



Open Surgical Tracheostomy in COVID 19 Patients and Their Outcomes During the Second Wave in India: Experience at a Tertiary Referral Centre

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Abstract Tracheostomy in COVID-19 is a debatable topic, with guidelines and recommendations evolving with every wave. Tracheostomy can help early weaning and potentially increase the availability of ICU beds. The aim of our study was to determine the outcomes of patients undergoing tracheostomy at different timings. This was an ambispective observational descriptive longitudinal study of patients confirmed to have COVID-19 by real-time reverse transcriptase polymerase chain reaction (RT-PCR) admitted in the ICU and needed intubation for mechanical ventilation and underwent tracheostomy at a tertiary referral centre. This study was over a period of two months from May to June 2021. A total of 169 patients were admitted to the ICU for COVID-19 from May to June 2021 out of which 27 patients underwent

open surgical tracheostomy. Study included almost equal number of male and female patients. The most frequent comorbidities were hypertension and diabetes. The majority of patients were between 5th and 7th decades of life (59.2%; 16 patients). The common indications for tracheostomy were acute respiratory distress syndrome, failure to wean from ventilation, sedation management, difficult airway, and persistent airway oedema. Five patients (18.5%) underwent tracheostomy on day 8, the maximum number on a single day. The earliest tracheostomy was done on day 3 and the latest on day 17 with variable results. There were 6 survivors out of 27, youngest being a 27-year-old female and oldest a 60-year-old male. Our study showed that there was no association of age, sex of the patients and presence of comorbid conditions with the timing of intubation. Clinical outcome of the patients also was not affected by the any of the socio clinical variables viz. age, sex of the patient, presence of comorbid conditions and timing of intubation. Tracheostomy in COVID-19 is an aerosol generating procedure; strict recommendations and guidelines need to be followed.

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Introduction

Coronavirus disease (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a worldwide pandemic and the health care systems worldwide have been facing unprecedented challenges. The second wave in India had put a challenging demand on intensive care units (ICU) and hospitals. The patients requiring oro-tracheal intubation and prolonged invasive mechanical ventilation had increased enormously. The sudden surge in critically ill patients is a challenging situation in the ICU. Studies have shown that 10–17% of the patients with COVID-19

Table 1 Demographic details of patients undergoing tracheostomy

| Sl no. | Age | Sex | Co morbidity | CT scoring |
|--------|-----|--------|---------------------------|------------|
| 1 | 45 | Male | PRE DIABETES | 12 |
| 2 | 66 | Male | DM,HTN,IHD | 9 |
| 3 | 50 | Male | HTN | 17 |
| 4 | 57 | Female | NIL | 16 |
| 5 | 27 | Female | NIL | 15 |
| 6 | 72 | Male | HTN,DM,IHD | 14 |
| 7 | 47 | Female | HTN,DM | 22 |
| 8 | 61 | Female | HTN,DM | 17 |
| 9 | 53 | Male | DM | 25 |
| 10 | 56 | Female | HTN,IHD | 25 |
| 11 | 60 | Female | DM | 10 |
| 12 | 74 | Female | HTN,DM | 19–20 |
| 13 | 71 | Female | HTN | 14 |
| 14 | 58 | Male | HTN,DM,IHD,HYPOTHYROIDISM | 22 |
| 15 | 70 | Female | DM,HTN,IHD | 17 |
| 16 | 69 | Female | CKD | 17 |
| 17 | 28 | Male | NIL | 18 |
| 18 | 70 | Female | DM,HTN,HYPOTHYROIDISM | 8 |
| 19 | 60 | Male | DM,HTN | 16 |
| 20 | 65 | Female | DM,HTN,HYPOTHYROIDISM,CKD | 10 |
| 21 | 69 | Female | DM,HTN,HYPOTHYROIDISM | 14–15 |
| 22 | 20 | Female | MO, MODY | 16–17 |
| 23 | 60 | Male | DM,HTN | 18 |
| 24 | 40 | Male | DM,HTN | 17 |
| 25 | 51 | Male | HTN,CKD | 5 |
| 26 | 58 | Male | DM,HTN,CKD | 13 |
| 27 | 45 | Male | DM,HTN | 12 |

need mechanical ventilation with some patients requiring prolonged period of ventilation [1–3].

The role of tracheostomy in shortening the duration of ventilation and length of ICU stay in any patient requiring prolonged mechanical ventilation was considered beneficial before the COVID-19 era [4]. However, there is uncertainty about the role of tracheostomy in COVID-19 and no clear indication of the timing of tracheostomy after orotracheal intubation and weaning of mechanical ventilation in these patients.

Tracheostomy has several advantages, such as it decreases sedation requirements, facilitates airway suctioning, clearance of secretions and also prevents tracheal stenosis, avoids pressure induced trauma to both oral cavity and trachea [4, 5]. However, the role and timing of tracheostomy in COVID-19 patients is unclear as it is a high aerosol generating procedure, with risk for the safety of health care workers. Certain specific precautions need to be considered in performing surgical tracheostomy in reducing aerosolization though adjustments can be made during percutaneous tracheostomy to reduce aerosolization [6, 7].

The objective of our study was to describe the evolution of critically ill COVID-19 patients requiring invasive mechanical ventilation and tracheostomy and to make a note of the mean length of ICU stay and mean time to weaning. With every wave of COVID-19, guidelines keep changing based on the expert opinion and varied studies. Here we report our experience of tracheostomy in the management of COVID-19.

Materials and Methods

This was an ambispective observational descriptive longitudinal study of patients confirmed to have COVID-19 by real-time reverse transcriptase polymerase chain reaction (RT-PCR) admitted in the ICU and needed intubation for mechanical ventilation and underwent tracheostomy at a tertiary referral centre. This study was done over a period of two months from May to June 2021. COVID 19 patients above 18 years of age on prolonged mechanical ventilation and consenting for tracheostomy were included in the study.

Demographic data (age, gender), co-morbidities such as diabetes mellitus (DM), hypertension (HTN), ischemic heart disease (IHD), chronic kidney disease (CKD), chronic obstructive pulmonary disease, active cancer; CT scoring, mean time of invasive mechanical ventilation until tracheostomy, mean time from tracheostomy to weaning, and final outcome (discharge/death) were recorded (Table 1). The primary outcome measure was survival. Secondary outcomes included duration of ventilation and ICU stay. The decision regarding timing of tracheostomy, and the patients requiring the procedure was as per the multidisciplinary team (MDT) comprising of the intensivist, anesthesiologist, physician and otorhinolaryngologist handling the patient. Hence tracheostomy was considered in those patients requiring prolonged mechanical ventilation. Post tracheostomy patients were followed up till discharge from hospital which was generally 2–4 weeks. The institutional ethical committee clearance was obtained and those patients who underwent tracheostomy before the ethical committee clearance was obtained were included retrospectively and others prospectively making it an ambispective study. Informed consent for the study was taken. Data was analysed by frequency, percentage and Fisher exact test.

Methods

Open surgical tracheostomy was performed by 4 experienced otorhinolaryngologists along with intensivists and anesthesiologists who managed the endotracheal tube during the tracheostomy tube insertion and ensured that the patient was adequately sedated and paralyzed. Procedures were performed in personal protective equipment (PPE) with water-resistant gowns, caps, boots, double gloves, goggles and FFP3 masks with full face transparent shields. Tracheostomy was done bedside in the ICU, avoiding shifting the patient to the operating room.

Procedure

Vertical skin incision was preferred to keep the procedure quick, thyroid isthmus was retracted. To reduce aerosolization, complete paralysis was obtained. The trachea was incised between the 2nd and 3rd tracheal rings. A cuffed non-fenestrated tracheostomy tube was placed and confirmation of the correct tube placement was made by end tidal carbon dioxide (ET-CO₂) monitoring and chest movements. Auscultation was avoided. The tracheostomy tube was sutured to the skin at the end of the procedure to avoid displacement. During the procedure before pulling the endotracheal tube proximally and inserting the tracheostomy tube,

Table 2 Details of the patients who survived

| Sl no | Age | Sex | Co morbidities | CT scoring | ICU stay (in days) |
|-------|-----|-----|----------------|------------|--------------------|
| 1 | 50 | M | HTN | 17 | 11 |
| 2 | 27 | F | NIL | 25 | 15 |
| 3 | 56 | F | HTN,IHD | 25 | 32 |
| 4 | 60 | M | DM,HTN | 16 | 11 |
| 5 | 40 | M | DM,HTN | 17 | 10 |
| 6 | 45 | M | DM,HTN | 12 | 16 |

positive pressure ventilation was disconnected or paused and was resumed when the tracheostomy tube was inserted.

Results

A total of 27 patients underwent open surgical tracheostomy from May 2021 to June 2021. Patients undergoing the procedure were almost equally distributed; 13 male patients (48.14%) and 14 female patients (51.8%). A total of 169 patients were admitted to the ICU for COVID-19 from May to June 2021. The most frequent comorbidities were hypertension and diabetes. The majority of patients were between 51 and 70 years (5th–7th decade) of age; 59.2%, that is 16 patients. The common indications for tracheostomy were acute respiratory distress syndrome, failure to wean from ventilation, sedation management, difficult airway, and persistent airway oedema. The average time of intubation before tracheostomy, defined as the time from first intubation to tracheostomy, was 9 ± 4 days with a range of 3–17 days. Tracheostomies were performed by four different surgeons. Five patients (18.5%) underwent tracheostomy on day 8, and 14.8%, that is 4 each, on day 6 and day 4. The earliest tracheostomies were on day 3 where in 4 patients underwent tracheostomy, reasons being difficult to maintain sedation, difficult airway, and one patient developed surgical emphysema on proning. The rest of the patients underwent tracheostomies between day 10 and day 17. There were 6 survivors out of 27 patients, youngest being a 27-year-old female and oldest a 60-year-old male (Table 2). The highest CT scoring recorded was 25/25, in 2 females and both those patients recovered gradually taking 5–6 weeks till discharge. The lowest CT score was 5/25. The youngest patient who succumbed was a 20-year-old female with a CT score of 17, with morbid obesity (MO) and maturity onset diabetes of the young (MODY). The oldest patient who succumbed was a 74-year-old female with a CT scoring of 20 who had diabetes and hypertension. We have done tracheostomy as

Table 3 Association of socio-clinical variables with clinical outcome

| | Recovery | Death | <i>p</i> value |
|----------------------------|----------|-------|----------------|
| <i>Age</i> | | | |
| 20–49 | 3 | 4 | 0.317 |
| 50–79 | 3 | 17 | |
| <i>Sex</i> | | | |
| Male | 4 | 9 | 0.573 |
| Female | 2 | 12 | |
| <i>Comorbid conditions</i> | | | |
| Yes | 5 | 19 | >0.999 |
| No | 1 | 2 | |
| <i>Intubation</i> | | | |
| Early intubation | 6 | 12 | 0.125 |
| Late intubation | 0 | 9 | |

early as day 3 and as late as day 17 but the results were variable. Fisher exact test was applied to find out the association of socio clinical variables with time of intubation and clinical outcomes respectively. There was no association of age, sex of the patients and presence of comorbid conditions with the timing of intubation. Clinical outcome of the patients also was not affected by the any of the socio clinical variables viz. age, sex of the patient, presence of comorbid conditions and timing of intubation (Table 3).

Discussion

The most common indication for tracheostomy in an ICU setting is the need for prolonged mechanical ventilation and difficult weaning [8]. Studies have shown that early tracheostomy occurring within 10 days after intubation for mechanical ventilation was associated with decreased long-term mortality [9]. However, a systematic review and meta-analysis by Meng et al. [10] found no difference between early and late tracheostomy with regard to mortality or length of hospital stay. Hence, the results from the previous studies remain conflicting. With the era of COVID-19 there were a lot of controversies evolving around the need for tracheostomy and the timing of tracheostomy as it is considered a high aerosol generating procedure putting healthcare personnel at risk. The aim of our study was to analyze the effects of tracheostomy timing on patient mortality and survival. Study by Park et al. [11] also concluded that tracheostomy timing and technique (open tracheostomy versus percutaneous tracheostomy) were not associated with differences in patient survival, but late timing was associated with more tracheostomy related deaths.

In our study, primary extubation was the preferred option but for those patients who were expected to have slow

respiratory weaning or prolonged ventilation, tracheostomy was considered for weaning sedation and improving patient comfort and rehabilitation. In the first COVID-19 wave many guidelines based on expert opinion were published regarding the role of tracheostomy in COVID-19, which proposed avoiding tracheostomy before 10 days of intubation and to consider between 10 and 21 days after intubation [4, 12]. Tracheostomy within 14 days compared to more than 14 days was associated with a shorter period of ventilation in ICU stay which implies a short period from intubation to tracheostomy was beneficial [4]. The second wave in India caused a sudden overwhelming requirement for ventilators and ICU beds. Hence, the need for considering early tracheostomy was in order to reduce the overall length of time required on mechanical ventilation and ICU stay and maximize hospital ventilator capacity.

In the present study, open surgical tracheostomy was preferred over percutaneous as it is faster and most of the patients were on antiplatelet injections and could have a higher chance of bleeding necessitating surgical control. Tracheostomies were conducted bedside as shifting patients to the operating theatre had its limitations. We have summarized our experience in performing tracheostomy in 27 patients with a mean range of 3–17 days of intubation. The survival and recovery in each patient was unpredictable and we suggest tracheostomies could be considered within 10 days to reduce complications and early weaning from ventilation which in turn increases availability of ICU beds. Ventilated COVID-19 patients require prolonged continuous sedation, and tracheostomy can reduce sedation requirements which aids in earlier recovery and allows patients to return to oral alimentation and reduced delirium [4, 13, 14]. Among the MDT all were immunized and none of the clinicians developed COVID-19 symptoms. During the second wave in India all age groups were seen to be affected from 2nd to 7th decade and majority of the ventilator patients did not do well probably because of the mutated and virulent viral strain.

The limitation of our study was the small sample size ($n=27$) which makes it difficult to conclude. The exact timing of tracheostomy should be individualized. For critically ill patients on ventilator with adult respiratory distress syndrome (ARDS), waiting for 14–21 days is recommended before offering tracheostomy [15].

Conclusion

COVID-19 is an ongoing pandemic with guidelines evolving regularly. Tracheostomy being an aerosol generating procedure needs planning and specific guidelines to be followed. Clinical outcome of the patients also was not affected by any of the socio clinical variables viz. age, sex of the patient,

presence of comorbid conditions and timing of intubation. However, the 6 patients who survived all underwent tracheostomy within 10 days of intubation. This can also maximize the ventilator capacity and may help the healthcare personnel in planning for future COVID-19 pandemic surges.

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Availability of data and materials Data is available and will be presented if required.

Declarations

Conflict of interest Authors declare that they have no conflict of interest.

Ethical Approval This study was done after taking approval from the Ethical Committee of the Institution and is compliant with ethical standards.

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