

Correct Execution of the Nasopharyngeal Swab: A Fundamental Method to Improve Diagnosis of SARS-CoV-2 Infection

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Background: Severe acute respiratory infection Coronavirus 2 (SARS-CoV-2) infection has spread all over the world since December 2019. Treatment of the syndrome represents an important challenge for all physicians. Spread prevention relies on a correct diagnosis which is performed with nasopharyngeal swabs. **Objective:** To describe the proper execution of the swab with a few simple steps. **Methods:** Figures and video recording. **Results:** A few simple steps are presented within this paper in order to perform easily nasopharyngeal swab for SARS-Cov-2 diagnosis and for other possible infectious diseases of the airways tract. **Conclusions and Implication for Nursing:** Nasopharyngeal swab may be performed in an easier way than usually thought. This method may also be used for any other microorganism detection. By following simple steps, a correct diagnosis can easily be obtained.

Keywords: nasopharynx; nasopharyngeal swab; SARS-CoV-2 infection; COVID-19

Since December 2019, the new severe acute respiratory syndrome Coronavirus 2 (SARS-CoV2) spread out giving the coronavirus disease (COVID-19) (Wu & McGoogan, 2020). A high colonization by the virus has been observed in the nasopharynx (Loeffelholz & Tang, 2020). One of the main symptoms, indeed, is represented by alterations of smell or taste, thus suggesting a high viral load inside the nose (Boscolo-Rizzo, Polesel, et al., 2020).

Nasopharynx is the upper-posterior area of the nose. It is bounded anteriorly by choanas, superiorly by the sphenoid sinus, posteriorly by the clivus, laterally by tubaric ostia, and inferiorly by an imaginary horizontal plane running from the soft palate to the posterior wall (Centers for Disease Control and Prevention [CDC], 2021). This area is covered by respiratory pseudostratified columnar ciliated epithelium and is rich in polysaccharides which represent a fertile ground for pathogens,

in case of upper airway infections (Gogos & Federle, 2019).

As recommended by international guidelines (CDC, 2021), the nasopharyngeal swab represents the gold standard for obtaining virus specimens from the upper airways and for achieving diagnosis of infection. Nasopharyngeal swab is indicated in case of close contact of the patient with a positive subject (Boscolo-Rizzo, Borsetto, et al., 2020), or in case of suspected symptoms, such as influenza-like symptoms and alterations of sense of smell and taste which may be even persistent (Boscolo-Rizzo et al., 2021).

The sample is harvested using a narrow stick made of a plastic rod that is covered, at one tip, with absorbing material. Removal of superficial mucosal cells may be obtained by rubbing the nasal mucosa (nasal swab) and the pharyngeal one (nasopharyngeal swab).

This article and the video illustrated in Figure 6 aim to explain the correct execution of the nasopharyngeal swab, so that operators can collect mucosal cells properly and achieve diagnosis.

How to Use Swabs

Before the procedure, the operator should wear proper personal protective equipment (PPE), including a face-mask (if an N95 respirator is not available), eye protection (e.g., glasses and an external protective visor), gloves, and a gown (CDC, 2021; Spinato et al., 2021). The operator should give the patient a brief explanation of the procedure, in order to gain better compliance. Moreover, he should warn the patient about possible discomfort that may easily resolve spontaneously in a few minutes.

We suggest that the patient should sit, slightly extending his/her head, and the operator should ask if one of the nostrils is totally or partially obstructed, so that to insert the swab on the other side. The operator should pull the edge of the nose upwards to widen the nostrils (Figure 1) and push gently the swab by grabbing it with thumb and forefinger. The swab should go ahead into the nostrils, it should touch the base of the nasal fossa and should be pushed perpendicularly to the patient's face (Figure 2). The swab needs to be



Figure 1. The tip of the nose should be lifted in order to open the nostril and to make the passage of the swab easier.

moved on a parallel line to the floor of the nasal cavity: in this way, it will be easier for the operator to make it slide; moreover, it will be less stressful for the patient, because scratches and injuries on the turbinates will be avoided as much; also, the operator should avoid to rub the median wall of the nose (i.e., the septum), because it will be painful for the patient and in some cases it can lead to bleeding (Figure 3).

Moving gently onward, the swab should pass the nasal cavity and choana, reaching the nasopharynx and the posterior wall (about 8–10 cm from the nostril). At this point the operator will feel the swab stopping (Figure 4). Now the operator should rotate it two to three times to allow a fine scrub of the absorbent tip of the swab to the nasopharyngeal mucosae (Figure 5). After these maneuvers, the swab should be gently taken off the patient's nose and put into the test tube. The latter must be then transferred to the laboratory in specific containers for analysis (CDC, 2021).

In a point by point summary, the procedure should be performed as follows:

- wear PPE
- insert the swab in the best nostril
- push the swab gently, perpendicularly to the patient's face, as far as 8–10 cm
- when the swab stops, rotate it two to three times
- remove the swab and put it into the test tube (Figure 6).

Difficulties in Sampling and Complications

As in other diagnostic maneuvers, some difficulties can be encountered, often deriving from a lack of knowledge of the anatomy or the size of this area. A case series of complications encountered among 4,876 subjects during nasopharyngeal swab has been reported (Fabbris et al., 2021) and showed an overall reliability of the



Figure 2. The swab is pushed gently onward following the nasal floor and perpendicularly to the patient's face.

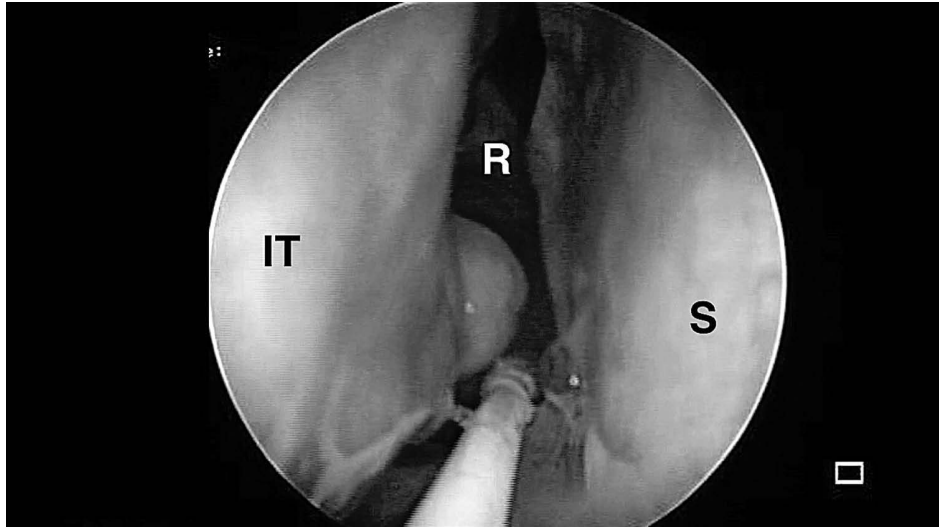


Figure 3. Endoscopic view of the right nasal cavity. Nasal septum is on the right side of the figure, inferior turbinate is on the left, and the swab lies on the nasal floor at the bottom.



Figure 4. Once the swab has been pushed gently onward, the limit is represented by the posterior wall of the nasopharynx. This is the posterior limit of the procedure and is generally reached 8–12 cm from the tip of the nose and corresponds to the external auditory canal.

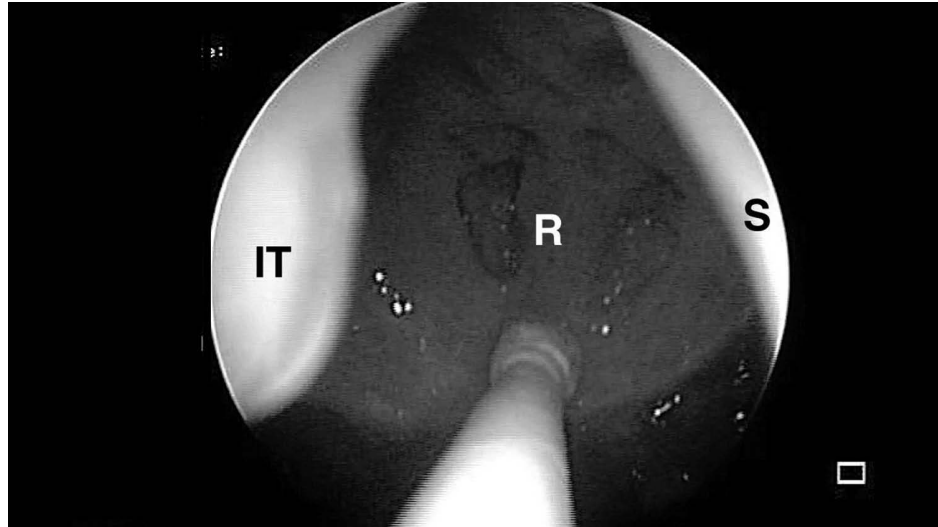


Figure 5. Endoscopic view of the nasopharynx. The swab reached the posterior wall of the nasopharynx. It should be rotated clockwise and counterclockwise for a few seconds and then gently pulled off.



Figure 6. Correct execution of the nasopharyngeal swab. In the first part of the video, correct movements of the operator are presented. In the second part, an endoscopic view of the right nasal cavity is shown towards the nasopharynx. The third part shows the route the swab follows on the nasal floor to reach the nasopharynx.

Source: https://drive.google.com/open?id=1PZjkKgOyiOS_eETHa3_q7iH3vOLnPtJ

procedure. A brief analyses of the difficulties are listed below, in order to prevent complications as much as possible.

One of the most common issues is nasal septum deviation. The septum may show crests (bone protrusions) and may be curvy, thus deforming the nasal cavity on the side of the crest. In this case the swab may not be moved easily through that nasal fossa (that is probably the side with higher airway resistance), so we suggest to insert the swab through the opposite nasal cavity, bearing in mind that nasopharynx is accessible by both nostrils (Loeffelholz & Tang, 2020). In case the swab stops

during its course, it could be useful to pull it off gently to avoid pain, mucosal damage, and bleeding.

If the patient had trauma or surgery, there could be other anatomic abnormalities. Therefore, it's useful to take a short clinical history to prevent difficulties during the sampling and to choose the best nostril, as discussed for septal deviations.

Another difficulty could be nasal mucosa congestion. In this case it is not hard to reach the nasopharynx and the operator should push a little more to achieve the goal, even if it usually causes just a little distress to the patient. Mucosal injuries will be a little riskier, so the entire procedure needs to be performed gentler.

Special attention should be paid in case the patient has high risk of hemorrhage. The most common factor is represented by oral anticoagulant therapy and anti-hypertensive drugs. On the other hand, even some syndromes may determine profuse bleeding, such as hereditary hemorrhagic telangiectasia (HHT), also known as “Osler-Weber-Rendu Syndrome,” that is an inherited disease that leads to malformed blood vessels in multiple organs and typically begins with nosebleeds. In case of mild to moderate epistaxis, the nostrils should be compressed medially and the patient should lean his/her head for a few minutes, after which bleeding generally stops. In case of profuse bleeding, not easily stoppable with self-limiting maneuvers, a temporary nasal packing should be placed and the patient should be sent to an immediate otolaryngological evaluation.

An accurate clinical history collection is thus mandatory in order to obtain all this information and to avoid complications. In any case, proper information to the patient, even regarding possible adverse events, should be given before sampling.

Conclusion

Due to the high risk of infection by SARS-CoV-2, a diagnosis as precise as possible is fundamental. Since the nasopharynx is highly colonized by this virus, accurate sampling is crucial and can be performed with a few simple steps. An overall knowledge of the nasal anatomy and of patient’s clinical history is strongly recommended before performing the procedure.

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