

IMMEDIATE RESTORATION OF OLFACTORY FUNCTION FOLLOWING COVID-19 INFECTION IN A PATIENT WITH ANOSMIA DUE TO FUNCTIONAL ENDOSCOPIC SINUS SURGERY COMPLICATION – A CASE REPORT



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ABSTRACT The authors present a case of a 50-year-old female patient with a history of chronic rhinosinusitis, for which she underwent functional endoscopic sinus surgery. This significantly improved respiration, but left her with a self-reported complete loss of olfactory function. Six years later, still with unresolved anosmia, she tested positive for COVID-19 a few days after she had been vaccinated with the first dose of Pfizer BioNtech COVID-19 vaccine (Pfizer, New York, NY, US). The disease course was uneventful, and she remained asymptomatic. One day after the diagnosis of COVID-19 infection, she reported a sudden complete return of her olfactory function, which has remained stable until now, 3 months after her recovery from COVID-19 infection. The physiologic dynamics underlying this event are a mystery.

CONFLICT OF INTEREST AND SOURCE OF FUNDING STATEMENT

We declare that there is no actual or potential conflict of interest including any financial, personal, or other relationships with other people or organizations that could inappropriately bias this work.

INTRODUCTION

One of the known complications of functional endoscopic sinus surgery (FESS) for the treatment of chronic rhinosinusitis is the deterioration of olfaction (anosmia)^{1,2}.

Sudden smell and taste impairments among COVID-19 patients, even in an asymptomatic phase, are ubiquitous, having been reported in up to 85-90% of cases, and included on the list of significant clinical symptoms of COVID-19^{1,2}.

A major reduction in both smell and taste has been reported without significant differences in laboratory test results using The University of Pennsylvania Smell Identification Test (UPSIT), a well-validated 40-odorant test, or in clinical assessment using a subjective questionnaire in participants of a multilingual survey³.

The aim of this case-report is to present a heretofore unreported side effect of COVID-19 infection, which led to immediate and full recovery of olfactory function in a patient who had sustained complete anosmia as a complication of FESS for chronic rhinosinusitis.

CLINICAL PRESENTATION

An otherwise healthy 50-year-old female patient diagnosed with chronic rhinosinusitis had undergone a FESS procedure 6 years ago. According to her medical records, her main preoperative complaint had been progressive deterioration in her previously normal ability to inhale through her nose.

The FESS procedure was performed under general anaesthesia. Nasal preparation with a topical lidocaine gel followed by injection of lidocaine with epinephrine into the lateral nasal wall at the superior aspect of the uncinate process was performed. The middle turbinate was

carefully pushed aside to expose the uncinate process, and a backbiting forceps, along with a microdebrider, was used to take down the medial wall of the ostiomeatal complex and the maxillary sinus.

The maxillary sinus cavity was inspected with a 30- and 70-degree endoscope, and all the inflamed sinus mucosa was selectively removed. The sinus cavity was then irrigated with saline solution, after which the bulla ethmoidalis was opened inferiorly and medially to expose the anterior and middle ethmoidal air cells.

The inflamed sinus mucosa was selectively removed using a variety of forceps, and the FESS process was completed. Following the surgical procedure, the patient reported a significant improvement in her ability to breathe, but sustained a complete loss of olfactory function as a complication of the surgery.

Six years following that surgery, and with no change in the anosmia, she became infected and tested positively to the COVID-19 virus only a few days after she had been vaccinated with the first dose of Pfizer BioNtech COVID-19 vaccine (Pfizer, New York, NY, US).

The disease remained asymptomatic. However, on the second day after the diagnosis of COVID-19 infection, she reported the complete return of her olfactory function, which has remained stable until the time of this report, 3 months following her recovery.

DISCUSSION

FESS is considered the treatment of choice for chronic sinusitis when non-surgical therapies fail^{4,5}. Olfactory impairment is one of the main complaints in patients with chronic rhinosinusitis. Our patient underwent the FESS procedure due to chronic sinusitis without olfactory impairment. A high percentage (53%) of patients with chronic rhinosinusitis and olfactory impairment who undergo endoscopic sinus surgery sustain improvement of olfaction up to 5 years after surgery, indicating that this surgical intervention, in conjunction with continued topical steroid treatment, leads to long-term improvement in the sense of smell².

Complication rates ranging from 4% to 21% have been associated with FESS^{1,2,4,5}.

Complications of FESS are classified as major or minor according to the degree of morbidity, and treatment needed. Major complications include: retro-orbital haemorrhage, brain abscess, cerebrospinal fluid leak/meningitis, blindness/diplopia, severe haemorrhage, and symptomatic lacrimal duct obstruction requiring surgical correction. Minor complications include: periorbital oedema or ecchymosis, epistaxis, bronchospasm, formation of symptomatic adhesion between the middle turbinate and the lateral nasal wall, dental or lip pain or numbness, and loss of smell. Between 6% and 9% of patients who had normal olfactory function preoperatively developed impaired olfaction after FESS^{1,6}.

The olfactory neuroepithelium encompasses the superior nasal septum, the cribriform plate region, and the superior turbinate, comprising a surface area from 2 cm² to 10 cm² in males. The region is covered with mucous produced primarily by the submucosal Bowman's glands². Several mechanisms of olfactory injury resulting from nasal surgery have been proposed, among them direct trauma to the olfactory epithelium, traction of the olfactory nerve due to cribriform plate motion, vascular compromise of the olfactory neuroepithelium during surgery, drug effects due to pharmacological agents used in the perioperative period, atrophic rhinitis due to overenthusiastic removal of intranasal tissue, anatomical alterations after septoplasty, and sinus surgery with obstruction of odorant access².

Many cases of anosmia are believed to be secondary to direct injury from neurotrophic viral infection, such as herpes viruses, influenza virus, and hepatitis viruses².

Finally, part of the olfactory epithelium can be invaded and replaced by respiratory epithelium,

as is usually observed in post-viral olfactory disorders, thereby reducing the extent of recovery from anosmia².

A sudden loss of sense of smell and taste can be found even in the absence of the other “usual symptoms” of COVID-19 infection, i.e., fever, cough, and respiratory sequelae. A major reduction in smell and taste has been reported among participants tested with The University of Pennsylvania Smell Identification Test, as well as those assessed by a multilingual questionnaire³.

Olfaction involves the detection of volatile chemical compounds present in the environment or in the oral cavity (retronasal olfaction). Odorant molecules can also be detected by the complex self-regenerating olfactory epithelium (OE), located in the superior parts of the nasal cavity below the cribriform plate. The OE is composed of several cell types, including millions of olfactory sensory neurons (OSNs) in addition to microvillar, sustentacular, and basal cells, which are multipotent stem cells⁷.

OSNs are bipolar neurons that extend dendrites over the mucosa surface with axons passing through the cribriform plate to form synapses within glomeruli in the olfactory bulbs. Odorant detection is mediated by a large multigene family that codes for olfactory receptors (ORs), which are G protein-coupled receptors expressed within the membrane of OSN dendrites. Olfactory information is then transmitted toward a great number of higher brain regions, from the piriform cortex, amygdala, olfactory tubercle, and entorhinal cortex to other regions, including the orbitofrontal cortex, hypothalamus, thalamus, and hippocampus⁸.

Overall, the majority of data indicates that the main targets of SARS-CoV-2 in the olfactory epithelium are sustentacular cells. Following infection, most of the olfactory epithelium seems to be lost through desquamation, as indicated by the presence of cellular debris in the lumen of the nasal cavity reported in numerous studies^{8,9}.

This desquamation will remove part of the OSN population, but it could also be accompanied by a loss of the dendritic layer of OSN, where olfactory transduction occurs. These cells are essential to maintain the integrity of the olfactory epithelium, and they are tightly wrapped around olfactory sensory neurons⁹. These two consequences of the SARS-CoV-2 infection could explain the anosmia observed in COVID-19 patients¹⁰.

However, more research is needed to discover the potential mechanism behind the restoration of olfactory function following COVID-19 infection. The authors can only assume that the neurological stimulus affects the regeneration of damaged neurons that revive the sense of olfaction through axons at the cribriform plate. Moreover, we can only speculate as to whether our patient healed spontaneously 6 years after having lost her olfactory function, or whether the COVID-19 infection actually induced her full recovery. Nonetheless, this unusual finding might be a useful contribution to the attempt to try to understand the mechanism behind the healing of lost olfactory function.

CONCLUSIONS

Both the mechanism that causes anosmia in COVID-19 patients and that behind the full olfactory recovery immediately following SARS-CoV-2 infection in the anosmic patient described in this report remain a medical enigma.

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