

COVID-19 SENSORY IMPACT: TRACKING TASTE AND SMELL ALTERATIONS DURING AND AFTER ILLNESS

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Abstract

Background: The COVID-19 pandemic has caused immense devastation across the world. Loss of taste and smell sensations has been reported in large percentage of patients. This study aims to analyse the taste and smell sensations of patients during the active phase of illness and after recovery from the disease. **Materials and Methods:** We have conducted a prospective observational study in 400, COVID-19 patients. Smell and taste sensations was evaluated by objective assessment for a period of 8 months. **Result:** Based on our study on 400 patients, results indicate about 71% have olfactory and gustatory dysfunctions with covid 19 infections. In our study majority had taste and smell disturbances 2-4 days prior to lab confirmation of COVID 19. The median duration being 2-4 weeks, most of them recovered within 2 weeks. 3.3% patients had olfactory and gustatory dysfunction persisting at the end of 8 months. **Conclusion:** Taste and smell disturbances are strongly associated with SARS-CoV-2 infection. In most cases, these disturbances are temporary and normal sensations are restored within days to weeks after COVID-19 has passed. Very small percentage of patients had persisted smell and taste disturbances for long term.

INTRODUCTION

The COVID-19 pandemic has caused immense devastation across the world. The virus responsible for COVID-19 is the Severe Acute Respiratory Syndrome Coronavirus (SARS CoV), which is one of the two pathogenic coronaviruses, the other being the Middle East Respiratory Syndrome Coronavirus (MERS CoV).^[1,2]

The state of Kerala is one of the regions that has been severely affected by COVID-19. The disease has presented in a wide range of clinical manifestations, ranging from asymptomatic to severe illness, including pneumonia, neurological disorders, and gastrointestinal problems. Loss of taste and smell sensations has also been reported in large percentage of patients.

Early reports have indicated that taste and smell disturbances could be the first or even the only symptom of COVID-19 infection.^[3] This study aims to analyse the taste and smell sensations of patients during the active phase of illness and after recovery from the disease. Most COVID patients had regained their smell and taste function, a small percentage of them had either delayed or no recovery. Even though it is a small percentage since COVID affected a large number of individuals, the total number of patients

with no recovery constitute a large number. Though smell and taste disturbances have been reported with other viral upper respiratory tract infections,^[4,5] the incidence with them are less, and nasal discharge and obstruction are predominant associated symptoms with them.

MATERIALS AND METHODS

Study design and study group

We have conducted a prospective observational study in Jubilee Mission Medical College and Research Institute, Thrissur, Kerala. The study evaluated a consecutive series of patients between January 1, 2021, and January 1, 2023. The study included patients who were admitted and registered with COVID-19 in our institution, as well as those who attended ENT OPD and had COVID-19 viral infection.

We have analysed 400 patients, and the sample size was derived based on a previous study by Paolo Boscolo-Rizzo et al⁶ with 95% confidence level and 10 % relative allowable error, the study period extended for two years to meet the sample size, and in all such cases, SARS-CoV-2 was confirmed through laboratory testing. Those with pre-existing taste and smell disturbances, allergic rhinitis and with

pre-existing CNS disorders were excluded from the study. The presence of COVID-19 was confirmed by a nasopharyngeal swab showing a rapid antigen test or RT-PCR test. We have obtained written informed consent from all participants, and our institution's ethics committee approved the study(17/21/IEC/JMMC&RI).

Data Collection

The subjects included in the study were contacted by phone and asked if they had any smell or taste disturbances and those who reported such complaints were examined physically and their sense of smell and taste was assessed using objective methods. The severe category patients were assessed after they were stable and could be examined physically. In the olfactory function test, the examiner presented four different odours to the patient, one at a time, from a distance of 1-2 cm away from the patient's nostril. A gap of at least 30 seconds was given between each odour to avoid olfactory desensitization. The participants were allowed to take their time to identify the odour presented. Scoring was done using visual analogue scale⁷ based on their responses. In the gustatory testing, four different solutions representing the four different types of taste (sweet, salt, sour and bitter) were used. Each participant rinsed their mouth with water first. Two drops of each solution were then applied to the front two-thirds of their tongue and they were asked to identify the taste. The participants were asked to rinse their mouth between each application of the solution. The subjects were followed up at the end of 2 weeks and 3 months. Those small percentage of subjects who did not show recovery of taste and smell at the end of

3 months were followed up to a maximum of 8 months at monthly intervals.

Statistical analysis

The statistical analysis was performed using the SPSS version 21. Categorical variables expressed in frequency and percentage. Numerical values are expressed in Mean and standard deviation. Pearson correlation was used for the Significance was indicated by a p-value below 0.05.

RESULTS

A total of 400 patients with confirmed SARS-CoV-2 infection were included in this study. Of these patients, 231 (57.8%) were male and 169 (42.3%) were female, with an average age of 46.23 years and a standard deviation of 17.5. The age range was from 18 years to 85 years.

The severity of the disease was categorized into three groups: A, B, and C. Out of the 400 patients, 104 (26%) belonged to category A, 210 (52.5%) belonged to category B, and 86 (21.5%) belonged to category C.

A total of 285 (71.3%) patients reported having experienced smell disturbances. Among these 285 patients, 109 (27.25%) had anosmia, 169 (42.25%) had hyposmia, 5 (1.25%) had parosmia, and 2 (0.50%) had heterosmia upon evaluation.

Turning to gustatory abnormalities 284(71%) out of 400 had taste malfunction. 135(33.75%) had total loss of smell and 149(37.25%) had partial loss on evaluation.

Table 1: Distribution of age according to COVID-19 disease Categorization(N=400).

| Age | CAT A | CAT B | CAT C |
|--------------------|-----------|-----------|-----------|
| Mean age | 36.05 | 45.31 | 58.35 |
| Standard deviation | 14.75 | 16.05 | 16.73 |
| Minimum Age | 18 | 19 | 24 |
| Maximum Age | 82 | 85 | 85 |
| Age | CAT A | CAT B | CAT C |
| <20 years | 4(3.8%) | 4(1.9%) | 0 |
| 20-40 years | 77(74.0%) | 96(45.7%) | 17(19.8%) |
| 40-60 years | 14(13.5%) | 68(32.4%) | 28(32.6%) |
| 60-80 years | 7(6.7%) | 38(18.1%) | 33(38.4%) |
| >80 years | 2(1.9%) | 4(1.9%) | 8(9.3%) |
| Total | 104 | 210 | 86 |

Table 2: Distribution of smell disturbance(N=400) Category wise

| Smell | CAT A | CAT B | CAT C |
|-------|-----------|------------|-----------|
| Yes | 50(48.1%) | 155(73.8%) | 80(93.0%) |
| No | 54(51.9%) | 55(26.2%) | 6(7.0%) |
| Total | 104 | 210 | 86 |

Table 3: Distribution of type of smell disturbance(N=400) category wise

| Type of smell disturbance | CAT A | CAT B | CAT C |
|---------------------------|-----------|-----------|-----------|
| Absent | 49(47.1%) | 74(35.2%) | 11(12.8%) |
| Anosmia | 24(23.1%) | 54(25.7%) | 31(36.0%) |
| Hyposmia | 29(27.9%) | 80(38.1) | 41(47.7%) |
| Paroxysmia | 2(1.9%) | 0 | 3(3.5%) |
| Heterosmia | 0 | 2(1.0%) | 0 |
| Total | 104 | 210 | 86 |

Table 4: Distribution of taste disturbance (N=400) Category wise

| Taste | CAT A | CAT B | CAT C |
|-------|-----------|------------|-----------|
| Yes | 16(15.4%) | 63(30.0%) | 49(57.0%) |
| No | 88(84.6%) | 147(70.0%) | 37(43.0%) |
| Total | 104 | 210 | 86 |

Table 5: Distribution of type of taste disturbance(N=400) category wise

| Type of taste disturbance | CAT A | CAT B | CAT C |
|---------------------------|-----------|------------|-----------|
| Absent | 48(46.2%) | 52(24.8%) | 5(5.8%) |
| Ageusia | 21(20.2%) | 52(24.8%) | 73(84.9%) |
| Hypoageusia | 35(33.7%) | 106(50.5%) | 8(9.3%) |
| Total | 104 | 210 | 86 |

Table 6: Comparison of results obtained in serial follow up

| VAS | N | Pearson correlation | P value |
|----------|-----|---------------------|---------|
| f0 vs f1 | 400 | 0.877 | <0.001 |
| f0 vs f2 | 400 | 0.368 | <0.001 |
| f1 vs f2 | 400 | 0.345 | <0.001 |

During our evaluation of COVID 19 patients we found that the smell and taste disturbances were reported in 62.40% of subjects. Other symptoms included fever, cough, nasal discharge, body pain, headache and about 1% of them had no symptoms. Many patients reported the onset of smell and taste disturbances 2-4 days before being diagnosed with COVID-19 by lab tests. At the time of active disease(f0), the mean VAS (Visual Analogue Scale) score for smell and taste disturbance was 5.49 with a standard deviation of 2.379. After two weeks(f1), the mean VAS score increased to 7.6 and after three months(f2), it was 8.52.

The median duration of illness before patients reported a recovery of baseline smell and taste sensation was within 2-4 weeks. Most patients recovered within two weeks 148 or 59% after the onset of symptoms, by the end of 3 weeks 91% (288 in total) had recovery. 5.7% (18) took 6 weeks for their recovery. 3.3% (11) of subjects did not show any sign of recovery at the end of 8 month of follow up.

Of the 400 patients, only 14 patients received steroid therapy in the form of sprays or oral tablets for their smell and taste disturbances. Whether actual treatment protocol had steroids was not considered in this study.

DISCUSSION

Most studies on taste and smell disturbances were carried out while the pandemic was at its peak, hence they were based on subjective assessment by telephonic interviews, the severe category subjects were not included. Present study was done after the peak of pandemic and have included severe category subjects as well, though they were assessed objectively only after they were stable. Presence of smell and taste disturbances were high in most of the studies, but some variations were observed in different studies. This could be due to ethnic reasons or even variations of questionnaire. We have made objective assessment on those subjects who had positive symptoms and those who did not show

recovery were followed up, to a maximum of eight months.

A study by Jerome R. Lechien,^[4] had an incidence of 85.6% and 88.0% of olfactory and gustatory dysfunction respectively. Study by Fzilet Altin and Cemal Cingi,^[5] reported 61.7% olfactory dysfunction. Yonghyum Lee and Pokkee Min,^[8] had only 15.3% of their subjects with altered taste and smell function. L.A.Vaira,^[9] and Paolo Boscolo,^[6] have reported 84.8% and 66.3% respectively. Based on our study on 400 patients, results indicate about 71% have olfactory and gustatory dysfunctions with covid 19 infections. In our study majority had taste and smell disturbances 2-4 days prior to lab confirmation of Covid 19, its not clear whether there were delay in lab testing or delayed reporting to hospital. The median duration being 2-4 weeks, most of them recovered within 2 weeks. In a study by Klopfenstein et al,^[10] generally anosmia was found 4.4 days after the onset of SARS COV infection, with a duration of 8.96 days and among them 98% recovered within 28 days. Jerome R Lechien⁴ reported 72.6% recovery in the first 8 days whereas median recovery in the study by Yonghyun Lee⁸ was 7 days.

In our study, no worsening of smell and taste sensation scores from baseline (at the onset of disease) to observation time 1 (2 weeks after symptom onset), which suggest that smell and taste disorders are manifestations of early stage disease. At the time of active disease, the mean VAS score of smell and taste disturbances was 5.49 with standard deviation of 2.379. After 2 weeks mean VAS score increased to 7.6 and after 3 months mean VAS score reported to be 8.52.

Progressive improvement of smell and taste function during the study period suggests viral impact on the receptors or to a regional inflammatory process.^[9,11,12]

Symptoms persisted in 7.2% of patients, two months after the onset in the study by Vaira L A,^[12] 11% patients with persistence of symptoms ant the end of 4 weeks was reported by Paolo Boscolo. In the present study Only 11 patients (3.3 per cent) still had

olfactory or gustatory dysfunction at the end of 8 months after symptom onset, shows that smell and taste disorders in association with COVID 19 is not a long-term morbidity however it is a first line symptom.

The pathophysiological reasons for smell and taste disturbances in corona virus infection is not well understood. Coronavirus has already recognised as family of viruses that can lead to smell dysfunction.^[13]

According to the study by, Suzuki et al in 2007,^[13] coronavirus can be detected in the nasal discharge of subjects with loss of smell. They also suggested, other mechanisms other than local inflammation and obstruction as the cause for symptoms. Biomolecular mechanisms suggest, peripheral neurons could be affected by viruses that can lead to access to central nervous system.^[14] Animal studies on transgenic mice demonstrated SARS-CoV may enter the nervous system through the olfactory bulb, suggesting trans neuronal spread.^[15]

Regarding the initiation of treatment, the chance of self-recovery is a possibility and we should consider the adverse effects of treatment also. Most studies include small sample size and the rate of recovery does not mention whether it is spontaneous improvement or treatment effect. Another possibility is that most of the patients on category B and category C has got their systemic steroid in their COVID 19 treatment who got admitted in the hospital as per management protocol, may add on to the spontaneous recovery of the patient. In a study by Heilman S et al on local and systemic administration of corticosteroids in the treatment of olfactory loss suggest that only the oral steroid but not the local steroid spray had effect in treating the post viral anosmia.^[16] Our study shows highest recovery of symptoms occurred in the first 10 to 20 days. Among them 20 % of subjects had severe persisting loss. All subjects with moderate symptoms at 20 days recovered within 2 months. Thus, treatment for patient should be consider only if symptoms persist more than 20 days, then the risk of adverse effects of treatment will be significantly reduced.

In an uncontrolled study by Hummel et al,^[17] it is shown that Alpha- lipoic acid is said to improve smell function but it has adverse effect like headache, dizziness and confusion, this can be confused with the Covid-19 manifestations itself. Addition of intranasal vitamin A to olfactory training had better results compared to olfactory training alone. This local intranasal application of vitamin A caused irritation to nasal mucosa.^[18]

Medical treatment for taste dysfunction is not as clear as for smell disturbances. Hence no recommendations can be made with clarity. Is taste dysfunction secondary to anosmia also not clear. However, the angiotensin converting enzyme 2 receptor is widely seen on the oral mucosal epithelia as well.

CONCLUSION

Out of 400 cases, 285 cases had smell disturbances and 284 had taste disturbances with SARS-CoV-2 infection. In most cases, these disturbances are temporary and normal sensations are restored within days to weeks after COVID-19 has passed. Further research is needed to understand the clinical features and pathogenesis of COVID-19 patients experiencing taste and smell disturbances. Many patients have reported complete resolution or improvement of these symptoms. Ongoing disturbances in smell and taste are not indicative of persistent SARS-CoV-2 infection. To prevent long-term morbidity, specific treatments should be considered in moderate to severe cases if symptoms persist more than 20 days after the onset.

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