

Peer Review File

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First External Peer Review

Reviewer A

1. Please double space your manuscript, including abstract, body of text, and references.

Reply 1:

Changes in the text: double spacing was performed

2. Please list each author's individual contribution to the manuscript separately on the title page as it will appear in print. Please list each author's contributions using the following format: "Author Name: This author helped..."

Reply 2: The author contribution is at the end of the manuscript

Changes in the text: The author contributions are now inserted on the title page as recommended.

3. Please list the word count of the Abstract, Introduction, and Discussion on the title page. Also list the overall word count for the entire body of text (excluding Abstract and References).

Reply 3:

Changes in the text: word counts were added

4. Please make sure your short title (running head) that states the essence of the article is <50 characters with spaces.

Reply 4:

Changes in the text: the running head was shortened exactly to 50 characters

5. A Glossary of Terms must be provided for ALL abbreviations/acronyms appearing in the manuscript, including trial names.

Reply 5:

Changes in the text: a glossary was added on the title page

Reviewer B

This case report showed that iatrogenic TML can be managed with intraluminal repair even in difficult situations such as ongoing COVID-19 infection.

However, despite such routine procedures, damage of tracheal membranous part due to the intubation procedure and TML due to the use of hard tubes are very shameful complications.

Comment 1: It is by no means due to uncertainty regarding the safe performance of COVID-19 patients.

Reply 1: Thanks to the reviewer for his assessment. The feeling of uncertainty is very subjective and we fully agree that during the ongoing pandemic a certain routine and stability was established so uncertainty is no explanation any more. In our case, the involved doctors on duty reported this kind of uncertainty.

The uncertainty mentioned in the conclusion referred to the performance of endoluminal repair which is done under jet ventilation with a maximum of aerosol exposure.

Changes in the text: none

Reviewer C

This manuscript describes endoscopic repair of an iatrogenic tracheal injury sustained during tracheostomy in a COVID-19 patient. While I applaud the authors on their innovative solution to endoscopic tracheal repair, I do not feel that describing its use in a frail COVID-19 patient adds significantly to the existing reports that have been published by the corresponding author.

Comment 1: One of the objectives of this case report was to highlight the precautions that were taken to prevent COVID-19 transmission during initial tracheostomy and subsequent tracheal repair. Besides describing the use of PPE, no specific strategy for minimizing aerosolization was utilized. The authors state that a surgeon who had overcome COVID-19 infection and “relied on his immunity” performed the procedure. It is, in my opinion, reckless to recommend such a strategy, given that there has been no strong evidence or consensus that prior infection confers reliable and sustained protection against re-infection. A more appropriate strategy would have been to

minimize the number of non-essential personnel in the room during an aerosolizing procedure, and to allow only the most senior, experienced providers to participate in the procedure. I would also recommend that the team rehearse the steps of the procedure ahead of time and coordinate airway management with the anesthesiology team to ensure expeditious and smooth conduct, minimizing exposure to all involved.

Furthermore, the authors postulate that the added pressure to minimize aerosolization and the additional personal protective equipment required may have contributed to the complication of tracheal laceration. This suggests an overall lack of preparedness or unfamiliarity with high risk airway procedures. I would argue that this patient's situation would be no different than any other patient with a highly communicable disease, such as pulmonary tuberculosis, a condition which is not uncommonly encountered by thoracic surgeons and requires an equally cautious strategy to prevent transmission to involved providers.

Reply 1: Thanks to the reviewer C for his critical comments. They clearly highlight the dilemma in the decision making process of this difficult case. As all the involved staff wore personnel protective equipment including protective goggles the small remaining risk for the surgeon was subjectively covered by a certain immunity. We do not postulate that immunized doctors can safely perform the procedure, but we wanted to comprehensively describe the situation and discussion we had at that time. We do not think it is reckless to include immunity of health providers into a procedure planning.

Changes in the text: "As security measures non-essential personnel left the room, and the most experienced providers performed the procedure." "protective goggles"

Conclusion: This case demonstrates that iatrogenic TML may be managed with endoluminal repair

It is my opinion that a substantial revision of this manuscript addressing these issues would be required to render it suitable for publication. Additional questions to consider:

Comment 2: What were the patient's ventilator settings at the time of tracheostomy (mode, FiO₂, PEEP, etc...)?

Reply 2: The ventilator settings were BiPAP assist, FiO₂ 50%, PEEP 10 mbar and inspiratory pressure 31 mbar.

Changes in the text: At that time the respirator was set at assisted biphasic positive

airway pressure (BiPAPass), with inspired oxygen fraction (FiO₂) 50%, positive end expiratory pressure (PEEP) 10 mbar and maximum inspiratory pressure (P_{ins}) of 31 mbar.

Comment 3: Was the patient difficult to intubate? Were there multiple attempts made to intubate?

Reply 3: The patient was intubated without complications.

Changes in the text: none

Comment 4: Did the patient have a history of corticosteroid use?

Reply 4: the comorbidities are listed in the case presentation: Her comorbidities included hypertension, diabetic neuropathy, diabetic nephropathy and a history of breast cancer. No use of corticosteroids prior to hospital admission. But during COVID-19 and CMV treatment high dose Prednisolone treatment was started 2 weeks prior to tracheostomy.

Changes in the text: Ganciclovir treatment for three weeks was therefore commenced and i.v. Prednisolone 100mg per day was administered.

Comment 5. Please describe your technique for initial tracheostomy

Reply 5: Thanks for this valuable comment. The technical performance was our standard technique that we described in more detail as follows

Changes in the text: While the preparation of the trachea, the U-shaped incision and the elevation and fixation of one tracheal ring were uneventful, the insertion of a rigid tracheostomy cannula (Tracoe® twist plus 8mm, Tracoe, Germany) proved to be difficult and required 2 attempts due to the short neck and unfavorable angulation. Strict apnoe was kept beginning when the trachea was opened and the oral tube was withdrawn until blocking of the tracheostomy cannula.

Comment 6: How far from the carina was the laceration and did it extend into either mainstem bronchi?

Reply 6: The TML almost reached the carina but did not involve the main bronchi.

Changes in the text: A second bronchoscopy revealed a larger left lateral full thickness TML 5mm up to the carina with direct view on the esophagus.

Comment 7: When a full thickness injury was noted, was there any consideration given to EGD to rule out esophageal injury?

Reply 7: It is a routine measure to use the bronchoscope with oxygen inflation to assess the esophagus in such cases. The treating doctor noted “no esophageal lesion visible. Because this was not a full EGD, we did not mention this in the manuscript.

Changes in the text: Using the flexible bronchoscope, a rough examination of the esophagus did not show any lesion.

Reviewer D

Congratulations for the case

Reviewer E

This article describes the Endotracheal Repair of an Iatrogenic Tracheal Laceration in a COVID 19 Patient. The endoscopic technique for repair of tracheal laceration has been reported many years ago by Welter Stefan, et al [1]. And it has been widely accepted by a majority of thoracic surgeons and endoscopists nowadays. For sure, this technique requires to be operated by experienced thoracic surgeons or endoscopists. In terms of the technology itself, this article is not quite innovative. A fact that draws our attention is that the lacerated patient suffers from severe covid-19 pneumonia. It is suggested that the authors concentrate the discussion on the following points:

Comment 1: What is the cause of tracheal laceration? Is it caused by improper operation by the surgeon, or by the inflammatory edema of the tracheal membrane resulted from the patient's disease?

Reply 1: We thank this reviewer E for his valuable comments and suggestions. We tried to highlight 3 problems associated with TML: using a rigid cannula in unfavourable anatomical circumstances, the existence of an older TML directly under the tracheostomy causing a weak area and general risk factors like age, female gender, and local inflammation.

line 107: ... the insertion of a rigid tracheostomy cannula (Tracoe® twist plus 8mm, Tracoe, Germany) proved to be difficult and required 2 attempts due to the short neck and unfavorable angulation.

line 148: In our case we suspect a TML during initial intubation leaving a weak

area in the posterior membrane, visible as an older lesion above the entrance of the tracheostomy (Figure 2b). The rigid tracheostomy cannula contained a pointed applicator that might have perforated and loaded the already weakened posterior tissue, causing further damage to the posterior membrane during attempts to advance the device forward

line 155: In general, advanced age, female sex and inflammation due to tracheobronchitis might have weakened the membranous portion of the trachea as described by others

Changes in the text: In summary, age, female sex, Prednisolone treatment and local inflammation as general risk factors in combination with a local weak area from earlier TML and the use of a rigid cannula in unfavorable anatomical circumstances contributed to this deleterious complication.

Comment 2. During repairing lacerations, is it reasonable to use the jet ventilation, since this ventilation mode is more likely to cause the spread of the virus? To protect the operator, would it be better to complete the repair with the assistance of ECMO, reducing the risk of exposure to the virus?

Reply 2: This method only works with jet ventilation. Unfortunately the risk of virus spread is increased as assumed by the reviewer. ECMO would be a possible way to avoid virus spread. As we tried to order an ECMO machine for a different patient in this week and no system for leasing was available due to large demands, we did not take this possibility into consideration. Furthermore we think that ECMO has further side effects like increased bleeding. Endobronchial bleeding is a main concern during this procedure because it hinders the identification of the rims and suction is not possible and bleeding is immediately distributed into the bronchial system. In conclusion, we would not use ECMO because the main intention is to reduce patients risk and invasiveness.

Changes in the text: none

Comment 3: The laceration leads to mediastinal emphysema and left-sided pneumothorax, indicating that the laceration location is special and may be close to the left main bronchus. Whether the specific location of the laceration and the relationship with the esophagus were determined before surgery?

Reply 3: The location and laceration as well as the integrity of the esophagus was examined preoperatively.

Changes in the text: line 118...A second bronchoscopy revealed a larger left lateral full thickness TML, 5mm up to the carina with direct view on the esophagus. Additionally, an older lesion above the entrance of the tracheostomy cannula was visible.. line 123... Using the flexible bronchoscope, a rough examination of the esophagus did not show any lesion.

Comment 4: Is there any further discussion/exploration on other treatments that are more beneficial to both patients and surgeons?

Reply 4: Indeed, other options exist but were not discussed in detail due to the word limitations of the manuscript.

Changes in the text: The idea of open repair through posterolateral thoracotomy was rejected as the patient was frail and COVID-19 is associated with highly increased operative mortality.

Second External Peer Review

Reviewer B

This case report showed that iatrogenic TML can be managed with intraluminal repair even in difficult situations such as ongoing COVID-19 infection. Despite routine procedures, damage to the tracheal membrane due to the intubation procedure and TML due to the use of hard tubes are considered to be very shameful complications.

They just happened to be able to intraluminal repair successfully, but there is no new knowledge.

Comment 1: A compelling indication of the effectiveness of this treatise would be to mention the possibility of intraluminal repair under jet ventilation with maximum aerosol exposure.

Reply 1: As far as I understand, the reviewer wants us to underline, that this successful treatment is possible for the prize of maximum aerosol exposure. We tried to make that clear in the text: Discussion, Line 176: “Endoluminal repair was assessed to be the least

aggressive and best suitable intervention for this frail patient, albeit with the greatest risk for virus spread through aerosols from jet ventilation.”

Changes in the text: Endoluminal repair was assessed to be the least aggressive and best suitable intervention for this frail patient, albeit with maximum aerosol exposure from jet ventilation.

Reviewer C

This manuscript has been revised to address the comments from prior review. The revisions and responses to the initial inquiries provide significant clarity to an obviously challenging case. Notably, the authors have provided a detailed description of the initial tracheostomy placement and the technical challenges they faced given the unfavorable anatomy. This, in addition to her pre-existing diabetic co-morbidities and recent high dose steroid administration, provides a much clearer picture of her elevated risk of airway complications. However, it is also quite evident that tracheostomy was necessary to help facilitate ventilator weaning and the timing of trach was appropriate based on her modest ventilator requirements. Although pressure to minimize aerosolization and restrictive PPE may have also contributed to this complication, I would assume that this is the case with other COVID-19 patients requiring tracheostomy.

A couple of minor revisions to consider:

Comment 2: As described in the case report, the patient was diabetic with multiple associated complications (retinopathy, nephropathy), suggesting poorly controlled disease. This is a well-known risk factor for impaired wound healing, particularly with airway injury. I would emphasize this as a significant risk factor for TML during tracheostomy as well as the older injury that was suspected to occur during initial oral intubation.

Reply 2: Thanks for this helpful hint.

Changes in the text: In this case, poorly controlled diabetes with multiple complications and the presence of an older TML were additional risk factors at the time of tracheostomy. In summary, age, female sex, prednisolone treatment, complicated diabetes and local inflammation as general risk factors in combination with a local weak area from earlier TML and the use of a rigid cannula in unfavorable anatomical

circumstances contributed to this deleterious complication.

Comment 3: If the authors feel strongly that the restriction from PPE and pressure to minimize aerosolization were significant factors leading to TML, I recommend further discussion of the learning points gained from this case that can be applied to future cases (e.g. delaying trach until risk of viral transmission is acceptably low, restricting tracheostomy to experienced airway surgeons, etc...)

Reply 3: Thanks again for this important comment. We discussed the case in our M&M conference and concluded that delaying tracheotomy was not an option because there was uncertainty about the time until the patient would become negative. Unfortunately the tracheostomy was performed by an experienced surgeon who had 5 years experience after his qualification... But difficult anatomy is a reason to call for experienced stuff anyway.

Changes in the text: Line 177: As a consequence we would discuss delaying tracheostomy until the patient is virus negative and always call for experienced airway surgeons even for a simple tracheostomy.

I applaud the authors again on an innovative approach to a clearly challenging case.

Reference

1. Welter Stefan, Jacobs Jan, Krbek Thomas et al. A new endoscopic technique for intraluminal repair of posterior tracheal laceration. [J] .Ann Thorac Surg, 2010, 90: 686-8.