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Letter to the editor

Surgical tracheostomies in COVID-19 patients: A multidisciplinary approach and lessons learned

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ABSTRACT

Surgical tracheostomies have a role in the weaning process of COVID-19 patients treated in intensive care units. A multidisciplinary team approach (MDT) is required for decision making. This process is augmented by specific standard operating practices implemented by senior clinicians. Here, we report on our early experience and outcomes with open tracheostomies in a cohort of COVID-19 patients. We outline the criteria that guide decision making and explore the challenges faced by our intensive care colleagues in the management of these patients. The cohort was 100% male with 90% of them having a raised Body Mass Index (BMI) and other comorbidities (hypertension and diabetes), 60% have been decannulated and have been stepped down the intensive care unit. We recorded no surgical complications or adverse events. The service to date has been shown to be effective, safe, largely reproducible and reflective.

Introduction

As the COVID-19 pandemic evolves, it is evident that around 6% of the patients will require ICU admission [1–4]. Around 75% of those will need invasive ventilation [4], and approximately 10% will require ventilation beyond 14 days [5–9]. Undoubtedly, some patients will benefit from a tracheostomy during the weaning recovery phase. A tracheostomy is an aerosol generating procedure with a significant viral spread risk. Identifying who will benefit from it and developing safety procedure protocols requires clear selection criteria [10].

Details around operating protocols have been simultaneously published by our team [11] and an Italian group [12]. The “CORONA-steps” [12] and the “5Ts” [11] cover the entire spectrum of a safe tracheostomy procedure.

Here we aim to share our outcomes in a cohort of COVID-19 patients that had surgical tracheostomies. We focus in selection criteria and outcomes, and share safety lessons-learned.

Methods

Case selection/decision-making

Decisions were made on a case-by-case basis (communication between ICU-OMFS). Decision-making was based on acute and chronic comorbidities such as acute kidney injury, obesity, anatomy, airway-related difficulties and ICU-related delirium/withdrawal. Prognosis (long-term, short-term) was also a decisive factor.

Most ICU patients were heavily sedated and dependent on benzodiazepines and long-acting opioid infusions; this increased the risk of sedation-related complications (withdrawal/delirium) during sedation holds and extubation attempts.

We developed selection criteria and summarise them based on an ‘ABCD’ algorithm:

A (Airway): Intubation for close to 14 days or more
B (Breathing): FiO2 < 40%, PEEP below 15

C (Circulation): Apyrexial, cardiovascularly stable, reducing inflammatory markers (WBC:Neutrophil ratio, CRP)
D (Disability): Tracheostomy requirement for weaning

Two negative tests for COVID-19 were not mandatory. Whilst ideal, the potential for false negatives and false positives (“Positive” PCR from dead virus) makes results unpredictable [13].

Post-tracheostomy decannulation criteria were:

1. 48h minimum unsupported spontaneous breathing
2. No signs of infection reactivation for 48h
3. GCS > 14
4. No signs of ongoing delirium
5. Verified safe upper airway access
6. Hemodynamic stability (no vasopressors/inotropes)

Our cohort consists of ten COVID-19 patients who underwent surgical tracheostomy in the weaning phase. Data were collected from case notes with appropriate institutional ethics.

Results

Patients profile

All patients were male (average age 57.3) (Table 1). Literature supports male predominance, but reaching 100% was surprising [14]. Nine patients had co-morbidities. Nine had a BMI greater than 30, (> 100 Kg, < 1.83 m). Eight had pre-existing hypertension and 5 had pre-existing diabetes [15].

Five patients developed renal failure/undergoing haemodialysis. All patients were intubated for a minimum of 11 days. Due to body habitus we used a size-9 adjustable flange tube in 7/10 patients. We aimed to minimise the risk of inadvertent decannulation. We had no incidents of dislodgement.

There were no significant intraoperative/immediate postoperative complications. Two patients experienced tracheostomy obstruction 72h
| Case No | Gender | Age | Pre- COVID-19 Comorbidities | Post-ARDS Medical Issues | No of days intubated (ETT) | Tracheostomy tube size | No of days post-tracheostomy | Weaned off sedation | Weaned off ventilator | Days to decannulation | Outcome (Ward Step-down/Discharge) |
|---------|--------|-----|-----------------------------|--------------------------|-----------------------------|------------------------|-----------------------------|---------------------|---------------------|---------------------|-------------------------------|
| 1       | M      | 40  | HTN, High BMI               | Renal Failure            | 19                          | 9 (Adjustable)         | 22                          | Yes                 | Yes                 | 17                  | Ward                          |
| 2       | M      | 76  | Nil                         | Renal Failure            | 16                          | 9                      | 22                          | Yes                 | Yes                 | Minimal pressure support |                             |
| 3       | M      | 63  | HTN, High BMI               | Renal Failure            | 11                          | 8                      | 19                          | Yes                 | Yes                 | 9                  | Discharge                      |
| 4       | M      | 62  | HTN, High BMI, Atrial Fibrillation, Type II DM, Hypercholesterolemia | Renal Failure            | 12                          | 9 (Adjustable)         | 18                          | Yes                 | Yes                 | 9                  | Ward                          |
| 5       | M      | 54  | HTN, High BMI               | Renal Failure            | 15                          | 8.5                    | 15                          | Yes                 | Yes                 | 7                  | Discharge                      |
| 6       | M      | 35  | Schizophrenia, Type II DM, High BMI | Renal Failure            | 16                          | 9 (Adjustable)         | 14                          | Yes                 | Yes                 | 12                 | Ward                          |
| 7       | M      | 49  | HTN, Type II DM, High BMI   | Renal Failure            | 16                          | 9 (Adjustable)         | 10                          | Yes                 | Yes                 | 8                  | Ward                          |
| 8       | M      | 60  | HTN, Hypercholesterolemia, High BMI | Renal Failure            | 27                          | 9 (Adjustable)         | 8                           | Yes                 | Yes                 | Minimal pressure support |                             |
| 9       | M      | 71  | HTN, Type II DM, High BMI   | Renal Failure            | 17                          | 9 (Adjustable)         | 9                           | Yes                 | Yes                 | 10                 | Ward                          |
| 10      | M      | 63  | HTN, Type II DM, High BMI   | Renal Failure            | 23                          | 9 (Adjustable)         | 2                           | Yes                 | No                  | N/A                | ICU                            |

HTN: Hypertension, BMI: Body Mass Index, DM: Diabetes Mellitus.

| Case No | Safety pitfall | Impact of error                           | Solution sought                               | Lesson learned                                   |
|---------|----------------|-------------------------------------------|-----------------------------------------------|--------------------------------------------------|
| 1       | None           | N/A                                       | N/A                                           | Segment 1: Communicate with team members          |
| 2       | Early patient transfer to theatre | Surgical team not donned | Surgical team scrubbed in the anaesthetic Room | Check team for communication                        |
| 3       | Malfunctioning inner radio | Impaired communication with outer team | Loud voice/signs | Improve communication with anaesthetic/transfer team |
| 4       | ET Tube advanced too far caudally | Single lung ventilation | Measure ET tube prior to proceeding | Check radio prior to procedure                        |
| 5       | None           | N/A                                       | N/A                                           | Improve communication with anaesthetic/transfer team |
| 6       | None           | N/A                                       | N/A                                           | Improve communication with anaesthetic/transfer team |
| 7       | 2 members of anaesthetic team to be at head end for ET tube manipulation | Loss of fluency of ET tube manipulation at a critical point | Number 11 blade to be used | Better direction to anaesthetic team |
| 8       | ET tube balloon pierced. Pt had a history of previous tracheostomy | Had to keep ventilator off and place tracheostomy tube immediately | Broader blade used to create window. Use an 11 blade | Broader blade used to create window. Use an 11 blade |
| 9       | None           | N/A                                       | N/A                                           | Segment 2: Communicate with team members          |
| 10      | None           | N/A                                       | N/A                                           | Segment 3: Communicate with team members          |
post-procedure. Both were treated with change of inner cannula and bronchoscopy. One tube cuff deflated at day 8 post-op; this tube was changed uneventfully.

Patients were able to wean-off sedation within 24h. All patients required bridging with alternative sedatives (dexmedetomidine, clonidine). Common symptoms observed during the awakening phase were mainly down to sympathetic hyperactivity (hypertension, diaphoresis, tachycardia and tachypnoea). The tracheostomy provided a safe airway during these symptoms. Supplementary medications were effective, without compromising spontaneous breathing.

Overall, we observed the following benefits:

(1) Reduction in ICU length of stay, releasing essential capacity
(2) Reduction in prolonged use of sedatives/analgesics
(3) Earlier spontaneous breathing
(4) Better bronchial toilet; less traumatic suctioning
(5) Faster delirium resolution
(6) Faster rehabilitation/physiotherapy
(7) More efficient use of nursing resources

Currently, 6 (60%) patients have been decannulated and stepped down on ward. Patients’ profile and outcomes are summarized in Table 1. In the context of a 12-bed ICU, this is a significant number.

Procedural pitfalls

After each procedure, the team would debrief and reflect. An action plan was introduced to prevent recurring issues (Table 2). We aimed to identify human factors contributing towards safety pitfalls. The surgical team remained relatively constant but there was a considerable variation in the anaesthetic/scrub staff. This lack of continuity reinforced the need for a robust SOP and good communication.

We also noticed that doing these cases on a CEPOD list takes longer. A potential solution to streamline the process might be for ICU units to consider a designated area in ICU for performing surgical tracheostomies.

Personnel follow-up

All personnel used appropriate PPE [11]. None of the staff involved developed COVID-19 symptoms post-operatively (Appendix). One member of the team self-isolated for 2 weeks as his wife tested positive for COVID-19. He subsequently tested negative. This endorses the safety of our protocol.

Appendix

See Table 3.

Table 3

| Team                      | Total Number | Developed Symptoms | Tested positive | Note                                                                 |
|---------------------------|--------------|--------------------|-----------------|----------------------------------------------------------------------|
| Scrub Team (Scrub Nurse and Runner) | 14           | 0                  | 0               |                                                                    |
| Anaesthetics (Consultant, Trainee, Anaesthetic Nurse) | 23           | 0                  | 0               |                                                                    |
| Surgeons                  | 6            | 1                  | 0               | Surgeon’s wife developed symptoms (also a health care professional) prior to surgeon and she subsequently tested positive for COVID-19. (Likely contracted via different route.) |
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