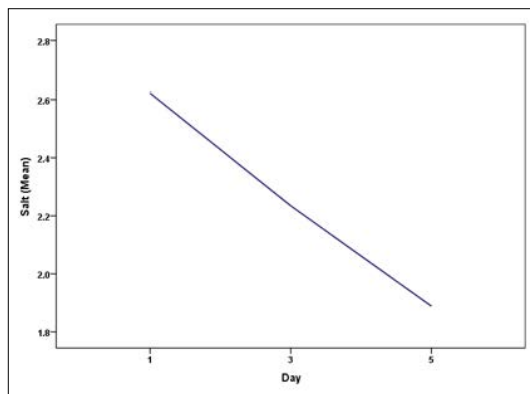


Figure 5b: Taste (salt)

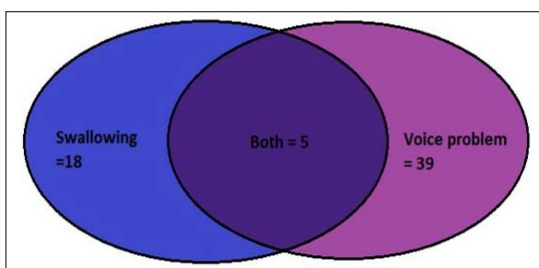


Figure 3b: Overlap of Swallowing and Voice Disturbance

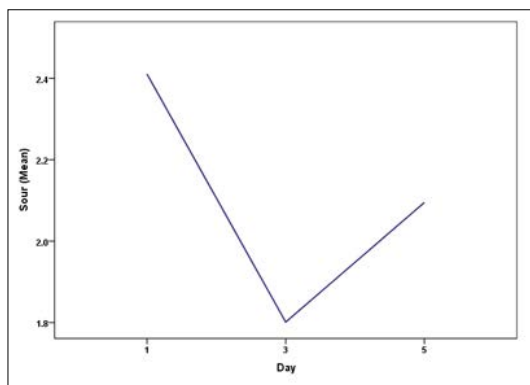


Figure 5c: Taste (sour)

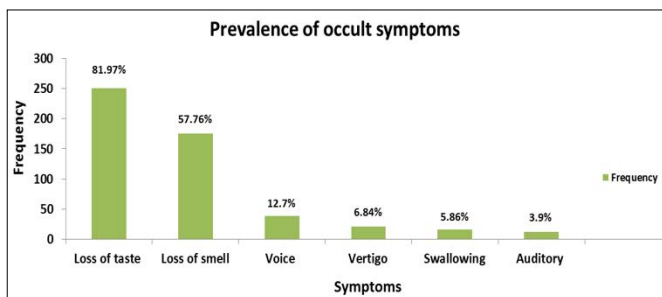


Figure 4: Prevalence of Occult Symptoms

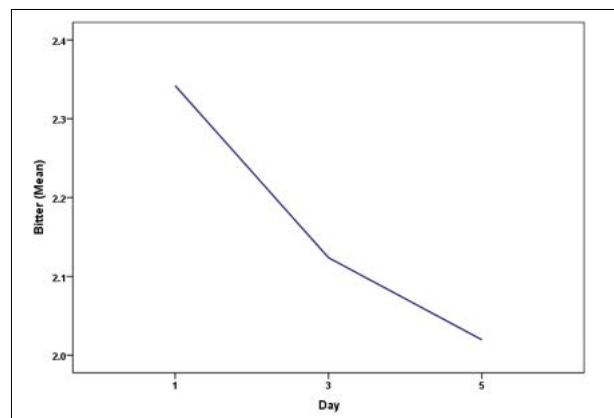


Figure 5d: Taste (bitter)

In our study, the order of frequency of taste disturbance for basic four taste were loss of salt taste 81.8%, followed by loss of sweet taste 81.5%, loss of sour taste 60.4% and loss of bitter taste 57.5%. It was further noticed that, among the patients having sour taste disturbance, the severity score decreased (normalised) on day 3 but subsequently worsened thereafter over day 5 as depicted in results Figure 5. Thus, taste for sour remained affected even after the symptomatic COVID 19 recovery. In addition sensation for bitter taste and sweet taste were undisturbed in 9 (2.92%) and 1 (0.32%) respectively while other tastes were affected.

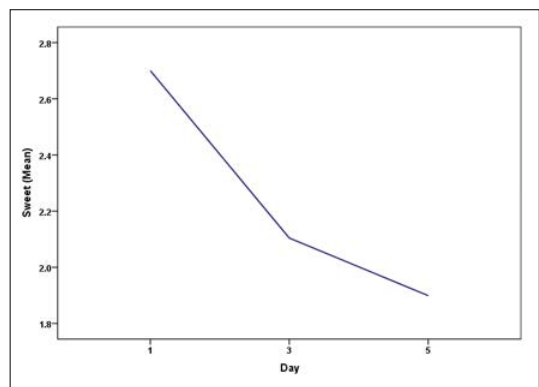


Figure 5a: Taste (sweet)

Loss of taste (82.41%)
Loss of smell (57.79%)
Voice change (12.66%)
Sore throat (11.04%)
Vertigo (7.14%)
Swallowing (5.86%)
Hearing difficulty (3.9%)

Based on this study we have proposed the following colour coded checklist considering the COVID severity and frequency of ENT manifestation.

Discussion

In the current study, 87.34% (269) patients had ENT manifestations and 12.66% (39) had only non-ENT manifestations. Greater the COVID 19 severity, greater was the ENT manifestations except for sore throat and vertigo. Amongst the patients with ENT Manifestation of covid 19, (263, 97.77%) were of occult i.e. had not come with ENT manifestations as chief complaints but on detailed enquiry and examination these manifestations have been detected. Most common ENT manifestation was loss of taste (253, 82.14%) followed by loss of smell (178, 57.79%).

The order of frequency of taste disturbance for basic four taste were loss of salt taste 81.8%, followed by loss of sweet taste 81.5%, loss of sour taste 60.4% and loss of bitter taste 57.5%.

Among the patients having sour taste disturbance, the severity score decreased (normalized) on day 3 but subsequently worsened thereafter over day 5 as depicted in results. Thus, taste for sour remained affected even after the symptomatic COVID 19 recovery. In addition, sensation for bitter taste and sweet taste were undisturbed in 9 (2.92%) and 1 (0.32%) respectively while other tastes were affected. Of 253 patients in our cohort having taste disturbance 174 i.e. 68.7% patients also had loss of smell. Greater the COVID 19 severity, greater was the ENT manifestations except for sore throat and vertigo. In a study done by Savtale S et al in Ambajogai in Beed district of Maharashtra, non-ENT manifestations like fever (95%) and fatigue (93.33%) were commonly seen. Among the ENT signs and symptoms; loss of taste (58.9%), loss of smell (55.5%), hearing loss (54.4%) and throat pain were commonly seen (47.2%) [4]. In another study done by Srivatsava A et al focusing on ENT manifestations in a COVID hospital in Lucknow (Uttar Pradesh), only 68% of the patients were symptomatic at the time of admission [5]. However, most of the symptomatic patients had ENT manifestations with sore throat (64.66%), nasal congestion (54.14%), breathing difficulty (41.71%), dry cough (37.07%) and altered sense of taste (1.76%). However, it should also be noted that while this study focused on self-reported symptoms and based on chart review, our study results were based on history taking and detailed clinical examination. Hence there is a chance of under-estimation of data in the study done above. Similarly, in a hospital-based study conducted to assess ENT manifestations among 465 symptomatic COVID patients admitted in an isolated ward of Haldwani (Uttarkhand) by Kuchhal V et al, it was noted that loss of smell (88), nasal congestion (72) and nasal blockade (66) were the common nasal symptoms. Itching in the ear (37), fullness in the ear (20), conduction hearing loss (12) and earache (10) were the most common ear manifestations; whereas dry cough (319), loss of taste (74) and cough with sputum (7) were the most common throat manifestations [6]. In our study, the order of frequency of taste disturbance for basic four taste were loss of salt taste 81.8%, followed by loss of sweet taste 81.5%, loss of sour taste 60.4% and loss of bitter taste 57.5%. It was further noticed that, among the patients having sour taste disturbance, the severity score decreased (normalized) on day 3 but subsequently worsened thereafter over day 5 as depicted in results Figure 26. Thus, taste for sour remained affected even after the symptomatic COVID 19 recovery. Furthermore, sensation for bitter taste and sweet taste were undisturbed in 9 (2.92%) and 1 (0.32%) respectively while other tastes were affected. It was observed that there was simultaneous occurrence of these symptoms. Of 253 patients in our cohort having taste disturbance 174 i.e., 68.7% patients had loss of smell. Similarly, 34 patients out of 253 patients of taste disturbance i.e., 13.4% also had change of voice. Loss of taste is recognized as a distinct symptom of COVID 19 infection [7]. A

systemic review and meta-analysis of 223 self-reported studies by Hannum ME et al, estimated the pooled prevalence of loss of taste among COVID 19 patients to be 36.53% (95% CI: 32.8%–40.5%) with higher prevalence in middle aged group [7]. Several studies have been done to understand the pathophysiology of loss of taste in COVID 19 infections. While ACE 2 receptors are associated with these infections, studies have shown that these receptors are not expressed in taste papillae. Hence cytokine storm during COVID 19 infections is attributed to loss of taste sensation, as is suggested to increase the permeability of taste papillae to SARS COV 2 virus (Meunier N et al) [8]. In addition, as taste cells have an average life span of 10-14 days (Beidler LM. and Smallman RL) (Barlow LA) and are renewed after this; this can be the reason for early normalization of tastes following infection [9,10]. However, our extensive search for similar results, we assume that ours is the first of its study to the peculiarity of changes in sour sensation with COVID 19 infections. Hence further studies are needed to focus on relationship between sour taste and COVID 19 infections.

The second most common ENT manifestation is loss of smell (57.8%). There was association between severity of loss of smell with COVID 19 severity is statistically significant with a p value of 0.001. It was interesting to note that out of 178 patients with loss of smell, 174 patients i.e. (97 %) also had loss of taste sensation. Similar results were seen in a study done by Shrestha Set al in an infectious disease hospital in Kathmandu (54%) [11]. But in their study, only 45% participants had concomitant loss of taste. In comparison, in a multi-centric study done by Lechien JR et al, higher proportion i.e., 85.6% and 88.0% of cases reported olfactory and gustatory dysfunctions respectively [12]. In addition, 54.8% of the cases had simultaneous gustatory symptoms [12]. Gerkin RC et al investigated the effectiveness of olfactory loss as a reliable predictor for COVID 19 infection and concluded that hyposmia or anosmia is the best predictor for COVID 19 infection [13]. However, their study focused only on olfaction and other symptoms like loss of taste wasn't considered. In contrast to taste papillae, olfactory cells have ACE receptors in several of their tissue (Sungnak W et al) (Mathew D) [14,15]. Hence loss of smell is hypothesized to the action of COVID 19 infection to these cells.

The other common ENT manifestation noted in our study was voice change (12.7%), sore throat (11.04%), vertigo (7.1%) and difficulty in swallowing (5.86%). It was also noted that 87.1% of cases with voice change had additional swallowing difficulty. In comparison, in a study done by Dassie-Leite AP et al, the tiered voice or change of voice after short term use was seen in 73.33% cases [16]. This was much higher than our study. It could be due to use of different study instruments between the studies. In a case series on patients who came to ENT clinic of Kasr Alainy (Cairo university) and Railway hospitals between March 2020 to April 2021, 6 cases of post COVID vocal cord paralysis was reported [17]. Majority of these cases were unilateral and 5 of the 6 cases recovered spontaneously and 1 case needed surgical intervention [17]. Hence there is a need to anticipate such situation in the future. In our study, while most cases of sore throat were seen in mild COVID cases (85.29%), all the cases of swallowing difficulties were seen in moderate COVID infections. Overall, around one-third of moderate COVID cases had difficulty in swallowing. Similarly, El-Anwar MW et al Shaikh A et al noted sore throat in 11.3% and 9.2% cases respectively [18,19]. In our study, overall prevalence of vertigo was 7.14% with higher prevalence in mild COVID [17(6.64%)] compared to that of moderate COVID [5(9.62%)] but this difference was not of statistical significance. However, it should be noted majority of vertigo cases were of occult manifestations and were diagnosed on further probing. In

comparison, Aldè M et al noted vertigo in 12% of cases where as Gallus R et al noted them in only 2% cases [20,21]. SARS COV 2 neurotropism with effects involving various neural pathway including the pathways responsible for hearing and balance are attributed to this symptom [22].

In the current study, Auditory deficit was predominantly the occult manifestation with prevalence of 3 (1.17%) in mild COVID cases and 9 (17.3%) in moderate COVID patients. The association between auditory deficit and COVID severity was statistically significant with a p value of 0.001. Amongst the patients with auditory deficit most of them were having bilateral auditory deficit 10 (3.2%). It was interesting to notice that the severity of auditory deficit for left ear in our cohort has normalised by day 3 and thereafter again worsened over day 5 and the symptom prevailed even after COVID recovery at follow up, at day 7. However, since it is seen in small number of patients, further confirmation required on larger cohort. In comparison, Öztürk B et al noted that, 6.7% of patients reported hearing loss during COVID 19 and 16.7% reported of hearing loss post COVID 19 infections. In addition, on further evaluation, they noted that COVID 19 can cause cochlear damage and this was more for higher frequencies [23]. There are only a few reported cases of hearing loss in COVID 19 [24]. Overall, De Luca P et al, in their systemic review noted that, despite being uncommon, auditory effects can occur in COVID 19 infections [25].

In our cohort there only 39 patients had purely non-ENT manifestation i.e., only thirty-nine (39) patients in our cohort were having none of the ENT manifestations. Fever (9.42%), cough (3.57%), body pain/weakness (1.62%), breathlessness (1.30%), and chest pain (0.62%) were the most common non-ENT manifestations seen in patients without ENT manifestations in the current study. However, it should be noted that majority of cases presented with ENT manifestations also had non-ENT manifestations and were not included in non-ENT manifestation cases. The current study didn't show significant difference in duration of hospitalization, supplemental oxygen requirement and normalisation of respiratory rate between groups with ENT and Non-ENT manifestation. Finally, it is pertinent to note that the most of the patients with ENT manifestations were Occult 263 (97.77%). Amongst the occult ENT manifestations, the prevalence of loss of taste is 250 (81.97%) is higher comparing to other occult symptoms. The prevalence of loss of smell is 175 (57.76%). The number of patients having vertigo as occult symptom is 21 (6.84%), swallowing difficulty is 18 (5.86%), having voice change problem is 39 (12.7%), having right auditory problem is 12 (3.9%) and having left auditory problem is 10 (3.2%).

Loss of taste (82.41%)
Loss of smell (57.79%)
Voice change (12.66%)
Sore throat (11.04%)
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Swallowing (5.86%)
Hearing difficulty (3.9%)

Based on this study we have proposed the following colour coded checklist considering the COVID severity and frequency of ENT manifestation.

Strengths of this study are

- The study has included wide age groups from aged > 18 years and ≤ 99 years irrespective of gender and comorbidities
- To one's knowledge, it is first of a kind of study that has undertaken broad age groups, with comorbidities, longer follow up duration.
- All possible ENT manifestations have been studied with detailed examination rather than just telephonic survey
- The disturbance in taste sensation has been studied in great depth by tasting for all four basic tastes separately

Limitation of this Study are

- Certain symptom(s) related to ENT i.e., swallowing difficulty are based on information obtained from patient, hence there is possibility of recall bias.
- Data is skewed in lieu of majority of the patients in this cohort being of mild stage of COVID.

Clinical Implication

The overall prevalence of ENT manifestations in COVID 19 in our cohort is very high upwards of 87 percent 269 patients in 308 i.e. (87.3%) as per our study and most of these patients are having occult ENT manifestations 263 (97.77%) where in the patients themselves have not come with these chief complaints but on detailed enquiry and examination these manifestations have been detected.

Hence it is prudent to include these symptoms in routine history taking and examination screening in fever clinic and at triage sites for early detection and appropriate COVID directed treatment.

We have proposed a colour coded check list to be incorporated at triage desks for COVID screening. This may aid in expanding the scope of our awareness about various possible symptomatology of COVID 19 in day-to-day clinical practice.

Conclusion

It is evident that the loss of taste is specifically attributed to specific receptors pertaining to four basic tastes. It was observed based on the results of this study that the bitter taste remained undisturbed in spite of other tastes being affected. This suggest that the probably the virus must be affecting afferent pathway of taste sensation and the site could be at the taste bud receptors. Mechanism of loss of smell could be due to affection of afferent pathway at olfactory epithelium. Presence of voice change could be associated with possible neurotropism, loss of resonance due to upper respiratory congestion or could be due to lower respiratory reserve in moderate to severe cases. Besides, difficulty in swallowing could be associated with possible neurotropism by virus. Vertigo experienced by patients could be due to possible affection of vestibular function by virus as viral labyrinthitis is documented entity. Based on the results of our study, majority of the patient complaining of hearing loss are having bilateral hearing loss, which could possibly be attributed to affection of respiratory epithelium by virus leading to bilateral Eustachian tube blockage or possible affection of end arterial system due to vascular coagulopathy associated with pathogenesis of SARS-CoV-2 virus. However, the exact mechanism of affection of these special senses by virus is yet to be known. There is further room for research in this area.

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