The incidence of anosmia in patients with laboratory-confirmed COVID 19 infection in India: An observational study

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Abstract

Background and Aims: Acute loss of smell or anosmia is a common and sometimes the only symptom observed in patients with coronavirus disease-2019 (COVID-19). The objective of the study was to determine the prevalence, time of onset, and duration of anosmia in patients with COVID-19 infection and the association of anosmia with other symptoms and eosinophil count.

Material and Methods: Two hundred patients with laboratory-confirmed COVID-19 infection, who were asymptomatic or mildly symptomatic were assessed for olfaction with a nonirritant odor. The presence of anosmia was recorded, and a questionnaire integrating the anosmia reporting tool was filled. Patients with anosmia/hyposmia were followed telephonically at 7 and 14 days for resolution of anosmia and other symptoms. The presence of anosmia was correlated with eosinophil count.

Results: Of the 200 COVID-19 patients, 87% were symptomatic. More than half of the patients had fever (56%). Anosmia was observed in 30% of the patients and hyposmia in 4% of patients. In 41% of the patients, olfactory loss was reported before diagnosis. The mean duration of anosmia was 7.8 (± 5) days; 97% of patients recovered with a resolution of symptoms within 2 weeks. Ageusia was the most common and significantly associated symptom with anosmia (66%, n = 45) followed by sore throat (41%), and rhinorrhea (28%). The symptoms in both the sexes were comparable. Absolute eosinophil count of <40/µL was observed in 59 patients (29.5%) and an absolute eosinophil count of 0 in 17 patients (8.5%). Among the 68 anosmic patients, 36 (47%) patients had eosinopenia, which was statistically significant.

Conclusion: Anosmia is an early and sometimes the only symptom in approximately one-third of the patients with COVID-19 infection. Eosinophil count should be checked in anosmic patient with suspicion of COVID-19 infection. Objective tools for olfactory and gustatory assessment should be brought into practice for early and prompt diagnosis to control the spread of the disease.

Keywords: Ageusia, anosmia reporting tool, anosmia, COVID-19, eosinophil count

Key findings

- Incidence of anosmia in patients with COVID-19 in the Indian population is 34%
- The anosmia report tool developed by the AAO-HNS has good face validity and could be used for detecting anosmia in patients with COVID-19
- Anosmia and ageusia affect the quality of life and recover with time. Reassurance and olfactory training may help patients
- Eosinophil count should be checked in an anosmic patient with a suspicion of COVID-19 infection.

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Introduction

The coronavirus disease 2019 (COVID-19) is a global pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and has so far resulted in over 15 lakh deaths worldwide.[1] In India, the disease has affected more than 9.6 million people and has caused 1.4 lakh deaths.[2]

The clinical symptoms of COVID-19 infection are nonspecific, like other viral respiratory infections such as fever, cough with or without sputum production, dyspnea, myalgia, arthralgia, headache, diarrhea, rhinorrhea, and sore throat. Patients with mild symptoms may rapidly progress to severe symptoms within a short period. The concern of rapid viral transmission by ambulatory patients with minimal to no symptoms underlines the importance of identifying early or subclinical symptoms of COVID-19 infection.[3]

Sudden onset olfactory dysfunction may be the only presenting feature in some patients with COVID-19 infection, especially in the initial stage of the disease.[4] Complete and partial loss of smell known as anosmia and hyposmia respectively, are commonly experienced by patients with COVID-19. However, unlike other viral infections, olfactory dysfunction associated with COVID-19 infection is often not associated with rhinorrhea or nasal obstruction. Although the exact pathogenesis remains elusive, olfactory epithelial damage and central nervous system involvement have been described as the probable cause.[5] High angiotensin-converting enzyme-2 (ACE-2) and transmembrane protease serine 2 (TMPRSS-2) expression in nasal epithelial cells allows for a wide viral entry and thus damage to olfactory sensory neurons. Invasion of the olfactory bulb has also been hypothesized as a mechanism of virus-induced anosmia.[6]

Anosmia/hyposmia is often associated with loss (ageusia) or alteration (dysgeusia) of taste sensation. Loss of smell and taste adversely affects the appetite as well as the mood and may negatively impact the patient’s quality of life.

Tests for the assessment of loss of smell/taste can be performed easily, and questionnaires can be made for the same. Understanding the time of onset and association of smell/taste loss in COVID-19 may help facilitate screening and early isolation of cases.

Eosinopenia is a common finding in COVID-19 and has a high sensitivity for the prediction of COVID-19 infection in symptomatic patients. So, it may be a potential biological indicator of SARS-COV-2 infections.[7]

There is insufficient literature available regarding the presence of olfactory symptoms in COVID 19 patients in the Indian population. We carried out this study to ascertain the prevalence of anosmia and its onset and duration in patients with COVID-19 presenting to a dedicated COVID facility and correlate its existence with other symptoms and laboratory investigations.

Material and Methods

We carried out this observational study in 200 asymptomatic or mildly symptomatic, laboratory-confirmed patients through reverse transcriptase-polymerase chain reaction test. These patients were admitted to a dedicated COVID facility in India for isolation and/or observation. Patients were enrolled in the study after obtaining patients’ consent and ethical approval from the Institutional Ethics Committee. Convenience sampling was carried out. The olfaction was assessed. The patients were blindfolded and asked to identify the odor of scented soap by sniffing it. We chose to assess olfaction with only one scent because of the technical difficulties in assessing olfaction in the COVID area, and our patients were also not well versed with fragrances used in a typical olfaction assessment test.

The presence of anosmia or hyposmia was recorded. After seeking permission, the Anosmia Reporting Tool developed by the American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS), Infectious disease, and Patient Safety Quality Improvement Committees was adopted because of its adequate face validity, and a questionnaire was formulated.[8,9] The details of the patient’s age, gender, associated comorbidities, and presence of symptoms related to COVID-19 infection, and history regarding the onset of anosmia were recorded. Those patients who had anosmia/hyposmia were followed at 7 and 14 days for resolution of anosmia and other symptoms telephonically. Complete blood count was performed in all the patients as a routine investigation, and the eosinophil count was reviewed. The presence of anosmia was correlated with eosinophil count. Absolute eosinophil count less than 40/μL was considered as absolute eosinopenia.[10]

The results were analyzed by using statistical software SPSS (version 17, IBM Corporation, New York, United States). Descriptive statistics were used for the categorical variables and were reported as numbers, percentages, or mean. Continuous variables were expressed as mean with standard deviation (SD). Chi-square or Fisher exact tests were performed for qualitative variables.

Results

The mean age of the patients was 37.4 (± 11) years, and 151 (75.5%) were males. The most frequent comorbidities were hypertension (14%, n = 28), diabetes mellitus (9%,
n = 18), and coronary artery disease (2%, n = 4). Twenty-five patients were smokers. Risk factors for contracting COVID-19 infection such as a positive history of contact with a COVID-19 infected individual, residence in containment zones, health care professional involved in nursing, driving an ambulance, sanitation work, and security work were present in 75.5% (n = 151) of the patients. Eighty seven percent (n = 174) patients were symptomatic while 13% (26) patients were asymptomatic. More than half of the patients infected with COVID-19 had fever (56%). [Table 1] Other symptoms observed were fatigue and myalgia (38%), sore throat (29.5%), dry cough (27.5%), rhinorrhea (15%), headache (10%), cough with expectoration (8.5%), and dyspnea (7%). Diarrhea, chest pain/heaviness, and anorexia were other uncommon symptoms reported by the patients (<5%). Anosmia was observed in 30% (60) of the patients and hyposmia in 4% (8) of the patients. It was mostly seen after the establishment of diagnosis (59%, n = 40), 2–3 days after diagnosis in the majority. However, anosmia was also reported before diagnosis in 41% (n = 28) patients. The mean duration of anosmia was 7.8 (± 5) days. Anosmia/hyposmia resolved within 7 days in 65% of patients (n = 44) and within 2 weeks in 32% of patients. However, hyposmia lasted beyond 2 weeks in 2 patients, and it resolved within 1 month of diagnosis. Of the 68 patients with anosmia/hyposmia, ageusia was the most commonly and significantly associated symptom with it (66%, n = 45). Other statistically significant symptoms associated were sore throat (41%) and rhinorrhea (28%). More than half of the patients with anosmia had fever (59%). Myalgias and fatigue and dry cough were associated with anosmia/hyposmia in 41% and 29.4% of the patients, respectively. Expectoration and cough (9%), headache (6%), dyspnea (7%), anorexia, and chest heaviness were less commonly associated with anosmia (<5%). [Table 2] The symptoms in both the sexes were comparable. Ninety-seven percent of patients recovered with a resolution of symptoms within 2 weeks. [Figure 1] Blood investigations were reviewed in all the patients. An absolute eosinophil count of <40/µL was observed in 59 patients (29.5%) and an absolute eosinophil count of 0 in 17 patients (8.5%). Among the 68 patients with anosmia, 36 patients had eosinopenia as well, which was statistically significant.

Discussion

We have observed 200 patients with COVID-19 infection and found anosmia/hyposmia in 34% (68) patients. Males (75.5%) outnumbered the female patients. The patients in our study were younger than previously reported (mean age of 37.4 ± 11 years). We observed that ageusia was an associated symptom in 66% of patients with olfactory dysfunction (anosmia/hyposmia).

The incidence rate of olfactory dysfunction varies from 33.90%–68% with female dominance in various studies. In European COVID-19 patients, the prevalence of olfactory and gustatory dysfunction was substantially higher. Hornuss

**Table 1: Demographic profile, comorbidities, and symptoms in patients with COVID-19**

| Characteristics          | Number |
|--------------------------|--------|
| Age (years): Mean (SD)   | 37.4 (±11) |
| Sex                      |        |
| Male                     | 151 (75.5%) |
| Female                   | 49 (24.5%) |
| Comorbidities            |        |
| Smoker                   | 25 (12.5%) |
| Hypertension             | 28 (14%) |
| Diabetes mellitus        | 18 (9%)  |
| Coronary artery disease  | 4 (2%)   |
| Risk factors             |        |
| Positive contact history  | 151 (75.5%) |
| Symptomatic patients     | 174 (87%) |
| Symptoms                 |        |
| Anosmia                  | 60 (30%) |
| Hyposmia                 | 8 (4%)  |
| Ageusia                  | 48 (24%) |
| Fever                    | 112 (56%) |
| Myalgia/fatigue          | 76 (38%) |
| Dry cough                | 55 (27.5%) |
| Sore throat              | 59 (29.5%) |
| Rhinorrhea               | 30 (15%) |
| Dyspnea                  | 14 (7%)  |
| Cough with expectoration  | 17 (8.5%) |
| Headache                 | 20 (10%) |
| Diarrhea                 | 7 (3.6%) |
| Chest pain/heaviness     | 6 (3%)   |
| Anorexia                 | 1 (0.5%) |

**Figure 1:** Kaplan Meyer graph of recovery from anosmia in patients with COVID-19
et al. reported anosmia in 40% of the patients and hyposmia in 44% of the patients with a mean age of 58 ± 17.5 years in the German population having COVID-19 disease.\textsuperscript{11}

In a study carried out in France, 47% (n = 54) reported anosmia among 114 patients with confirmed COVID-19 infection, and out of these 54 patients, 46 patients (85%) had dysgeusia. The mean age of the patients was 47 (± 16) years.\textsuperscript{12} Vaira et al. noted olfactory dysfunction in 19.4% of the 320 patients with COVID-19 infection in Italy.\textsuperscript{13}

Lechien et al. conducted a multicentric study on 417 mild-to-moderate patients with COVID-19 in Europe and have observed a higher rate of olfactory (85.6%) and gustatory dysfunctions (88%). They have also found a statistically significant association between the two disorders.\textsuperscript{4}

Asian countries also have reported symptoms of anosmia although in fewer numbers, and this has been an area of research as well. Of the 214 patients hospitalized with COVID-19 in Wuhan, Mao et al. identified anosmia in 11 (5.1%) and ageusia in 12 (5.6%) patients.\textsuperscript{14} Data from South Korea suggests that 30% of COVID-19 positive patients had anosmia as the primary presenting symptom.\textsuperscript{6}

Ethnic and racial disparity, the difference in expression of ACE2 and TMPRSS2 in different tissues due to genetic polymorphism, and mutation of viral proteins (such as surfac protein, spike S protein, and nucleocapsid N protein) may affect the symptoms and outcomes in COVID disease.\textsuperscript{15,16}

Lee et al. reported sudden onset anosmia in 15.7% of the patients who were asymptomatic or having mild COVID-19 disease in South Korea. The olfactory and gustatory symptoms were most reported in the female population (69%) and a younger age group (36.5 ± 17.5 years).\textsuperscript{17}

In our study, 28% of patients with anosmia/hyposmia had symptoms of rhinorrhea. However, a French study showed a higher percentage of patients with rhinorrhea (57%) along with anosmia. Lechien et al. stated that among the 18.2% of the patients without nasal obstruction or rhinorrhea, 79.7% were having hyposmia or anosmia.\textsuperscript{4}

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In our study, more than half of the patients with anosmia/hyposmia had fever (59%). Other associated symptoms were sore throat (41%), myalgias and fatigue (41%), and dry cough (29.4%). Headache, dyspnea, cough with expectoration, anorexia, and chest heaviness were not commonly associated with anosmia (<10%). Diarrhea although reported in patients with COVID-19 infection, was not associated with anosmia in any patient.

Klopfenstein et al. also observed other symptoms in patients with anosmia/hyposmia although in higher numbers as follows Fatigue (93%), cough (87%), headache (82%), fever (74%), myalgia (74%), and arthralgia (72%). Diarrhea was also present in almost half of the anosmic/hyposmic patients.\textsuperscript{12}

In our patient population, anosmia was mostly seen after 1 to 3 days of diagnosis of COVID-19 infection (59%, n = 40). However, symptoms of anosmia were also reported before diagnosis in 41% (n = 28) of the patients. Lechien et al.\textsuperscript{14} also noted the appearance of olfactory symptoms before (11.8%) as well as after (65.4%) the onset of infection and development of other symptoms. However, Klopfenstein

**Table 2: Details of COVID-19 patients having anosmia/hyposmia**

| Patient with Anosmia/Hyposmia | Total: 68 |
|-------------------------------|----------|
| Age (years): Mean (SD)        | 36 (±9.74) |
| Sex                           |          |
| Males                         | 54 (79.4%) |
| Females                       | 14 (20.6%) |
| Mean duration (days)          | 7.8 (±5) |
| The minimum duration of anosmia | 2 days |
| The maximum duration of anosmia | 30 days |
| Symptoms associated with anosmia/hyposmia |          |
| Ageusia                       | 45 (66%) |
| Fever                         | 40 (59%) |
| Sore throat                   | 28 (41%) |
| Myalgia/fatigue               | 28 (41%) |
| Dry cough                     | 20 (29.4%) |
| Rhinorrhea                    | 19 (28%) |
| Headache                      | 4 (6%) |
| Dyspnea                       | 5 (7%) |
| Cough with expectoration       | 6 (9%) |
| Chest heaviness               | 2 (3%) |
| Anorexia                      | 1 (1.4%) |
| Onset of anosmia/hyposmia     |          |
| Before diagnosis              | 28 (41%) |
| 1 day before                  | 6 (9%) |
| 2 days before                 | 19 (28%) |
| 3 days before                 | 3 (4%) |
| After diagnosis               | 40 (59%) |
| 1 day after                   | 1 (1.4%) |
| 2 days after                  | 20 (29.4%) |
| 3 days after                  | 19 (28%) |
| Resolution of anosmia/hyposmia |        |
| Within 7 days                 | 44 (65%) |
| Within 14 days                | 22 (32%) |
| Beyond 14 days                | 2 (3%) |

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et al., stated that anosmia developed around 4.4 ± 1.9 (1–8) days after the diagnosis of infection.\cite{12}

The mean duration of anosmia in our patients was 7.8 (± 5) days. Anosmia/hyposmia resolved within 1 week in 65% of patients (n = 44) and within 2 weeks in 32% of the patients. However, hyposmia lasted beyond 2 weeks in 2 patients. The patients called back and informed us of the resolution of anosmia at 1 month. Lechien et al., observed the recovery of anosmia in 72.6% of their patient population within the first 8 days of the disease. The early olfactory recovery rate was 44.0%.\cite{18} Lee et al., also found the duration of anosmia to be 7 (± 4 days).\cite{17}

Klopfenstein et al., found out that the mean duration of anosmia was 8.9 (± 6.3 [1–21]) days, and 98% of patients recovered within 28 days. The duration was ≥7 days for 55% and ≥14 days for 20%, one patient had not recovered at the end of the follow-up (after 28 days).\cite{12}

Most studies have reported recovery of olfaction and taste without treatment. In our study, also the patients received no specific treatment for anosmia/hyposmia. General measures like steam inhalation (patients with rhinorrhea), oral paracetamol (in case of fever), multivitamin supplements, and vitamin C were prescribed to the patients as per our treatment protocol. In addition, patients should be reassured regarding the recovery of a sense of smell and taste. Lechien et al., described that no treatment was received by 70% of the patients with olfactory dysfunction; nasal (8.1%) and oral corticosteroids (2.5%) for anosmia and L-carnitine (1.4%) for gustatory dysfunction in few patients.\cite{4} Although administering steroids (both local application and systemic steroids) is a common practice for treating anosmia, intranasal steroids have not shown to have a positive effect on olfactory dysfunction, whereas significant improvement in olfaction has been observed with systemic steroids.\cite{19}

Patients with severe COVID-19 disease have been reported to have eosinopenia, raising the concern of its association with the disease severity.\cite{20,21} We found an absolute eosinophil count of <40/µL in 59 patients (29.5%) and an absolute eosinophil count of 0 in 17 patients (8.5%) although our patients were asymptomatic or mildly symptomatic.\cite{22}

Eosinopenia along with raised C-reactive protein may prove as a useful aid in triaging the suspected patients with COVID-19 from other patients in fever clinics with the same clinical presentation. Li et al. have described a high sensitivity of eosinopenia (74.7%) for predicting positive SARS-CoV-2 cases.\cite{23}

A study carried out by Andreozzi et al. in patients with SARS-CoV-2 and influenza A infection (total = 91) revealed a total eosinophil count of <50/µL in 69 patients and undetectable eosinophil count in 44 patients. Eosinopenia could be due to COVID-19 or flu. Severe eosinopenia should raise the possibility of COVID-19 if there is no flu.\cite{24}

However, eosinophil responses in COVID-19 infection may differ in patients receiving treatment for asthma and hypereosinophilic syndrome due to the possibility of drug-induced eosinopenia.\cite{25} More research is warranted to understand whether in patients with COVID-19 eosinopenia will progress into critical illness.

Limitations of our study

There are few limitations of our study such as it was a single center study and only mildly symptomatic/asymptomatic patients were enrolled. Sick and intubated patients were not enrolled as it was not feasible and ethically not allowed. Therefore, we do not know the incidence of anosmia in sick and intubated patients with COVID-19. All our patients recovered fully and none of them had persistent anosmia.

Conclusions

Olfactory and gustatory losses are common and sometimes the only findings in patient with COVID-19 and may be missed in the absence of other symptoms. These patients are less likely to go for COVID-19 testing and may spread the disease. Eosinophil count should be checked in an anosmic patient with a suspicion of COVID-19 infection. More objective tools need to be developed and used for early assessment and prompt diagnosis to control the spread of the disease. Whether a patient remains infective after the resolution of anosmia is a question for further study. Multicentric studies are warranted to establish the prevalence and characteristic features of olfactory dysfunction.

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Conflicts of interest
There are no conflicts of interest.

References

1. Guan W-J, Ni Z-Y, Hu Y, Liang W-H, Ou C-Q, He J-X, et al. Clinical characteristics of Coronavirus disease 2019 in China. N Engl J Med 2020;382:1708-20.
2. Novel Coronavirus (2019-nCoV) situation reports - World Health Organization (WHO) https://covid19.who.int/region/searo/country/in. [Last accessed 2020 Dec 08].
3. Bai Y, Yao L, Wei T, Tian F, Jin D-Y, Chen L, et al. Presumed asymptomatic carrier transmission of COVID-19. JAMA 2020;323:1406-7.
4. Lechien JR, Chiesa-Estomba CM, De Siati DR, Horoi M, Le Bon SD,
Rodriguez A, et al. Olfactory and gustatory dysfunctions as a clinical presentation of mild-to-moderate forms of the coronavirus disease (COVID-19): A multicenter European study. Eur Arch Otorhinolaryngol 2020;277:2251-61.

5. Hummel T, Landis BN, Hüttenerink K-B. Smell and taste disorders. GMS Curr Top Otorhinolaryngol Head Neck Surg 2011;10:Doc04.

6. Zhang Q, Shan KS, Abdollahi S, Nace T. Anosmia and ageusia as the only indicators of COVID-19. Cureus 2020;12:e7918.

7. Wu X, Cai Y, Huang X, Yu X, Zhao L, Wang F, et al. Co-infection with SARS-CoV-2 and influenza a virus in patient with pneumonia, China. Emerg Infect Dis 2020;26:1324-6.

8. American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS). Anosmia reporting tool. Published March 2020. Accessed April 20, 2020 https://www.entnet.org/content/reporting-tool-patients-anosmia-related-COVID-19.

9. Kaye R, Chang CWD, Kazahaya K, Brereton J, Denneny JC. COVID-19 Anosmia reporting tool: Initial findings. Otolaryngol Head Neck Surg 2020;163:132-4.

10. Abidi K, Belayachi J, Derras Y, Khayari ME, Dendane T, Madani N, et al. Eosinopenia, an early marker of increase mortality in critically ill medical patients. Intensive care Med 2011;37:1136-42.

11. Hornuss D, Lange B, Schröter N, Rieg S, Kern WV, Wagner D. Anosmia in COVID-19 patients. Clin Microbiol Infect 2020;26:1426-7.

12. Klopfenstein T, Kadiane-Oussou NJ, Toko L, Royer P-Y, Lepiller Q, Gendrin V, et al. Features of anosmia in COVID-19. Med Mal Infect 2020;50:436-9.

13. Vaira LA, Salzano G, Deiana G, De Riu G. Anosmia and ageusia: Common findings in COVID-19 patients. Laryngoscope 2020;130:1787.

14. Mao L, Jin H, Wang M, Hu Y, Chen S, He Q, et al. Neurologic manifestations of hospitalized patients with Coronavirus disease 2019 in Wuhan, China. JAMA Neurol 2020;77:683-90.

15. Benvenuto D, Giovanetti M, Ciccozzi A, Spoto S, Angeletti S, Ciccozzi M. The 2019- new coronavirus epidemic: Evidence for virus evolution. J Med Virol 2020;92:455-9.

16. Li W, Zhang C, Sui J, Kuhn JH, Moore MJ, Luo S, et al. Receptor and viral determinants of SAS-coronavirus adaptation to human ACE2. EMBO J 2005;24:1634-43.

17. Lee Y, Min F, Lee S, Kim SW. Prevalence and duration of acute loss of smell or taste in COVID-19 patients. J Korean Med Sci 2020;35:e174.

18. Baggeri SH, Asghari A, Farhadi M, Shamshiri AR, Kabir A, Kamrava SK, et al. Coincidence of COVID-19 epidemic and olfactory dysfunction outbreak in Iran. Med J Islam Repub Iran 2020;34:446-52.

19. Heilmann S, Huettenbrink KB, Hummel T. Local and systemic administration of corticosteroids in the treatment of olfactory loss. Am J Rhinol 2004;18:29-33.

20. Qian GQ, Yang NB, Ding F, Ma AHY, Wang ZY, Shen YF, et al. Epidemiologic and clinical characteristics of 91 hospitalized patients with COVID-19 in Zhejiang, China: A retrospective, multi-centre case series. QJM 2020;113:474-81.

21. Zhang JJ, Dong X, Cao YY, Yuan YD, Yang YB, Yan YQ, et al. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China. Allergy 2020;75:1730-41.

22. Chusid MJ. Eosinophils: Friends or foes? J Allergy Clin Immunol Pract 2018;6:1439-44.

23. Li Q, Ding X, Xia G, Chen H-G, Chen F, Geng Z, et al. Eosinopenia and elevated CRP facilitate triage of COVID-19 patients in fever clinic: A retrospective case-control study. EClinicalMedicine 2020;23:100375.

24. Andreozzi F, Hermans C, Yombi JC. Eosinopenia and COVID-19 patients: So specific? EClinicalMedicine 2020;24:100439.

25. Lindesly AW, Schwartz JT, Rothenberg ME. Eosinophil responses during COVID-19 infections and Coronavirus vaccination. J Allergy Clin Immunol 2020;146:1-7.