

SARS-CoV-2 Testing of the Maxillary Sinus Immediately after COVID-19 Recovery

Takahiro Maeba, MD, PhD*

Haruka Watanabe, MD†

Naoki Wakuta, MD, PhD‡

Summary: We report the case of a 19-year-old woman with left orbital floor fracture after a motorcycle accident. She presented with headache and diplopia; computed tomography showed herniation of the inferior rectus muscle into the maxillary sinus with orbital floor fracture. She was admitted for observation of her concussion and tested positive for coronavirus disease 2019 (COVID-19) half a day after admission. Her COVID-19 symptoms were mild; the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) antigen quantification test was below the standard value on the 10th day of hospitalization, and her isolation was lifted. She had diplopia with vertical eye motion disorder and underwent reconstruction of her orbital floor fracture on the 11th day. Although the orbital floor was connected to the maxillary sinus due to the orbital floor fracture, the presence and the viral load of SARS-CoV-2 in the maxillary sinus were unknown. The surgeons performed the operation while wearing N95 masks. A SARS-CoV-2 antigen quantification test and PCR test were performed on a sample from the maxillary sinus mucosa obtained through the orbital floor fracture before reconstruction of orbital floor with a titanium mesh implant; both were negative. To our knowledge, this is the first report of SARS-CoV-2 testing from the maxillary sinus immediately after COVID-19 recovery. We believe that the risk of SARS-CoV-2 infection from the maxillary sinus is small if the antigen test from the nasopharynx is negative. (*Plast Reconstr Surg Glob Open* 2023; 11:e4959; doi: [10.1097/GOX.0000000000004959](https://doi.org/10.1097/GOX.0000000000004959); Published online 26 April 2023.)

Although coronavirus disease 2019 (COVID-19) has gradually become less severe, the pandemic continues. Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the virus that causes COVID-19, is common in the upper respiratory tract, but it is not clear whether it is present in the maxillary sinus. We report a case of SARS-CoV-2 testing from the maxillary sinus during orbital floor fracture reconstruction immediately after COVID-19 recovery.

CASE REPORT

A 19-year-old woman was transported by ambulance to our emergency department after a motorcycle accident. She

presented with a headache and diplopia with vertical eye movements. Computed tomography (CT) revealed left orbital floor fracture and herniation of the inferior rectus muscle into the left maxillary sinus, but no other injuries were noted. (See figure, Supplemental Digital Content 1, which displays the computed tomography showing an orbital floor fracture and deviation of the inferior rectus muscle into the maxillary sinus. <http://links.lww.com/PRSGO/C520>.)

A SARS-CoV-2 antigen quantification test (antigen test) and SARS-CoV-2 polymerase chain reaction test (PCR) were performed from nasopharyngeal swabs. The PCR results were negative, but the antigen test results were slightly above the positive threshold (Table 1). She was admitted for observation of her concussion to an isolation ward owing to the possibility of very early SARS-CoV-2 infection.

Half a day after admission, the antigen test result was strongly positive, and the PCR result was positive; therefore, the date of COVID-19 onset was considered the admission day (Table 1). Her only COVID-19 symptoms

From the *Department of Plastic Surgery, Japanese Red Cross Fukuoka Hospital, Fukuoka, Japan; †Department of Infectious Disease, Japanese Red Cross Fukuoka Hospital, Fukuoka, Japan; and ‡Department of Neurosurgery, Japanese Red Cross Fukuoka Hospital, Fukuoka, Japan.

Received for publication January 26, 2023; accepted March 6, 2023.

Copyright © 2023 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the [Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 \(CCBY-NC-ND\)](https://creativecommons.org/licenses/by-nc-nd/4.0/), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: [10.1097/GOX.0000000000004959](https://doi.org/10.1097/GOX.0000000000004959)

Disclosure statements are at the end of this article, following the correspondence information.

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.

Table 1. Dynamics of SARS-CoV-2 Antigen Quantification and PCR Tests from the Nasopharynx and Maxillary Sinus

Date	Emergency Room		10th	11th (Surgery)
	Nasopharynx	Nasopharynx		
Specimen	Nasopharynx	Nasopharynx	Nasopharynx	Maxillary sinus
Antigen (pg/mL)	11.98	>5000	2.38	0.07
PCR (cycles)	>40	36.2		>40

The SARS-CoV-2 antigen quantification test by CLEIA (Lumipulse SARS-CoV-2 Ag, Fujirebio Inc.) considers over 10 pg/mL to be positive and less than 1 pg/mL to be negative. A SARS-CoV-2 antigen quantification test result less than 10 pg/mL is the criterion for lifting the quarantine. A SARS-CoV-2 PCR test is considered positive if reverse transcription-PCR (SARS-CoV-2 detection kit, MIZUHO MEDY Co., Ltd.) detects SARS-CoV-2 in less than 40 cycles.

were high fever and sore throat, which lasted for 7 days. In accordance with the criteria of the omicron epidemic in Japan, her isolation was lifted after the antigen test on the 10th day of hospitalization was below the threshold for lifting the quarantine (Table 1). Immediately after her isolation was lifted, a Hess screen test and forced duction test confirmed she still had diplopia and left ocular elevation disorder.

The day after isolation was lifted, we performed reconstruction for her orbital floor fracture by subciliary incision under general anesthesia. As the presence of SARS-CoV-2 in the maxillary sinus was unknown, we operated while wearing N95 masks. When we repositioned the herniated orbital tissue back into orbit, we swabbed for SARS-CoV-2 specimens from the maxillary sinus mucosa through the orbital floor fracture (Fig. 1). We then reconstructed the orbital floor using a titanium mesh implant. Both the antigen test and PCR of the maxillary sinus swab tests were negative (Table 1).

Six months postoperatively, CT showed the orbital floor reconstructed with titanium mesh and the repositioned inferior rectus muscle. (See figure, Supplemental Digital Content 2, which displays computed tomography 6 months after surgery showing that the orbital floor has been reconstructed using titanium mesh and the inferior rectus muscle was repositioned. <http://links.lww.com/PRSGO/C521>.)

The patient’s ocular motility was normal on the Hess chart and a little upward diplopia remained, but she felt no interference in her daily life.

DISCUSSION

The COVID-19 pandemic has significantly impacted healthcare services around the world. As the omicron strains are more often asymptomatic to mild than they were in the past, SARS-CoV-2 infections are often only identified during an emergency room visit or after admission. We diagnose the infection using both antigen test and PCR; however, in the present case, SARS-CoV-2 infection was not confirmed until half a day after admission. At that time in Japan, omicron strains warranted asymptomatic individuals or those with mild symptoms to stay home for 10 days. Our patient had a mild case of COVID-19 but



Fig. 1. An intraoperative image showing a swab being inserted into the maxillary sinus mucosa through the orbital floor fracture to test for SARS-CoV-2.

required observation for concussion. As such, she was admitted to the COVID-19 ward for 10 days of isolation.

Surgical repair is recommended within 2 weeks of orbital soft tissue entrapment on CT and diplopia with a positive forced duction test.¹ CT showed herniation of the inferior rectus muscle into the maxillary sinus through the orbital floor fracture, and our patient still had diplopia with upward vision and a positive forced duction test on day 10 postinjury, when the isolation was lifted; thus, we performed orbital floor reconstruction on day 11. The orbital floor is reconstructed with autogenous bone, absorbable prostheses, or titanium plates, but the choice is still debated.¹ As our patient did not want autogenous bone grafting, we reconstructed the orbital floor using a titanium mesh implant.

SARS-CoV-2 is known to bind to receptors of angiotensin-converting enzyme 2 and transmembrane protease serine-2,² and oral, nasopharyngeal, and maxillary sinus mucosae express both.³ As head and neck operations are considered high risk owing to the exposure of the airway and mucosal surfaces and the possibility of aerosol generation, surgery in nonurgent cases should be performed after COVID-19 recovery.⁴ The orbital floor was connected to the maxillary sinus due to the orbital floor fracture. One report stated that SARS-CoV-2 may be present in the maxillary sinus,⁵ but the viral load in the maxillary sinus was unknown. Because it is known that the viral load of SARS-CoV-2 varies by site and timing,⁶ we considered the possibility of high viral load in the maxillary sinus for a long period even after COVID-19 recovery. We performed surgery the day after antigen test results from the nasopharyngeal mucosa were negative, and the intraoperative antigen test and PCR from the maxillary sinus mucosa were

both negative. In this case, SARS-CoV-2 was detected at 0.07 pg/mL, but this could be due to contamination from aerosols or other sources. The virus was considered absent in the maxillary sinus the day after recovery from COVID-19. However, if surgery had been performed before the antigen test results from the nasopharynx were negative, antigen test of the maxillary sinus might have been positive to the same degree as that of the nasopharynx.

As chronic rhinosinusitis may be associated with a risk of prolonged viral shedding of SARS-CoV-2,⁷ the presence of maxillary sinusitis may result in high viral load of SARS-CoV-2 in the maxillary sinus.⁷ In the case of a patient with maxillary sinusitis and a history of COVID-19, the timing of surgery and appropriate precautions should be considered even if antigen test results from the nasopharynx are negative.

Although this was only one case, it shows that if antigen test results from the nasopharynx are negative, the risk of SARS-CoV-2 infection from the maxillary sinus is small and that surgery of the maxillary sinus can be performed safely.

Takahiro Maeba, MD, PhD

Department of Plastic Surgery
Japanese Red Cross Fukuoka Hospital
3-1-1 Ogusu, Minami-ku
Fukuoka 816-8555
Japan
E-mail: tmaeba@hotmail.com

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

ACKNOWLEDGMENTS

The authors thank Mr. Masanobu Mitsuya (Laboratory department, Japanese Red Cross Fukuoka Hospital) for technical advice regarding the SARS-CoV-2 antigen quantification and PCR tests.

FUNDING

No funding was received for this publication.

PATIENT CONSENT

The patient provided written consent for the use of her image.

REFERENCES

1. Gart MS, Gosain AK. Evidence-based medicine: orbital floor fractures. *Plast Reconstr Surg.* 2014;134:1345–1355.
2. Shang J, Wan Y, Luo C, et al. Cell entry mechanisms of SARS-CoV-2. *Proc Natl Acad Sci USA.* 2020;117:11727–11734.
3. Lechien JR, Radulesco T, Calvo-Henriquez C, et al. ACE2 & TMPRSS2 expressions in head & neck tissues: a systematic review. *Head Neck Pathol.* 2021;15:225–235.
4. Givi B, Schiff BA, Chinn SB, et al. Safety recommendations for evaluation and surgery of the head and neck during the COVID-19 pandemic. *JAMA Otolaryngol Head Neck Surg.* 2014;146:579–584.
5. Sarode SC, Sarode GS, Sengupta N, et al. Viral cytopathic effect in maxillary sinus epithelium and SARS-CoV-2: pitfalls in diagnostic characterization. *J Oral Biol Craniofac Res.* 2022;12:437–438.
6. Sethuraman N, Jeremiah SS, Ryo A. Interpreting diagnostic tests for SARS-CoV-2. *JAMA.* 2020;323:2249–2251.
7. Recalde-Zamacona B, Tomás-Velázquez A, Campo A, et al. Chronic rhinosinusitis is associated with prolonged SARS-CoV-2 RNA shedding in upper respiratory tract samples: a case-control study. *J Intern Med.* 2021;289:921–925.