Case Report

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Cerebrospinal fluid rhinorrhea following COVID-19 nasal swab testing: case report

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Abstract

The COVID-19 pandemic has led to widespread adoption of screening tests to quickly and accurately diagnose disease. Nasopharyngeal swab tests are among the most common utilized. We present a case of a 58 year old female who suffered a cerebrospinal fluid leak from a bony defect in the sphenoid sinus immediately following a pre-procedural COVID screening test with subsequent development of meningitis. Providers should be aware of this potential risk of nasopharyngeal swab collection. Alternate COVID screening tests may be considered in patients with a history of sinonasal or cranial base surgery.

Keywords: COVID-19; nasal swab; cerebrospinal fluid leak; rhinorrhea.

Introduction

Since the onset of the COVID-19 outbreak in the United States in 2019, the medical community has undergone considerable research into both screening and treatment protocols. Testing for presence of the virus remains a vital part of developing quarantine strategy, as isolation appears to be the only effective way of limiting infection spread [1]. Though the true benefit of widespread testing depends on the accuracy of the test and is not fully known, nasopharyngeal swab testing remains a common diagnostic tool [2, 3]. This upper respiratory swab is easier to collect and has less strain on the patient than a lower respiratory tract specimen. Reverse-transcriptase polymerase chain reaction testing to identify viral RNA from nasal specimens is highly specific and may be more sensitive than oropharyngeal swabs [2]. Due to proximity to the intracranial cavity, surgical procedures and instrument introduction in the nasal cavity and upper sinuses have the potential for iatrogenic cerebrospinal fluid leak [4].

Cerebrospinal fluid (CSF) leak at the skull base and sinuses is typically caused by a history of trauma with iatrogenic or cranial and sinonasal surgical trauma being present in 16% of cases [4]. Spontaneous leaks can occur and may do so in the setting of idiopathic intracranial hypertension [4]. Diagnosis of CSF leak through the nasal sinuses is suspected on clinical presentation and can be accurately confirmed with beta-2-transferrin testing. Fine CT imaging of the skull base and MRI of the brain can contribute to diagnostic work-up [1, 3]. Persistent CSF leak is a risk factor for meningitis, and surgical repair is typically advised in this scenario.

Case Report

This work was carried out in accordance with the Code of Ethics of the World Medical Association and the Declaration of Helsinki, as well as the requirements set by the local Institutional Review Board. Our patient is a 58 year-old female with a complex cardiac history involving double-inlet left ventricle surgical repair as an infant, complete heart block requiring a pacemaker, previous deep venous thrombosis of the legs, stage III chronic kidney disease, and cirrhosis. Her BMI was 33, and she did not have a suspected history of idiopathic intracranial hypertension. She suffered from recurrence ascites related to her right-heart failure and was to undergo an outpatient image-guided paracentesis. As part of the pre-operative screening process, she underwent nasal swab COVID-19 testing. Within 48 hours of her nasal swab testing, the patient noticed clear drainage from her nose. This was persistent and often associated with straining or upright position. She received outpatient testing of her rhinorrhea fluid with detected levels of beta2-transferrin, diagnosing CSF leak. Due to presence of a cardiac pacemaker, she was unable to undergo MRI of the brain. She received a head CT, which showed a small bony defect (~4-5 mm) in the left side of the posterior wall of the sphenoid sinus (Figure 1). No previous comparison images

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were available. Approximately eight weeks after this procedure, the patient was brought to the emergency department by her husband exhibiting fever, confusion, headache, neck pain, and fatigue. There were no grossly abnormal findings on physical examination. She was evaluated with the sepsis protocol, with lab studies showing WBC 60,000 cells/uL, lactic acid 2.2 mmol/L, and no alterations of electrolytes, ammonia, or renal function. She was admitted to the intensive care unit and begun and empiric antibiotics. Her blood cultures showed streptococcus pneumoniae. Urine culture showed no growth. She had no identified etiology for her bacteremia on positron emission tomography imaging of the chest, abdomen, or pelvis ordered by the infectious disease consultant. She was placed on bedrest and CSF rhinorrhea was noted to continue. The patient underwent a fluoroscopic-guided lumbar puncture to evaluate for meningitis, which was unsuccessful due to patient toleration and body habitus. Her rhinorrhea improved and mental status slowly improved, and no CSF leak was noted after several days of bedrest and head elevation. She received long-term intravenous access to allow outpatient antibiotics for the management of her sepsis. The infection disease specialist suspected that the patient's septicemia was secondary to chronic CSF leak and related meningitis from nasal cavity seeding and planned for six weeks of ceftriaxone and vancomycin therapy. Because the patient had no previous cranial imaging, it is unknown if the bone defect in the sphenoid sinus was present prior to COVID nasal swab testing; this diagnostic test may be causal with regard to the patient's CSF rhinorrhea. After two weeks of inpatient management she was discharged with close clinical follow-up.

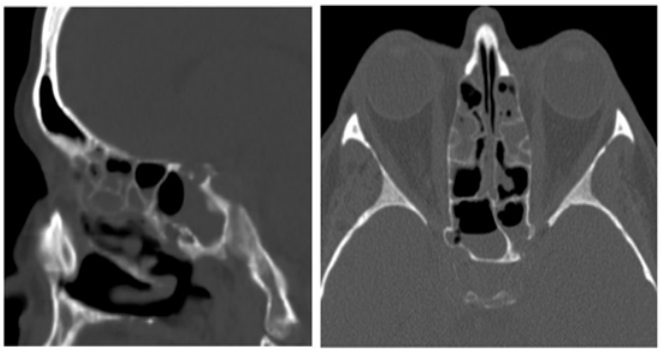

***Figure 1**: Sagittal and axial non-contrast computed tomography of patient's sinuses demonstrating bony defect in the posterior left wall of the sphenoid sinus.*

Discussion

Nasopharyngeal swab testing has been accepted as a widespread method for COVID-19 screening and diagnosis. The Center for Disease Control guidelines for clinical specimen collection in the nasopharynx instruct the healthcare provider to gently insert a swab parallel to the palate and advance "until resistance is encountered," and remove slowly while rotating the swab [5]. The distance from the entrance of the nostril to the back wall of the nasal cavity can be 8-10 cm. The sphenoid sinus typically lies above the hard palate, and the direction of force required to impact the posterior or upper walls of the sphenoid sinus would deviate from a parallel trajectory to the palate. An alternate technique mentioned by the CDC, anterior nasal swab sampling recommends sampling no further than 3/4 to 1 inch into the nasal cavity [5]. Our report of CSF leak following a nasopharyngeal specimen collection with a bony defect in the sphenoid sinus illustrates a unique potential risk of deviating from the proposed anatomical collection site. It is possible that a pre-existing bony defect occupied this space, and nasopharyngeal swab insertion caused a dural perforation. CSF leak is a well-established risk factor for meningitis, due to contamination of the subarachnoid space via bacterial flora from the sinonasal mucosa [3]. Approximately 10% of patients with a CSF leak will develop meningitis within a year, leading to significant morbidity and a high case-fatality rate if untreated [4]. It may be pertinent to consider anterior nasal swab or oropharyngeal swabbing as alternative screening tests for COVID—as both testing methods are gaining evidence for sensitivity. This could be especially relevant in patients with a known history of traumatic brain or skull injury, both from accidents or antecedent surgical procedures. Providers should inquire about surgical or procedural history prior to performing nasal swab testing.

Conclusion

Nasal swab testing for COVID remains a common sample method, and adherence to the CDC-procedural recommendations should be noted by the provider. Nasal procedures have a risk of CSF leak, and patients with history of brain trauma or surgical procedures of the sinuses or skull base may benefit from alternative swab sampling sites if being screened for COVID.

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