Literature regarding SARS-CoV-2 sampling complications is scarce. Breaking of the swab tip has resulted in a foreign body in the nasal cavity,1 the esophagus2 and, after sampling through tracheostomy, the bronchus.3 A case of test-related cerebrospinal fluid leak, probably owing to preexisting encephalocele, has been reported.4

Sampling should always be performed bearing in mind the anatomical structures of the nasal cavity and its surroundings to ensure safe sampling and correct results.5,6 Force should never be used, especially in patients with known prior operations of the nose or skull base. The sampling swab should be directed along the nasal floor, not too laterally nor too cranially, until resistance is encountered (Figure).6

The retrospective setting is a limitation of this study. It should be noted that Finland has a national public health service. Of the Helsinki University Hospital’s catchment population (1.6 million), all severe acute otolaryngology problems are treated solely in our 1 ED. Patients presenting with minor complications may have been treated at other facilities, but we did not have access to this information. Furthermore, no private otolaryngologist offices have been open for patients with suspected COVID-19. Nevertheless, this study is an apt representation of patients with SARS-CoV-2 nasopharyngeal swab test complications in a large tertiary care referral center.

Based on the results, the risk for a severe complication requiring specialist-level care after SARS-CoV-2 nasopharyngeal swab testing is extremely low. Nonetheless, complications involve anatomically challenging locations and may be life threatening. To avoid complications, correct sampling techniques are crucial.

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Table. Treatment and Sequelae of 8 Patients Treated for Complications After SARS-CoV-2 Nasopharyngeal Swab Test (continued)

<table>
<thead>
<tr>
<th>Clinical event</th>
<th>Specific occurrence</th>
<th>Measure of occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical (general anesthesia)</td>
<td>Anterior ethmoidal artery ligation</td>
<td>1 0 0 0</td>
</tr>
<tr>
<td>Endovascular procedures</td>
<td>Sphenopalatine artery embolization</td>
<td>0 0 1 0</td>
</tr>
<tr>
<td>Medication</td>
<td>Local hemostatic</td>
<td>0 3 1 1</td>
</tr>
<tr>
<td></td>
<td>Systemic antibiotics</td>
<td>Yes Yes Yes 0</td>
</tr>
<tr>
<td></td>
<td>Local antibiotics</td>
<td>0 Yes 0 0</td>
</tr>
<tr>
<td></td>
<td>Iron supplements (oral or intravenous)</td>
<td>Yes Yes Yes No</td>
</tr>
<tr>
<td>Blood transfusion</td>
<td>Red blood cells, 49 g Hb/unit</td>
<td>6 2 1 0</td>
</tr>
<tr>
<td>Complication</td>
<td>Local infection</td>
<td>Yes Yes Yes No</td>
</tr>
<tr>
<td></td>
<td>Septum perforation, scarring</td>
<td>0 1 0 0</td>
</tr>
</tbody>
</table>

Abbreviations: Hb, hemoglobin; NA, not applicable.

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Author Contributions: Dr Lamminmäki had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Concept and design: All authors.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: All authors.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: All authors.
 Administrative, technical, or material support: All authors.
Supervision: Lamminmäki.
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Preliminary Analysis of Association Between COVID-19 Vaccination and Sudden Hearing Loss Using US Centers for Disease Control and Prevention Vaccine Adverse Events Reporting System Data

Many vaccine-related adverse events are associated with otolaryngologic manifestations. In particular, the incidence of sudden sensorineural hearing loss (SSNHL) was examined after influenza vaccination in a large-scale study that demonstrated...
no association between vaccination and the rate of SSNHL. Anecdotal reports are rapidly emerging from the otolaryngology community of SSNHL occurring after inoculation by SARS-CoV-2 vaccines that are currently in use in the US under US Food and Drug Administration Emergency Use Authorizations. Recognizing the important public health implications of any association between COVID-19 vaccination and SSNHL, and motivated by patients who presented to our practice (Johns Hopkins University, Baltimore, Maryland) with audiometrically confirmed unilateral SSNHL that occurred within 24 hours of COVID-19 vaccination, we sought to (1) estimate the national incidence of SSNHL after COVID-19 vaccination using data from the Vaccine Adverse Events Reporting System (VAERS) maintained by the US Centers for Disease Control and Prevention (CDC) and (2) compare this with the expected incidence of SSNHL in the wider population.

**Methods** 
This study was determined to be exempt from institutional review board approval by Johns Hopkins University because it used publicly available, deidentified data. The CDC VAERS is a national repository of incident reports associated with adverse reactions that occur after any vaccination. Any individual may submit a report, and all reports are publicly available. This database was queried for adverse events in which sudden hearing loss, deafness, deafness unilateral, deafness neurosensory, and hypoacusis were listed as an adverse event from vaccinations administered between December 14, 2020, and March 2, 2021, which yielded 147 reports after de-duplication. The narrative and laboratory results section of each report were reviewed. A subset of all incidents found to have a temporal association (onset of hearing loss occurred within 3 weeks of vaccination) and high credibility of reporting (eg, reported by a health care clinician with documentation of audiologic findings or steroid treatment) were classified as most likely (n = 40; 25 women [63%]). We then estimated the incidence of SSNHL that occurred after vaccination on an annualized basis, performed a sensitivity analysis of this estimate, and compared our findings with known incidence of SSNHL in the wider population.

**Results** 
Between December 14, 2020, and March 2, 2021, 86,553,330 SARS-CoV-2 vaccine doses were administered in the US. Demographic and clinical characteristics of reported “most likely” cases of SSNHL are shown in the Table. Because VAERS reports are unverified, susceptible to underreporting bias, and the number of unique individuals within the vaccine cohort is not known exactly, we performed a sensitivity analysis and estimated a minimum and maximum incidence by tuning these assumptions. The results of these incidence estimates compared with the known population incidence of SSNHL are presented in the Figure and demonstrate that the incidence of SSNHL occurring after COVID-19 vaccination does not exceed that of the general population, and may be lower.

**Discussion** 
The CDC VAERS is a unique and important tool for postmarket surveillance, which has allowed systematic research in vaccine safety on a national scale. These

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (range), y</td>
<td>56 (25-88)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>25 (63)</td>
</tr>
<tr>
<td>Men</td>
<td>15 (37)</td>
</tr>
<tr>
<td>Manufacturer</td>
<td></td>
</tr>
<tr>
<td>Pfizer</td>
<td>28 (70)</td>
</tr>
<tr>
<td>Moderna</td>
<td>12 (30)</td>
</tr>
<tr>
<td>Mean SSNHL onset after vaccine dose (range), d</td>
<td>4 (0-21)</td>
</tr>
<tr>
<td>Steroid treatment</td>
<td>30 (75)</td>
</tr>
</tbody>
</table>

Abbreviation: SSNHL, sudden sensorineural hearing loss.

* Incidents classified as most likely based on temporal association and high credibility of reporting.

* A total of 86,553,330 vaccine doses were administered.

**Figure.** Comparison of Estimated Incidence Range of Sudden Sensorineural Hearing Loss (SSNHL) That Occurred After COVID-19 Vaccination

Based on Vaccine Adverse Events Reporting System (VAERS) reports of known SSNHL incidence, with an associated sensitivity analysis underlying determination of incidence estimates for the COVID-19 vaccine cohort.
preliminary findings of VAERS data in the early phase of societal COVID-19 vaccination using 2 messenger RNA vaccines suggest that no association exists between inoculation with a SARS-CoV-2 messenger RNA vaccine and incident sudden hearing loss. While the reporting period did not include other vaccines that are currently in use, we hope these findings will reassure health care clinicians and patients to receive all scheduled doses of the vaccination as recommended by current public health guidelines. We urge clinicians to rigorously report all possible adverse events to VAERS to allow identification of sentinel trends and systematic vaccine safety studies. Timely and detailed reporting to VAERS will be critical in studying whether specific patient characteristics (eg, sex, comorbid autoimmune disease, and history of preexisting labyrinthine conditions [such as Ménière disease]) may be associated with an elevated risk of hearing loss or other otolaryngologic adverse events.

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Author Contributions: Drs Formeister and Sun had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Conflict of Interest Disclosures: None reported.


OBSERVATION

Rapid Sequence Induction and Intubation for Patients With Hereditary Hemorrhagic Telangiectasia

Hereditary hemorrhagic telangiectasia (HHT), an autosomal dominant disorder that is associated with telangiectasias and arteriovenous malformations (AVMs), can result in recurrent epistaxis. With a prevalence of 1 in 5000 to 1 in 8000, many patients with HHT will find their way to the care of an otolaryngologist.1 Ablation of intranasal telangiectasias can decrease the frequency and severity of nosebleeds.2 However, treating these lesions can be difficult, necessitating operative intervention. Indeed, patients with HHT tend to undergo multiple exposures to general anesthesia (GA) over the course of their lives.3 Because many patients with HHT also have chronic anemia, intracranial AVMs, pulmonary AVMs with right-to-left shunting, GA for these patients is complex and challenging, with each patient requiring an individualized treatment strategy. We propose that clinicians develop an individualized careful perioperative plan for each patient to maximize safety.

Report of a Case | Last year, our HHT center cared for a middle-aged man with severe recurrent epistaxis refractory to medical therapy, and we recommended operative ablation of his intranasal telangiectasias. In the operating room, GA was initiated with propofol. After induction, the anesthesiologist attempted mask ventilation, which immediately led to massive hemorrhage from the nose and mouth. Repeated efforts to visualize the larynx with direct and video laryngoscopy proved unsuccessful, and an emergency tracheostomy was performed. Bleeding was controlled with oronasal packing. The patient subsequently underwent neurointerventional angiography demonstrating a large internal maxillary AVM, which was embolized. After a prolonged hospitalization, the patient was discharged without bleeding or any neurologic sequelae. After a root-cause analysis, it was decided that implementation of a regimented perioperative algorithm could minimize the risk of repeating such intraoperative complications.

Discussion | Rapid sequence induction and intubation (RSII) involves the simultaneous administration of an induction anesthetic and paralytic followed immediately by rapid intubation. This technique contrasts with standard induction, which allows for preoxygenation with mask ventilation in between administration of the induction anesthetic and intubation. In the HHT population, RSII may theoretically reduce the risk of inducing sudden epistaxis with positive pressure mask ventilation (although no published evidence directly supports this consideration). Furthermore, RSII is designed to minimize the risk of aspiration, and therefore is commonly employed when patients must be intubated urgently and have not had time for gastric contents to empty.3 Patients with HHT may never reliably be functionally nothing by mouth for the recommended duration of time owing to swallowed blood from recent epistaxis or from gastrointestinal (GI) bleeding.3 Longacre et al4 reported that 77% of patients with HHT in their series had gastric telangiectasias, suggesting that patients with HHT likely have chronic intermit-