Development of New-Onset Chronic Rhinosinusitis After COVID-19 Infection

Justin Lau[1]; David Hoying, MD[2]; David Kaelber, MD, PhD[1,3] Mohamad Chaaban, MD, MBA[4]
[1]Case Western Reserve University School of Medicine , [2]University of Nevada Las Vegas Department of Otolaryngology , [3]Metrohealth System , [4]Cleveland Clinic Department of Otolaryngology

Abstract

Introduction
Several studies have looked at the interplay between COVID19 in patients with diagnosed chronic rhinosinusitis (CRS), but the risk of developing CRS after contracting COVID19 has not been studied. This study seeks to evaluate the risk of new onset CRS after having COVID19 using a large national database.

Methods
TriNetX was queried for three cohorts between January 1st 2020 until December 31st 2023. The first cohort consisted of patients who only had an outpatient visit with a COVID diagnosis (COVID+ O). The second cohort consisted of patients hospitalized with COVID (COVID+ H). Finally, the control cohort (COVID-) was patients who had an outpatient visit without a COVID diagnosis. Cohorts were then compared with propensity matching for demographics (age, sex) and with and without matching for allergic rhinitis, asthma, and smoking. Comparisons with COVID+ H also included matching with pneumonia. The incidence of CRS and CRS with nasal polyps (NP) within 90 days of the index event were recorded and reported as odds ratios.

Results
The COVID+ O, COVID+ H, and COVID- cohorts contained 2527372, 2127637, and 10708782 patients respectively. Compared to COVID-, COVID+ O had an increased risk for developing CRS (OR: 2.88, 95% CI: 2.77, 2.99) and NP (OR: 2.25, 95% CI: 1.99, 2.55). For the COVID+ H group, there was only increased risk for CRS (OR: 1.69, 95% CI: 1.54, 1.68). When comparing COVID+ H and COVID+ O, the COVID+ H cohort had a decreased risk for developing CRS (OR: 0.59, 95% CI: 0.57, 0.62) and NP (OR: 0.54, 95% CI: 0.47, 0.62).

Conclusion
Patients with COVID19 had a higher risk for developing CRS compared to a control population. This may be due to COVID+ patients having more physician visits following their diagnosis. Interestingly, hospitalized COVID patients had a lower risk of new-onset CRS than non-hospitalized COVID patients. Further study looking at differences between these two populations may help elucidate the reason non-hospitalized patients are at higher risk for CRS.

Introduction

- COVID-19 is known to infect nasal and bronchial epithelial cells resulting in a viral inflammatory response[1]
- Several studies looking at the relationship between COVID-19 and chronic rhinosinusitis (CRS) have focused on CRS as a risk factor for COVID-19 infection and severity[2-5]
- Reports have suggested an increase in invasive fungal rhinosinusitis associated with COVID-19 infection[6]
- No studies have looked at the development of CRS, either with and without nasal polyps, in the setting of recent COVID-19 infection

Methods and Materials

- Cohorts were queried using TriNetX for patients ≥18 years old with or without COVID diagnoses in the outpatient or hospital settings (COVID+ O, COVID+ H, COVID-) between Jan 2020 and Dec 2023
- Propensity matching for demographics was performed for all comparisons
- Secondary matching with and without allergic rhinitis, asthma, and smoking performed, hospitalized COVID+ cohort was matched for pneumonia to account for infection severity
- Incidence of CRS and CRS with nasal polyps within 90 days of index event recorded and reported as odds ratios

Results

- COVID+ O cohort=2527372 patients, COVID+ H cohort=2127637 patients, COVID- cohort=10708782 patients
- COVID+ outpatient cohort was more likely to develop both chronic rhinosinusitis and nasal polyps compared to control
- COVID+ hospitalized cohort was more likely to develop chronic rhinosinusitis only compared to control
- COVID+ hospitalized cohort was less likely to develop chronic rhinosinusitis or nasal polyps compared to outpatient cohort

Discussion

- Chronic rhinosinusitis is a relatively common disease affecting 5-12% of the US population[7]
- COVID+ patients in both the outpatient and hospitalized settings have higher risk of developing CRS compared to COVID- patients
- Our study suggests that COVID infection may alter the inflammatory response of the nasal mucosa making patients more susceptible to CRS after recent infection
- However, patients with COVID may be more likely to seek medical attention following diagnosis which may explain the higher rates of CRS diagnosis
- Interestingly, admitted patients with COVID had lower rates of CRS diagnosis compared to outpatient – further study on the differences between these populations may better characterize the risk difference

Table 1. Rates of New-Onset Chronic Rhinosinusitis in Patients with COVID-19 Infection
*=matching for allergic rhinitis, asthma, smoking; **=additional matching for pneumonia

	COVID+ O vs COVID- (95% CI)	COVID+ O vs COVID-* (95% CI)	COVID+ H vs COVID- (95% CI)	COVID+ H vs COVID-* (95% CI)	COVID+ H vs COVID-** (95% CI)	COVID+ H vs COVID+ O (95% CI)	COVID+ H vs COVID+ O* (95% CI)	COVID+ H vs COVID+ O (95% CI)
Chronic rhinosinusitis	2.88 (2.77, 2.99)	2.60 (2.51, 2.70)	1.67 (1.62, 1.76)	1.61 (1.54, 1.68)	1.60 (1.53, 1.67)	0.59 (0.57, 0.62)	0.62 (0.60, 0.64)	0.60 (0.58, 0.62)
Nasal polyps	2.25 (1.99, 2.55)	1.88 (1.67, 2.11)	1.11 (0.97, 1.28)	1.06 (0.92, 1.22)	1.09 (0.95, 1.26)	0.54 (0.47, 0.62)	0.57 (0.50, 0.65)	0.55 (0.48, 0.63)

Contact

Justin Lau
Case Western Reserve University School of Medicine
9501 Euclid Ave, Cleveland OH 44106
jgl82@case.edu
(510) 358-7192

References

1. Wiersinga WJ, Rhodes A, Cheng AC, Peacock SJ, Prescott HC. Pathophysiology, Transmission, Diagnosis, and Treatment of Coronavirus Disease 2019 (COVID-19): A Review. *JAMA*. 2020;324(8):782-793. doi:10.1001/jama.2020.12839
2. Wang H, Song J, Pan L, et al. The characterization of chronic rhinosinusitis in hospitalized patients with COVID-19. *J Allergy Clin Immunol Pract*. 2020;8(10):3597-3599.e2. doi:10.1016/j.jaip.2020.09.013
3. Marin C, Hummel T, Liu Z, Mullol J. Chronic Rhinosinusitis and COVID-19. *J Allergy Clin Immunol Pract*. 2022;10(6):1423-1432. doi:10.1016/j.jaip.2022.03.003
4. Reda A, Lashin BI, Alaaraj MM, et al. The impact of chronic rhinosinusitis on COVID-19 risk and outcomes: A systematic review and meta-analysis. *Front Immunol*. 2023;14:1139031. Published 2023 Mar 29. doi:10.3389/fimmu.2023.1139031
5. Sbeih F, Gutierrez J, Saieed G, Chaaban MR. Chronic rhinosinusitis is associated with increased risk of COVID-19 hospitalization. *Am J Otolaryngol*. 2022;43(4):103469. doi:10.1016/j.amjoto.2022.103469
6. Barbara M, Elzayat S, Lotfy A, et al. Invasive fungal rhinosinusitis associated with COVID-19: Course changes and prognosis predictors. *Acta Otorrinolaringol Esp (Engl Ed)*. 2023;74(4):243-252. doi:10.1016/j.otoeng.2022.11.010
7. Dietz de Loos D, Lourijsen ES, Wildeman MAM, et al. Prevalence of chronic rhinosinusitis in the general population based on sinus radiology and symptomatology. *J Allergy Clin Immunol*. 2019;143(3):1207-1214. doi:10.1016/j.jaci.2018.12.986