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Post Extubation Stridor and the Cuff Leak Test in the Era of COVID-19: A Case Report

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Abstract **Case Report**

Performing the cuff leak test (CLT) prior to extubation to detect postoperative laryngealn stridor was a common practice among anesthesiologists prepandemically. Its diagnostic accuracy has been analyzed in several previous studies. Due to its limitations and the risk of aerosolization of the virus in the operating room, CLT is carried out less than before for fear of contamination in the era of COVID-19. We have encountered a patient who presented significant post extubation stridor and shortness of breath with desaturation reaching 90% following laparoscopic appendectomy. After exclusion of other etiologies, the respiratory distress was attributed to post extubation laryngeal edema. In addition to oxygen therapy provided by a nonrebreather mask, the patient was given methylprednisolone and was nebulized with epinephrine which allowed a rapid clinical improvement. The patient was weaned off oxygen after 2 hours and left the post anesthesia care unit after 12 hours. This scenario occurred because a CLT was not performed prior to extubation.

Keywords: Postextubation laryngeal edema; Post extubation stridor; Cuff leak test; Aerosolization.

INTRODUCTION

Performing the cuff leak test (CLT) before extubation to detect postoperative laryngeal edema was a common practice among anesthesiologists prepandemically [1]. Airway management guidelines have been updated recently due to the COVID-19 pandemic, but they do not include any statement regarding this test. The diagnostic accuracy of the CLT has been discussed in several previous studies [2, 3]. Because of the risk of aerosolization, the CLT is carried out less than before for fear of contamination. These new protective measures should not come at the expense of the patient's anesthetic safety. We have encountered a respiratory distress in the operating room due to postextubation laryngeal edema. This scenario occurred because a CLT was not performed prior to extubation.

CASE REPORT

A 35-year-old female (67 kg, 1.52 m, BMI = 29 kg/m2) who was previously healthy was admitted to the emergency department for acute abdominal pain with fever. After investigations the patient was diagnosed with acute appendicitis. On the preanesthetic assessment, she was assigned ASA physical status I. She had no criteria for difficult ventilation or intubation.

The patient did not present symptoms suggesting a COVID-19 infection. Nevertheless, a nasopharyngeal swab was sent for reverse transcriptase polymerase chain reaction (RT-PCR) testing for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The patient was admitted to the operating room without waiting for the results of the RT-PCR because it was an urgent surgery. The anesthetic team included an attending anesthesiologist and a nurse anesthetist. Both wore N95 mask, face shield, and gloves. The patient received 800 mg of cimetidine and 2 grams of amoxicillin-clavulanic acid. After preoxygenation, anesthesia was induced by 180 mg of propofol and 65 mg of rocuronium. The Sellick maneuver was applied. One minute later, blade number 3 of the video laryngoscope was introduced and showed a grade 1 Cormack and Lehane. The endotracheal tube could not pass the vocal cords although they were open. We realized that tube 6.5 mm was not suitable. By opting for a smaller one (6mm), we successfully intubated the trachea on the second attempt.

The balloon was inflated with air, and the pressure was checked at 20 cmH2O. The capnography confirmed the correct position of the tube. The patient was given 250 µg of fentanyl.

Laparoscopic appendectomy was performed without incident. Once the patient woke up and after checking a Train of four (TOF)> 0.9 at the adductor pollicis in the thumb, she was extubated and put on face mask oxygen at a flow rate of 4 L/min. At this moment she began to present shortness of breath with polypnea up to 30 cycles/min and significant stridor associated with desaturation reaching 90%. A nonrebreather mask was added, delivering oxygen at a flow rate of 10 l/ min. The patient was given 40 mg of methylprednisolone and was nebulized with epinephrine (1 mg+ 4 ml of serum chloride 0.9%). Gradually the stridor began to decrease and the respiratory rate dropped. The patient went to the buffer zone in the post anesthesia care unit (PACU) for recovery. She was weaned off oxygen after 2 hours.

Once her RT-PCR came back positive, she left the PACU after 12 hours of close monitoring. Then, she was admitted to the COVID-19 isolation unit. Injectable corticosteroid therapy was maintained for 24 hours.

During her stay, she presented no respiratory symptoms. No antiviral treatment has been started. She left the hospital on the seventh day in good condition.

DISCUSSION

Post extubation stridor (PES) is a sign suggesting narrowing of the laryngotracheal pathway in an extubated patient. It can be encountered in the operating room following general anesthesia. However, its occurrence, although rarely reported in the literature among adult patients, seems less frequent than that in critical care settings, where the prevalence ranges from 4 to 37% [2]. The main reason is that the intubation conditions are usually optimal in the operating room.

The risk assessment for PES is done by performing the CLT. The test can be quantitative or qualitative, and can be carried out in a patient in spontaneous ventilation, in assist-controlled ventilation or even during cough.

There have been several studies assessing the accuracy of the CLT. In a multicenter prospective study conducted in 2017 that included 362 patients, *Schnell et al* analyzed the accuracy of 4 types of leak tests to predict PES. One test was quantitative and 3 were qualitatives. They reported a sensitivity ranging from 27% to 46% and a specificity ranging from 70% to 88%. They stated that the CLT displayed limited diagnostic performance for the detection of PES. Therefore, performing it routinely may expose patients to undue prolonged mechanical ventilation [3]. In the same year, the guidelines on liberation from mechanical ventilation in critically ill adults published by the American Thoracic Society (ATS) and American College of Chest Physicians (ACCP) weakly recommended CLT to be performed on all high-risk PES patients [1].

Recently, *Kuriyama et al* included 28 studies involving 4,493 extubations. The authors found that the pooled sensitivity and specificity of CLT were 62% and 87% respectively. This was an excellent specificity but moderate sensitivity for postextubation airway obstructions. Thus, they concluded that the CLT works better to rule in than to rule out potential PES. Therefore, it can be used to select patients to consider treatment with steroids, but the traditional practice of closely monitoring all patients after extubation must be maintained due to its low sensitivity [2].

Given all the limits attributed to this test and the risk of aerosolization of the virus, it does not seem appropriate to perform it routinely in all intubated patients in the era of COVID-19. The treatment of postoperative laryngeal edema is mainly prophylactic. Corticosteroid administration prior to extubation can be used to prevent PES. Nevertheless, its routine use before elective extubation is not recommended. Studies have suggested that the CLT should be used as a screening method and prophylactic steroids should be administered only to those with a positive test [4].

In addition, it has already been shown that performing the test in all patients prior to extubation did not show any clinical benefit on the outcome and may expose patients to delayed extubation [1]. Following the same line of reasoning, a checklist can be used to target high risk patients. CLT eligibility was defined as meeting at least one of the following criteria: traumatic intubation, female sex, endotracheal intubation > 6 days, trauma to upper airway anatomy, reintubation after unexpected extubation and large endotracheal tube > 8 mm [1].

However, in anesthesia, not all the risk factors listed above would justify performing the test. For example the female sex alone or the use of the 8 mm endotracheal tube in a tall patient is not a sufficient argument to use the CLT.

Our patient had two risk factors, namely female sex and traumatic intubation (two attempts with an unsuitable tube). Normally, the CLT should have been performed. It would probably have allowed us to suspect PES and to administer corticosteroids prior to extubation. To reduce the risk of aerosolization during the CLT, we suggest covering the face with transparent steridraps. This approach is inspired by the protective measures described for extubation of the patient with COVID-19.

Additionally, although different CLT have similar intrinsic performances [2], we suggest performing quantitative CLT among COVID-19 patients if needed and not the qualitative ones. The reason is that

all personnel protective equipment (PPE) may interfere with the auditory detection of air leaks. The detection of air leaks in patients with spontaneous ventilation disconnected from the ventilator or during coughing is strongly contraindicated because of the high risk of aerosolization.

As most patients may present with a cough when the balloon is deflated and when they are awake, we suggest that the CLT must be performed after the bolus of a propofol and opioid. In patients with COVID-19, the incidence of PES seems to be relatively high and may reach 45% in some series [5]. With such a high incidence, the predictive positive value (PPV) of the test becomes clinically relevant. According to *Schnell et al*, with a prevalence of PES of 50%, the PPV of the CLT can reach 64% [3].

It therefore seems legitimate to perform the quantitative CLT in COVID-19 patients while respecting the abovementioned protective measures. In a small case series of 9 patients with PES among COVID-19 patients, the authors suggested that there may be risk factors specific to COVID-19 that increase the prevalence of PES. First, the development of laryngitis may be a concern, as with other members of the coronavirus family. Second, pre-existing obesity in many COVID-19 patients, along with the use of PPE for anesthesia teams, may increase the incidence of traumatic intubation. Finally, the prone position may also be a risk factor for PES. The authors assumed that further analysis is needed to determine the exact correlation. Nevertheless, they stated that the CLT did not provide an accurate prediction of PES [5].

We should note that the observation of stridor in this study was based on subjective assessment rather than objective findings of airway edema. In addition, six patients were initially extubated to either high flow nasal cannula or noninvasive ventilation. For all these reasons we suggest that stridor might not be secondary to postextubation laryngeal edema. Some patients might have had respiratory insufficiency due to COVID-19 squeal that necessitates high-minute ventilation and tachypnea through an edematous airway that manifested as stridor. In such situations, it is difficult to separate stridor due to postextubation events from stridor due to respiratory insufficiency.

CONCLUSION

The CLT, despite all the limitations, can detect most PESs when performed in a high-risk population. However, anesthesiologists should not rely on a single test before deciding to extubate their patients. A checklist must be established and followed in which the CLT keeps a significant place.

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