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Original Research Article

An Analysis of Airway obstruction Registry in ICUs of a Tertiary Care Hospital during COVID Pandemic

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Abstract

Introduction: During the COVID pandemic in India many patients were under mechanical ventilation for a prolonged period requiring Tracheostomy to eliminate the physiological dead space. The timing, indications, and priority were not well followed due to the fear of aerosol spray and the spread of the virus. This study aimed at describing the clinical features, indications, and method of prioritizing Tracheostomy in patients with acute respiratory distress syndrome of COVID-19 disease.

Aim of the Study: To observe and analyze the clinical features of Acute Airway Obstruction patients and formulate the timing, protocol, and fix up the priority of undertaking Tracheostomy in ICUs of a Level-I COVID Hospital in Telangana.

Materials: 46 patients with airway obstruction admitted to ICUs during the COVID-19 pandemic were studied. Indications of Tracheostomy related and unrelated to COVID were included. Demography, clinical features, SOFA score, and APACHE II scores were noted. The predictive values of mortality by these scores were observed.

Results: Among 46 patients with COVID-19 and acute respiratory obstruction during the COVID-19 pandemic, 28 (60.86%) were males and 18 (39.13%) were females. The male to female ratio was 1.55:1. The mean age was 62.85± 4.10 years. Early tracheostomy at a mean of 08.55±3.25 days and late tracheostomy group at a mean of 18.35± 4.15 days were performed.

Conclusions: During the COVID-19 pandemic ICU admissions consisted of COVID positive in association with non-COVID-19 conditions. SOFA score and APACHE II scores were useful in predicting the outcome and reduced scores certainly indicated decreased mortality. Early Tracheostomies had a certain edge over the late Tracheostomies in hastening the recovery as well as preventing organ failure by improving the oxygen saturations and usage of little sedation.

Keywords: SOFA, APACHE II, Tracheostomy, ARDS, and COVID-19

Introduction

In India COVID -19 disease pandemic resulted in a large number of patients presenting with Acute Respiratory Distress Syndrome (ARDS) due to pathophysiological changes in both upper and lower tracheobronchial tree [1]. The COVID-19 disease in India was caused by coronavirus 2 (SARS-CoV-2) [2,3)]. Autopsies of COVI-19 patients had focal white patches in the tracheal and bronchial mucosa. These areas of ulceration showed histological ulceration and mixed inflammatory cell infiltration including neutrophils [4,5]. Large airway inflammation was observed in 92% of the COVID patients who were never intubated. These patients were either associated with parenchyma changes or without [6]. Microscopic pictures of lung parenchyma of COVID disease showed the frequent presence of airway inflammation and alveolar zones with hyaline membranes and type 2 pneumocyte (AT2 cell) hyperplasia [7]. Less commonly interstitial fibroblastic proliferation with fibromyxoid stroma, organizing pneumonia, squamous metaplasia, and alveolar wall acute inflammation was observed [8]. Organizing pneumonia, squamous metaplasia was seen in the lungs of patients with longer disease duration; a range of 5–34 days and 5–32 days, respectively [7] Airway obstructions have to be managed by skilled physicians in the ICUs to save the patients and prevent mortality [9]. Initial treatment with nasal oxygen moistened with high flow fails to manage hypoxia intubation is performed under emergency conditions [10]. High-flow nasal oxygen therapy was also used as an alternate method to ventilate the lung, but in the long run for prolonged periods intubation or Tracheostomy was more practical [11]. Tracheostomy is a commonly performed procedure in ICUs on critically ill patients requiring long-term airway management with mechanical ventilators [12]. Tracheostomy helps in eliminating the anatomical dead space of the trachea-bronchial tree and minimizes the dose of sedation required [13]. It also minimizes work for breathing, helps in weaning from ventilators, clears the airway with suction, and reduces the potential possibility of pneumonia [14]. There are many recommendations to guide the timing of Tracheostomy; one among them was by the UK and North America: They suggested a minimum period of 14 days from the day of intubation for airway obstruction for the viral load to decrease to a minimum and for the prognostic information to become evident [11] Whereas France recommended early Tracheostomy to enable weaning off also earlier and the patients could be shifted to the Tracheostomy weaning ward and making the ICU beds available [15]. In the present study, the aim was to observe and analyze the clinical features of Acute Airway Obstruction patients and formulate the timing, protocol, and fix up the priority of undertaking Tracheostomy in ICUs of a Level-I COVID Hospital in Telangana.

Materials

A prospective study was conducted at a COVID-19 designated Government Medical College Hospital. Telangana between June 2019 and May 2021. The Hospital was managing ICUs for the COVID-19-positive patients requiring critical care treatment. 46 patients with airway obstruction were treated in the ICUs of this Hospital during the COVID-19 pandemic. Most of the patients were referred from the Grade II COVID-19 Hospitals of Warangal District. All the COVID pandemic data submitted to the District Officials were collected and the present study was conducted. The institution cleared the ethics committee approval, the consent form, and the proforma.

Inclusion Criteria: Patients belonging to all age groups were included. Patients of all genders were included. Patients with COVID-19 positive RT PCR test were included. Patients' attendants accepting the decision of the physician to perform a Tracheostomy were included.

Exclusion Criteria: Patients' attendants were not willing to accept the decision of the ICU doctors for Tracheostomy, their patients were not included. All the data was collected in a standard proforma listing the indications for Airway intervention, Clinical status at the time of admission, and the status at the time of airway obstruction was noted. Clinical indications for emergency and elective Tracheostomy were noted dividing them as CIVID-related and non-COVID-related indications. Demographic details of the patients were recorded. It included age, gender, medical history, pulse, respiratory rate, oxygen saturation, and laboratory tests. APACHE II (Acute physiology and chronic Health Evaluation) scores at the time of admission and on the third day were noted. The sequential failure assessment scores (SOFA) were used to evaluate the chronology of deterioration and organ failure in the patients. The type of Tracheostomy, anesthesia used, procedure, timing after intubation, and complications were noted. In patients who survived the time taken for weaning, duration of Tracheostomy care, and duration of Hospitalization were noted. The final medical status at the time of discharge was noted.

Statistical Analysis

The numbers mean, standard deviation and percentages were used to denote the demographic details of the patients. Data related to the categories like Tracheostomy before and after 14 days were compared statistically using the student "t" test.

Results

Out of 46 patients who developed acute respiratory obstruction during the COVID-19 pandemic included in this study 28 (60.86%) were males and 18 (39.13%) were females. The male to female ratio was 1.55:1. The youngest patient was 41 years and the eldest patient was aged 72 years with a mean age of 62.85± 4.10 years. Patients belonging to the age group of 20 to 40 were 08 (17.39%), 40 to 60 were 23 (50%) and 60 to 80 were 15 (32.60%), (Table 1). Demographic data showed that there was no difference in the incidence between the two genders (Table 1), (statistically insignificant as p is <0.05) 40/46 (86.95%) patients had co-morbidities varying from Diabetes in 08 (17.39%), Hypertension in 11 (23.91%), B. Asthma in 14 (15.21%) and Chronic renal diseases in 04 (08.69%) patients.

Table 1: showing the demographic details of the study subjects (n-46).

Observation	Male- 28 (60.83%)		Female=16 (39.13%)		P value
	Number	Percentage	Number	Percentage	
Age					
20 to 40- 08 (17.39%)	04	08.69	04	08.69	0.231
40 to 60- 23 (50%)	14	30.43	09	19.56	
60 to 80- 15 (32.60%)	10	21.73	05	10.86	
Smoking					
Yes 12 (26.08%)	09	19.56	03	06.52	0.247
No 34 (73.91%)	21	45.65	13	28.26	

Socio- economic status					0.358
Low 16 (56.52%)	09	19.56	07	15.21	
Middle 15 (54.34%)	09	19.56	07	15.21	
High 15 (32.60%)	11	23.91	04	15.21	
Co-morbidities					
Hypertension- 11 (23.91%)	07	15.21	04	08.69	0.661
Diabetes Mellitus- 08	06	13.04	02	04.34	
(17.39%)	04	08.69	03	06.52	
Chronic Renal diseases- 07	08	17.39	06	13.04	
(13.04%)	03	06.52	03	06.52	
B. Asthma- 14 (15.21%)					
No co-morbidities- 06					
(13.04%)					

The various indications for which early and late Tracheostomy operations were done are shown in Table 2.

Table 2: Showed the different indications of Tracheostomy in the Study (n-46)

Early Tracheostomy- Indications	Number/ percentage 24 (47.82%)	Late Tracheostomy- Indications 22 (52.17%)
Acute Respiratory Distress syndrome	05 (20.83)	02 (09.09)
Lower respiratory Tract insufficiency	03 (12.5)	01 (04.54)
Emphysema	01 (04.16)	01 (04.54)
Pneumonia	04 (16.66)	02 (0.09)
B. Asthma	02 (08.33)	01 (04.54)
RTA	01 (04.16)	01 (04.54)
Consolidation	05 (20.83)	02 (09.09)
Acute Tracheobronchitis	01 (04.16)	02 (09.09)
Acute Laryngitis	01 (04.16)	02 (09.09)
Thyroid surgeries	--	01 (04.54)
Post-Abdominal surgeries	--	02 (09.09)
Cerebrovascular accidents	--	01 (04.54)
Laryngeal Edema	--	01 (04.54)
Maxillofacial trauma	--	01 (04.54)
Chest injuries	--	01 (04.54)
Hepatic coma	--	01 (04.54)
Diabetic coma	--	01 (04.54)
Organophosphorus poisoning	--	01 (04.54)

27/46 (58.69%) patients underwent Tracheostomy in this study before 14 days, and 19/46 (41.30%) patients after 14 days (Table 2). The mean duration between endotracheal intubation and tracheostomy in the early tracheostomy group was 08.55±3.25 days and in the late tracheostomy group, it was 21.35± 4.15 days. The duration in the early group was significantly shorter; the t value was -5.60476 (p-value <0.05). The SOFA scores were compared in both the early and late tracheostomy groups at the time of admission and at the time of tracheostomy and it was found to be significantly lower in the early group; the p-value was 0.032 and the t value was -2.31099. The APACHE II scores at the time of ICU admission time and at the time of

Tracheostomy were compared in patients of early and late tracheostomy groups. The APACHE scores were significantly lower in the early group than in the late group; the p-value was 0.028 and 0.031 respectively; the t value was -2.0188 (Table 3).

Table 3: Showing the incidence of Tracheostomies in the study and its indications (n-46).

Tracheo-stomies	No.	%	Mean Duration	SOFA score		APACHE II score	
				Admission time	Tracheostomy time	ICU Admission time	Tracheostomy time
Before 14 days	24	52.17	08.55±3.25	07	05	12	09
After 14 days	22	47.82	21..35± 4.15	08	06	17	12
P value	--	--	0.00001	0.032	0.041	0.028	0.031

Discussion

The present study was conducted with an aim to observe and analyze the clinical features of Acute Airway Obstruction patients and formulate the timing, protocol, and fix-up priority of undertaking Tracheostomy in ICUs of a Level-I COVID Hospital in Telangana. The male to female ratio was 1.55:1. There were 28 (60.86%) males and 18 (39.13%) females.

The youngest patient was 41 years and the eldest patient was aged 72 years with a mean age of 62.85± 4.10 years. Patients belonging to the age group of 20 to 40 were 08 (17.39%), 40 to 60 were 23 (50%) and 60 to 80 were 15 (32.60%), (Table 1). Demographic data showed that there was no difference in the incidence between the two genders (Table 1), (statistically insignificant as p is <0.05) 40/46 (86.95%) patients had co-morbidities varying from Diabetes in 08 (17.39%), Hypertension in 11 (23.91%), B. Asthma in 14 (15.21%) and Chronic renal diseases in 04 (08.69%) patients.

A review of the literature showed one study by Huang C, Wang Y *et al*. [16,17] mean age was found 49.25 years; Higher incidence among the 41-50 years age group (38.12%). The male-to-female ratio was observed as 1.85:1; both these observations were similar to this study. There was no difference in the indications for which early and late Tracheostomy was in this study (Table 2). Tracheostomy is regularly done in the ICUs whenever the patients develop acute respiratory distress or failure. It enables the physician to secure the airway and connect the patient to the mechanical ventilator. The merits and demerits of various indications vary from center to center and from physician to physician. In the present study, the commonest indication was ARDS in 07/46 (15.21%) patients followed by pneumonia in 06/46 (13.04%) patients (Table 2). Adly A, Youssef TA *et al*. ARDs was the commonest indication followed by Cerebrovascular accidents and cervical cord injuries.

In a study conducted by Olton *et al* [18] among all the patients, those who underwent Tracheostomy within 14 days showed the least predicted morbidity and mortality and also the ICU stay was shorter. In this study 24 /46 (52.17%) patients underwent tracheostomy within 14 days and 22/46 (47.82%) patients after 14 days. There were no complications during the period of tracheostomy and 05/46 (10.86%) deaths occurred. Complication rates as reviewed from the literature showed one study by Choudhury *et al*. [19] who reported

complication rates from 06 to 60% of the total Tracheostomies performed.

In a study by Mahmud *et al*. [20], complications were reported as 10% which included all emphysema being the commonest. The mean duration between endotracheal intubation and tracheostomy in the early tracheostomy group was 08.55±3.25 days and in the late tracheostomy group, it was 21.35± 4.15 days. The duration in the early group was significantly shorter; the t value was -5.60476 (p-value <0.05). The optimal time frame for undertaking a tracheostomy operation in ICUs still is controversial [21]. Also, it was dangerous to perform in COVID-19-positive patients due to the risk of spreading the Covid virus through aerosols. The viral load in the respiratory secretions falls after 14 days but it depends upon the severity of the COIVD-19 disease [22]. But delaying the timing of tracheotomy keeping in view the safety of the medical staff should be weighed against the critical status of the patient waiting for relief in airway obstruction [23].

The SOFA scores were compared in both the early and late tracheostomy groups at the time of admission and at the time of tracheostomy and it was found to be significantly lower in the early Tracheostomy group; the p-value was 0.032 and the t-value was -2.31099. The APACHE II scores at the time of ICU admission time and at the time of Tracheostomy were compared in patients of early and late tracheostomy groups. The APACHE scores were significantly lower in the early group than in the late group; the p-value was 0.028 and 0.031 respectively; the t-value was -2.0188 (Table 2).

Goldhill DR and Summer A opine that knowing decreasing SOFA scores helps the physician to predict the improved outcome and prompts aggressive treatment [24]. Cryer HG, Leong K, *et al.* [25] stated that as early organ failure sets in ICU patients, the SOFA scoring system helps in regular surveillance of organ function. They also showed that SOFA scores over 48 hours of stay of patients in the ICUs would provide a useful monitoring system of organ functioning. Hence a decreasing SOFA score could be used to predict decreased mortality from 50 to 27%. A study by Elzouki AN and Suliman S [26] reported in their patients admitted to ICUs with cirrhosis of the liver APACHE II scores were useful in predicting mortality. Few authors use APACHE II scores assessed in the first 24 hours and a few use APACHE II scores assessed on the third day as useful in predicting patient outcomes. Yoon *et al*. [27] also observed that the APACHE II score assessed on the third day had the highest prognostic value for predicting poor outcomes.

Conclusions

During the COVID-19 pandemic, ICU admissions consisted of COVID positive in association with non-COVID-19 conditions. SOFA score and APACHE II scores were useful in predicting the outcome and reduced scores certainly indicated decreased mortality. Early Tracheostomies had a certain edge over the late Tracheostomies in hastening the recovery as well as preventing organ failure by improving the oxygen saturations and usage of little sedation.

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