Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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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, 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 co-morbidities 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**)**. Lliterature 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

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Table 1
COVID-19 patient's medical profile and follow-up.

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	Minimal pressure support		
3	M	63	HTN, High BMI		11	8	19	Yes	Yes	9	Discharge
4	M	62	HTN, High BMI, Atrial Fibrillation, Type II DM, Hypercholesterolemia		12	9 (Adjustable)	18	Yes	Yes	9	Ward
5	M	54	HTN, High BMI		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		16	9 (Adjustable)	10	Yes	Yes	8	
8	M	60	HTN, Hypercholesterolemia, High BMI	Renal Failure	27	9 (Adjustable)	8	Yes	Minimal pressure support		Ward
9	M	71	HTN, Type II DM, High BMI		17	9 (Adjustable)	9	Yes	Yes		
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.

Table 2
Procedural safety pitfalls, solutions sought and lessons learned for future prevention.

Case No	Safety pitfall	Impact of error	Solution sought	Lesson learned
1	None	N/A	N/A	N/A
2	Early patient transfer to theatre	Surgical team not donned	Surgical team scrubbed in the anaesthetic Room	Improve communication with anaesthetic/transfer team
3	Malfunctioning inner radio	Impaired communication with outer team	Loud voice/signs	Check radio prior to procedure
4	ET Tube advanced too far caudally	Single lung ventilation	Measure ET tube prior to proceeding	Do not begin tracheostomy unless confirmation that ET tube is in appropriate position
5	None	N/A	N/A	N/A
6	None	N/A	N/A	N/A
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	Mandatory 2 members of anaesthetic team to be at head end at time of ET tube manipulation	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	Number 11 blade to be used	Broader blade used to create window. Use an 11 blade
9	None	N/A	N/A	N/A
10	None	N/A	N/A	N/A

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 personel 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
Staff Involved in relation to developing COVID-19 symptoms.

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.)

Discussion

Our early experience with surgical tracheostomies in COVID-19 patients, suggests that this procedure has a positive effect on their outcome. 70% of our patients are no longer ventilator-dependant and 60% have beendecannulated. This releases valuable resources (ICU beds, staff, ventilators) to those that need them. Moreover, is a safe procedure both for patients and staff, if a well-considered SOP is followed.

Our patients are chosen in a multidisciplinary setting, utilising the best available evidence. These patients tend to have high BMI and various comorbidities. We recognise the expanding literature and we react accordingly adjusting our practice. It is important to remain adaptable in challenging times. Recognising the importance of human factors has significant benefits in providing safe/effective service.

Our study has limitations. The sample size is low, but it reflects a significant % of our ICU capacity, translating into effctive use of resources. In addition, our cohort represents all of the patients undergone the procedure (no exclusions). Our study has no control group or experimental setting, as this wouldn't be appropriate, but data were kept in a prospective, protocol-driven fashion. Lastly, we haven't considered a comparison with percutaneous tracheostomies, as this is now considered a procedure with higher AGM transmission risk. Plus, none of our patients would qualify due to anatomy/obesity.

Conclusion

Surgical tracheostomy is an invasive procedure with potentially significant risks. Decision-making should be based on MDT consensus and with a protocol to get the maximum benefit whilst minimizing risk. Doing this in a carefully planned and executed manner with strict inclusion criteria has a positive effect for the patients and the team.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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