



Case Report

Cerebrospinal fluid leak postnasopharyngeal swab for SARS-CoV-2 testing: A case report

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ABSTRACT

Background: Due to the SARS-CoV-2 virus pandemic and its rapid spread worldwide, an early and effective detection strategy was the nasopharyngeal reverse transcription polymerase swab tests, a procedure still performed today. A relatively safe procedure when done correctly, however, one of the rare complications reported in the literature includes a cerebrospinal fluid (CSF) leak.

Case Description: A 69-year-old female patient presented to the emergency department with clear fluid rhinorrhea, clinically diagnosed with a CSF fistula after a SARS-CoV-2 nasopharyngeal swab. Resulting computed tomography and magnetic resonance images did not report any abnormalities; however, persistence of clear fluid rhinorrhea obligated pharmacological treatment without resolution, requiring insertion of a lumbar catheter to achieve clinical resolution.

Conclusion: It is essential to train staff to correctly administer nasopharyngeal swabs and thus reduce the rate of complications, as well as early recognition of symptoms and signs of CSF fistula.

Keywords: Case report, Cerebrospinal fluid leak, COVID-19, Nasopharyngeal swab, Skull base

INTRODUCTION

The SARS-CoV-2 pandemic began in December 2019 and created a large number of changes worldwide. According to data obtained from the city of Wuhan (city of origin of the pandemic), the 1000 mark of infected people was reached just 2 months after the first case was reported. Due to its rapid transmissibility, a year later cases had exceeded 72 million worldwide.^[2,7]

One of the strategies implemented to try and control the spread of the virus was based on early detection and screening. To this day, the most frequently used method is the test reverse transcription polymerase chain reaction or rapid antigen testing obtaining a sample of the upper respiratory tract through a nasopharyngeal swab.^[13]

Reports of nasopharyngeal swab complications have been described, among them cerebrospinal fluid (CSF) fistulas or leaks. We present a case below of a CSF leak secondary to a CoV-2

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nasopharyngeal swab, despite clinical evidence of CSF rhinorrhea, imaging studies did not report abnormalities.

CASE DESCRIPTION

A 69-year-old female patient who came to the emergency room in December 2020 due to the presence of clear fluid coming out of the left nostril 2 days after having performed a nasopharyngeal swab for the detection of SARS-CoV-2, in a specialized center for taking swabs for the diagnosis of COVID-19, the sample was taken by a nursing assistant with the established protocols, inserting the swab approximately 10 cm deep. The patient reported intense pain during the procedure, with no other complications since she did not present epistaxis, and days later, she began to notice a clear and odorless watery secretion from the left nostril, suggestive of CSF leak [Video 1]. Initially, she was evaluated at another institution without any studies or clinical history available, where she was admitted in an otorhinolaryngology outpatient setting at our institution. The patient referred intermittent periods of CSF leak, with initial treatment of acetazolamide; however, despite this, the patient persisted with the CSF fistula for approximately 8 months, with multiple reconsults at different institutions in the outpatient setting. A computed tomography (CT) cisternography was ordered and reported as normal; however, a few days before the imaging studies, the patient reported spontaneous rhinorrhea resolution.

In November 2021, patient reconsulted to the emergency department at our institution with headache, fever, irritative urinary symptoms, and onset of a clear, odorless, and salty left nostril rhinorrhea. Physical examination revealed a CSF fistula, acetazolamide (500 mg every 8 h) was initiated as well as prophylactic antibiotic therapy. A head and paranasal sinus CT were performed with no abnormal results reported;



Video 1: Evidence of rhinorrhea on physical examination. Video is accessible from the portal.

in addition, glucose measurement was requested in the nasal secretion with a result of 87 mg/dl, which reinforced the diagnosis of CSF fistula. Considering the symptoms and imaging results, studies were extended with lumbar puncture, urine, and blood cultures, all with negative results for infection or abnormalities. Antibiotic treatment was suspended, and days later, the patient reported rhinorrhea resolution and clinical improvement, on which the patient was discharged.

In February 2022, the patient was readmitted to the emergency department for a new episode of the left nostril rhinorrhea associated with headache. A new paranasal sinus CT was performed within normal limits. In addition, a flexible nasofibrolaryngoscopy was performed without any evidence of a CSF leak. Based on these findings, it was decided to reinitiate acetazolamide (since the patient had decreased dosage) and a subarachnoid lumbar catheter was inserted with approximate drainage of 750 cc in 7 days, after which it was removed on resolution of the fistula. Two months later, the patient was assessed in the neurosurgery outpatient consult, with no evidence of rhinorrhea and complete improvement of symptoms.

DISCUSSION

CSF fistulas are important conditions that affect the central nervous system and predisposes multiple neurological complications. These are classically classified according to their etiology and location. First, traumatic CSF leaks can occur due to a medical procedure (nasal or intracranial surgeries), also known as iatrogenic, or noniatrogenic related to traumatic events. Second, CSF leaks can appear spontaneously in relation to other conditions such as intracranial hypertension or CSF hypotension.^[3]

Spontaneous CSF fistulas are characterized by positional headache, where the headache improves in supine and worsens on sitting, related to the possible leptomeninges traction as well as nuchal rigidity, photophobia, diplopia, and even radiculopathy. The imaging diagnosis of this type of fistulae can be performed through a CT to locate the site of the bone defect; even though the patient has clear symptoms of a CSF leak, images may be normal so studies with MRI and CT myelography can be extended.^[6]

In contrast, CSF leaks of traumatic origin usually appear in the first 48 h after the trauma, reporting discharge of a clear fluid from the nose that worsens depending on the patient's position and can be accompanied by aqueous drainage from the ears, salty water postnasal drip, headache, and other trauma-related symptoms such as epistaxis, otorrhagia, or alterations of consciousness. In addition to the images mentioned above (CT, MRI, and CT myelography), other tests can be applied to confirm the presence of CSF leak.^[9]

The most frequent CSF leaks are the noniatrogenic etiologies, with blunt head trauma being the most common etiology producing fistulas between 1% and 3% of all cases. Iatrogenic postsurgical leaks can also occur, predominantly ethmoidal cribriform plate injuries after nasal surgeries. During the COVID-19 pandemic, new cases of traumatic fistulas posterior to nasopharyngeal swabs were reported.^[12]

One of the first cases was a 45-year-old female patient who presented with unilateral rhinorrhea after a nasopharyngeal swab, accompanied by severe headache and nuchal rigidity. Brain CT and magnetic resonance (MR) images diagnosed an encephalocele, suggestive of a previous defect, in the right ethmoid fovea and a pseudomeningocele in the right sphenoid wing. The patient underwent endoscopic management to correct the CSF leak.^[12]

Other cases reported include a 59-year-old male patient with unilateral rhinorrhea for 2 months after a nasopharyngeal swab. Images confirmed a sella turcica lateral wall defect conditioning an abnormal communication between the left middle cranial fossa and the left sphenoid sinus.^[12]

Finally, a 38-year-old female patient with intense pain during the nasopharyngeal swab followed by 2 days of rhinorrhea that worsened when leaning forward. In addition, the patient complained of constant headache and postnasal drip of metallic taste. CT and MR images revealed a cribriform plate defect which was surgically repaired.^[11]

Although nasopharyngeal swabs have been in use well before the COVID-19 pandemic in diagnosis of respiratory viruses, to the best of our knowledge, no reports were found of CSF leaks before the COVID-19. Considering the rapid expansion of COVID-19 and the increased number of procedures performed, perhaps complications were rare. Despite it being a simple diagnostic tool, other complications are rare but they cannot be ruled out. In addition to CSF leaks, other reported nasopharyngeal swab-related complications include rupture of the swab in the nostrils and epistaxis.^[11]

According to reports in the literature, despite the fact that the majority of patients with CSF fistula required surgical procedure, in two cases, nonsurgical interventions were decided. A 40-year-old male patient with rhinorrhea after nasopharyngeal swab developed meningitis which resolved with antimicrobial treatment and improved rhinorrhea. The second case was a 45-year-old female patient with abnormal anterior ethmoid cell CSF passage found on MRI after a nasopharyngeal swab, in whom lumbar drainage was performed with complete resolution of the rhinorrhea after 10 days. These cases show that it is possible to opt for conservative management.^[10]

The diagnostic approach of a CSF fistula includes imaging such as CT, CT cisternography, contrast-enhanced MRI, and radionucleus cisternography. These images are able to detect bone defects, communications between the subarachnoid and

extracranial space, herniation of the meninges, accumulation of contrast medium, and visualization of the radiotracer in the nasal cavity. Decision on imaging studies should be based on the context of the CSF fistula onset and whether the fistula is active or occurs intermittently.^[4]

However, basic imaging may fail to detect skull base defects and be normal, as in our patient with a CSF leak hours after a nasopharyngeal swab with intermittent presentation throughout the clinical follow-up. Recursive clinical tests can also be performed, such as the use of filter paper to show a “halo” or “double ring sign” generated from a drop of the liquid onto the paper forming an internal ring by blood (when this is present in the nasal cavity) and an external ring by the CSF. Alternatively, the glucose oxidation test, in which a glucose oxidase strip is used on the sample, believed to be CSF and the positive result is a concentration greater than 20 mg/dl (normal nasal secretion has a concentration up to 10 mg of glucose). Lastly, the ideal laboratory test is measurement of beta-2-transferrin which is specific for CSF, as well as the concentration of chloride when it is above 100 mEq/L is highly suggestive of CSF. Notwithstanding, all the above tests have false positive results, so the diagnosis must be a complement between clinical signs, laboratory tests, and diagnostic images.^[9]

With regard to our case report, unfortunately the only clinical test performed was the glucose oxidase strip, since it was the only objective measure available at that time and could provide information taking into account the time of evolution of the patient's symptoms. Although this can strongly limit our definite diagnosis, taken together with the referred clinical time of onset, nasopharyngeal antecedent, and symptoms reported by the patient, we can infer that a traumatic CSF leak posterior to the swab was the cause of the rhinorrhea.

Recommendations and safety precautions have been established in the performance of nasopharyngeal swab, taking into account the length of the swab and its insertion angle. The current consensus is that the swab should be directed in a horizontal plane between the nostril and the patient's external auditory canal, entering parallel to the floor of the nostril and avoiding injury to the middle turbinate. Likewise, it is recommended to avoid inserting the swab greater than 30° (in cephalad direction) as this is where the junction between the middle turbinate and the cribriform plate is found and any trauma at this level could potentially affect skull base.^[8]

It is essential to abide by the recommendations and indications in the correct administration of a nasopharyngeal swab, since one of the potential complications is a CSF fistula and a resulting meningitis (complication rates of 20% and mortality of 10%). In addition, one has to consider the risk that entails any neurosurgical procedure for fistula correction, specifically in patients with a history of previous nasal surgeries or spontaneous CSF fistulas, where alternative diagnostic methods should be considered in the setting of SARS-CoV-2.^[1,5]

It is important to consider any signs or symptoms posterior to a nasopharyngeal swab such as severe headache, clear fluid rhinorrhea, or otorrhea that exacerbates with Valsalva maneuvers, postnasal drip described as salty or metallic, and intense pain during or after the swab. Any of these symptoms in the context of a swab can be attributed to COVID-19 symptoms; however, the clinical suspicion should be present to identify potential CSF leaks. The ideal diagnostic method is to test for the clear liquid suggestive of CSF in the ear or nostrils with beta-2-transferrin to confirm the leak in conjunction with CT imaging to identify skull base lesions.^[5] However, it is not always possible to visualize alterations in the base of the skull in the CT or MR images, sometimes no lesion is found, as in the patient in our case.

CONCLUSION

Performing a nasopharyngeal swab will continue to be one of the fastest and most frequently used techniques worldwide to obtain samples from the upper respiratory tract for the identification of the respiratory viruses. Despite the fact that it is a relatively safe procedure, it is not exempt from serious complications such as CSF fistulas. It is essential that health personnel are fully trained and follow international recommendations for proper sample collection as well as a clinical suspicion of potential complications from the swab.

Likewise, it must be taken into account that not all cases will have a clear defect identified on images. Despite this, the patient's symptomatology and the appropriate medical treatment must be prioritized to ensure clinical resolution.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

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