

Self-reported olfactory and taste disorders in SARS-CoV-2 patients: a cross-sectional study

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Dear Editor

We read with interest the paper by Wang et al [1] describing the clinical features of 69 patients with Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) infection in Wuhan, China. The authors provide a detailed description of major signs and symptoms of overt disease [2, 3], but fail to give an account of minor symptoms that may be present at earlier stage of the infection.

After some patients admitted for SARS-Cov2 disease at the Infectious Disease Department of L. Sacco Hospital in Milan, Italy, complained of olfactory and taste disorders (OTDs), we performed a cross-sectional survey of the prevalence of these alterations in the context of SARS-CoV-2 infection. On 19 March 2020, a simple questionnaire including questions about the presence or absence of OTDs, their type and time of onset respect to hospitalization was submitted through verbal interview to all SARS-CoV-2-positive hospitalized patients who were able to give an informed consent. Of 88 hospitalized patients, 59 were able to be interviewed (29 non respondent of whom 4 dementia, 2 linguistic barrier and 23 on non-invasive ventilation) (table1). Of them, 20 (33.9%) reported at least one taste or olfactory disorder and 11 (18.6%) both. Twelve patients (20.3%) presented the symptoms before the hospital admission, whereas 8 (13.5%) experienced the symptoms during the hospital stay. Taste alterations were more frequently (91%) before hospitalization, whereas after hospitalization taste and olfactory alteration appeared with equal frequency. Females reported OTDs more frequently than males [10/19 (52.6%) *versus* 10/40 (25%), $P=0.036$]. Moreover, patients with at least one OTDs were younger than those without [median 56 years (Inter Quartile Range (IQR) 47-60) *versus* 66 (IQR 52-77), $P=0.035$]. All patients reported the persistence of OTDs at the time of the interview.

Olfactory and taste disorders are well known to be related with a wide range of viral infections [4, 5]. SARS-CoV have demonstrated in mice model a transneuronal penetration through the olfactory bulb [6]. Moreover, angiotensin converting enzyme 2 receptor, which is used by SARS-CoV-2 to bind and penetrate into the cell, is widely expressed on the epithelial cells of the mucosal of oral

cavity [7]. These evidences could explain the underlying pathogenetic mechanism of taste and olfactory disorders in SARS-CoV-2 infection.

Due to limitations related to the diffusivity of the disease and emergency contingencies it was impossible to perform a more structured questionnaire associated with validated tests (i.e. Pennsylvania smell identification test) [8]. However, our survey shows that OTDs are fairly frequent in patients with SARS-Cov2 infection and may precede the onset of full-blown clinical disease. In a pandemic context further investigations on non-hospitalized infected patients are required to ascertain if these symptoms, albeit unspecific, may represent a clinical screening tool to orientate testing of pauci-symptomatic individuals.

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Conflict of interest

AG received consultancy fees from Mylan and non-financial support from Gilead. SR received grants, fees for speaker's bureau, advisory boards and CME activities from BMS, ViiV, MSD, AbbVie, Gilead, Janssen. CG received grants, fees for speaker's bureau, advisory boards and CME activities from BMS, ViiV, MSD, AbbVie, Gilead, Janssen. MG received grants, fees for speaker's bureau, advisory boards and CME activities from BMS, ViiV, MSD, AbbVie, Gilead, Janssen and Roche. GR received grants, fees for speaker's bureau, advisory boards and CME activities from BMS, ViiV, MSD, AbbVie, Gilead, Janssen and Roche. SA received support for research activities from Pfizer and Merck Sharp & Dome. LP, LO, MS, DB, FC, ALR has nothing to declare.

References

1. Wang Z, Yang B, Li Q, Wen L, Zhang R. Clinical Features of 69 Cases with Coronavirus Disease 2019 in Wuhan, China. *Clin Infect Dis.* **2020** ; pii: ciaa272. doi: 10.1093/cid/ciaa272. [Epub ahead of print]
2. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China [published correction appears in *Lancet.* 2020 Jan 30;:]. *Lancet.* **2020** ; 395(10223):497–506.
3. The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19)—China, 2020. *China CDC Weekly.* **2020** ; 2:113-22.
4. Hummel T, Landis BN, Hüttenbrink KB. Smell and taste disorders. *GMS Curr Top Otorhinolaryngol Head Neck Surg.* **2011** ; 10:Doc04.
5. van Riel D, Verdijk R, Kuiken T. The olfactory nerve: a shortcut for influenza and other viral diseases into the central nervous system. *J Pathol.* **2015** ; 235(2):277-87.
6. Netland J, Meyerholz DK, Moore S, Cassell M, Perlman S. Severe acute respiratory syndrome coronavirus infection causes neuronal death in the absence of encephalitis in mice transgenic for human ACE2. *J Virol.* **2008** ; 82(15):7264–7275.
7. Xu H, Zhong L, Deng J, et al. High expression of ACE2 receptor of 2019-nCoV on the epithelial cells of oral mucosa. *Int J Oral Sci* ; **2020**;12(1):8.
8. Doty RL, Shaman P, Dann M. Development of the University of Pennsylvania Smell Identification Test: a standardized microencapsulated test of olfactory function. *Physiol Behav.* **1984** ; 32(3):489-502.

Table 1 Characteristic of patients with SARS-CoV-2 infection assessed for taste and olfactory disorders.

Patients	Total 59
Age (years), median (IQR)	60 (50-74)
Male, n (%)	40 (67.8)
Days from illness onset to hospital admission, median (IQR)	6 (4-10)
Days from illness onset to the interview, median (IQR)	15 (10-21)
Pneumonia at hospital admission, n (%)	43 (72.8)
Symptoms at hospital admission	
Fever, n (%)	43 (72.8)
Cough, n (%)	22 (37.3)
Dyspnoea, n (%)	15 (25.4)
Sore throat, n (%)	1 (1.7)
Arthralgia, n (%)	3 (5.1)
Coryza, n (%)	1 (1.7)
Headache, n (%)	2 (3.4)
Asthenia, n (%)	1 (1.7)
Abdominal symptoms, n (%)	5 (8.5)
No taste or olfactory disorders, n (%)	39 (66)
With olfactory and/or taste disorders, (%)	20 (33.9)
Taste disorders only, n (%)	
Dysgeusia	5 (8.5)
Ageusia	1 (1.7)
Olfactory disorders only, n (%)	
Hyposmia	3 (5.1)
Anosmia	0 (0)
Mixed taste and olfactory disorders, n (%)	
Dysgeusia and hyposmia	2 (3.4)
Dysgeusia and anosmia,	2 (3.4)
Ageusia and hyposmia	2 (3.4)
Ageusia and anosmia	5 (8.5)

List of abbreviations: severe acute respiratory syndrome coronavirus 2, SARS-CoV-2; n, number; IQR, Inter Quartile Range.