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Management of Respiratory Failure at Pulmonology unit in a Tertiary Care Hospital

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A B S T R A C T

Background: Respiratory failure is a common cause of in-hospital mortality. Its correct diagnosis along with the determination of underlying cause/s and appropriate treatment is important.

Objective: Objective of the resent study was to audit the management of Respiratory Failure at Pulmonology unit.

Methodology: This was an observational study conducted at the Pulmonology department of a tertiary care Hospital from 1st august to 31st October 2021. Medical records of all patients admitted with SpO2 < 92% were retrieved. Parameters of interest were the diagnosis of Respiratory failure, ABGs analysis, and proper oxygen prescription. BTS guidelines (2017) were considered as standard for comparison. Data were entered into SPSS 19. Percentages were calculated for diagnosis, type of respiratory failure, ABGs Analysis, documentation of Oxygen prescription, target SpO2, and delivery device. Mean and Std. deviation was calculated for age and mean sSpO2. The results were presented as graphs.

Results: A total of 100 patients' charts were reviewed. The mean age of patients was 48.8 (±19) years and among these, 45% were males. The initial SpO2 ranged from 45 to 91%. ABGs were taken in 87% of patients and the majority (64%) had type 1 Respiratory Failure. The correct diagnosis was mentioned in 82% of patients' charts. Oxygen was prescribed to 96% but the exact flow and target SpO2 were mentioned only in 33%.

Conclusion: Overall, the study identifies significant deficiencies in both oxygen prescription practices and diagnostic documentation in the management of respiratory conditions within the healthcare setting. Addressing these issues is crucial for improving patient outcomes and ensuring appropriate respiratory care delivery.

Keywords: Clinical Audit; Oxygen Therapy; Respiratory Failure

Introduction

The main function of the respiratory system is a gas exchange in which there is oxygenation of blood and elimination of carbon dioxide from the body. Respiratory failure occurs when this system fails in one or both of its gas exchange functions. It is not a disease by itself but rather a syndrome resulting from various pulmonary and non-pulmonary disorders leading to a high burden on respiratory and critical care units. [1]

It is categorized as type 1 respiratory failure (RF) when there is a problem with oxygenation only and types 2 when there is a problem with CO2 elimination with or without a drop in Oxygen level. Any lung disease involving the oxygen pathway ie. airways, alveoli, interstitium, or vascular compartment of the lungs can lead to type 1 RF. The mechanism may be either ventilation-perfusion mismatch, shunting, or abnormal diffusion of gases. Type 2 RF is a pump failure that occurs when there is insufficient ventilation of the alveoli failing the respiratory system to eliminate the CO2 that is being produced. Common causes of Type 2 RF include COPD, neuromuscular disorders, or drug overdose, just to name a few. [2]

The diagnosis of Respiratory failure is based on Arterial blood gas analysis. Type 1 RF is characterized by hypoxemia which is Pao2 (partial pressure of oxygen) lower than 60 mm Hg with a normal or low arterial PaCo2 (partial pressure of CO2). Type 2 RF is characterized by hypercapnia in which arterial PaCO2 level is above 50mm of Hg usually with a low Oxygen concentration. [3]

Hypoxemia is the major cause of organ dysfunction. Treatment of hypoxemia includes an uninterrupted oxygen supply with or without the application of mechanical ventilation. In addition, the underlying cause of respiratory failure needs to be determined to initiate the specific treatment according to the etiology of respiratory failure. [4]

Hypoxemic (Type 1) respiratory failure requires continuous oxygen to achieve a target oxygen saturation (94% -96%) which can be delivered via various delivery devices like a nasal cannula, face mask, or a reservoir mask. Lack of response to appropriate oxygen delivery may be an indication for other modalities such as CPAP, HFNC, or lastly ETT and invasive mechanical ventilation if severe and non-responsive to less invasive modalities. [5]

Hypercapnic (Type 2) respiratory failure requires oxygen delivery in a controlled manner which is usually delivered via a venturi mask to achieve a lower target oxygen saturation (88-92%) in addition to the treatment of the underlying medical condition. Non-invasive or invasive mechanical ventilation may be required as an adjunct to eliminate high levels of CO2 from blood. [6] Various guidelines are available to guide oxygen therapy and to deal with Respiratory failure. [7]

As respiratory failure is the major indication for hospitalization in our unit, we conducted this clinical audit to evaluate the adequacy of diagnosis and management of respiratory failure to highlight and then improve the shortcomings.

Objective

The present study was conducted with the aimed of clinical audit to assess the management of Respiratory Failure at Pulmonology department.

Operational definitions

1. Management of Respiratory Failure (RF): it included the documentation of diagnosis, ABGs analysis and oxygen prescription along with flow and target oxygen saturation.
2. Type 1 RF: ABGs showing PO2 less than 60 mm of Hg.
3. Type 2 RF: ABGs showing PCO2 more than 50 mm of Hg.

Methodology

This was an observational study conducted at the Pulmonology department MTI KTH from 1st august 2021 to 31st October 2021. Medical records of all patients admitted with respiratory failure due to any cause were included in the study after approval from the hospital audit committee. Parameters of our interest were the diagnosis of RF, its types, causes, and oxygen therapy via proper oxygen prescription, delivery device, flow/percentage, and target SpO2. BTS guidelines for oxygen therapy (2017) were considered as standard for comparison.

Background information: BTS guidelines recommend a proper diagnosis of Respiratory Failure based on ABGs analysis for all patients having SpO2 below 92% along with management via prescription of proper oxygen dose, target, and delivery. The target for type 1 RF is 94% to 96% and a lower range (88-92%) for type 2 RF. [4]

All patients' clinical records were reviewed and charts showing SpO2 less than 92% were evaluated for parameters of our interest as mentioned above. The data were collected in a pre-designed proforma. The patient's age, gender, initial SpO2, and source of admission were recorded. The information related to the diagnosis of RF, its types, causes, and whether ABGs have been taken or not were obtained from documentation anywhere in the chart not necessarily on the front pages. Similarly, oxygen prescription, flow, target SpO2, and delivery device were noted.

Data Analysis

Data were entered into SPSS 21. Frequencies and percentages were calculated for qualitative variables like gender, source of admission, adequacy of diagnosis of RF, ABGs has been taken or not, type of RF, Causes of RF, documentation of Oxygen prescription, target SpO2, delivery device, controlled oxygen supply in case of type 2 RF and application of BiPAP. Mean and Standard deviation was calculated for age, mean SpO2, and Length of stay in the hospital. The results were presented as graphs.

Results

A total of 100 patients' charts were reviewed. The majority (63 %) were admitted from casualty, followed by OPD (33%), and 4% were shifted from other units. The mean age of patients was 48.8±19 years. Among these, 45% were males. The initial SpO2 ranged from 45 to 91% with a mean of 85 (±6) %. ABGs were taken in 87% of patients and the majority (64%) had type 1 RF. The diagnosis of RF was mentioned in 82% of patients' charts.

The commonest underlying cause of respiratory failure was COPD (17%) followed by malignancy (15%) and bronchiectasis (11%). ILD including post-COVID-19 constituted 9%, while Bronchial Asthma contributed to 7% of the causes of RF as shown in figure 01.

Oxygen was prescribed to 96% but the exact flow and target SpO2 were mentioned only in 33% (Figure 02). The delivery devices included a Nasal cannula (45%), a Face mask (16%), a Venturi mask (36%) and a reservoir mask in 3% as shown in figure 03. BiPAP was applied to all (5) deserving patients. Length of hospital stay was 6.75 ±4.99. Majority of the patients (55%) were discharged stable, 33% sent home with oxygen support and 12% died.

Discussion

The outcome of Respiratory Failure (RF) depends on the nature of the underlying diagnosis and the quality of care provided in a health care facility. The diagnosis requires immediate initial assessment including finger pulse oximetry followed by arterial blood gas (ABGs) analysis in case of hypoxemia.

As the treatment is based on the type of RF, ABGs analysis and interpretation are mandatory to set the oxygen delivery method and the target SpO2 to be delivered. High-quality evidence from a systemic review of 25 RCTs (16037 patients) confirms that liberal oxygen therapy in acutely ill patients increases mortality and supplemental oxygen with SpO2 above the range of 94-96% might become unfavorable.[8]

Patients having type 2 respiratory failure particularly secondary to COPD are especially vulnerable to oxygen toxicity and a recent RCT suggests that mortality in this subgroup of patients was doubled when high flow oxygen was administered as compared to well-controlled oxygen

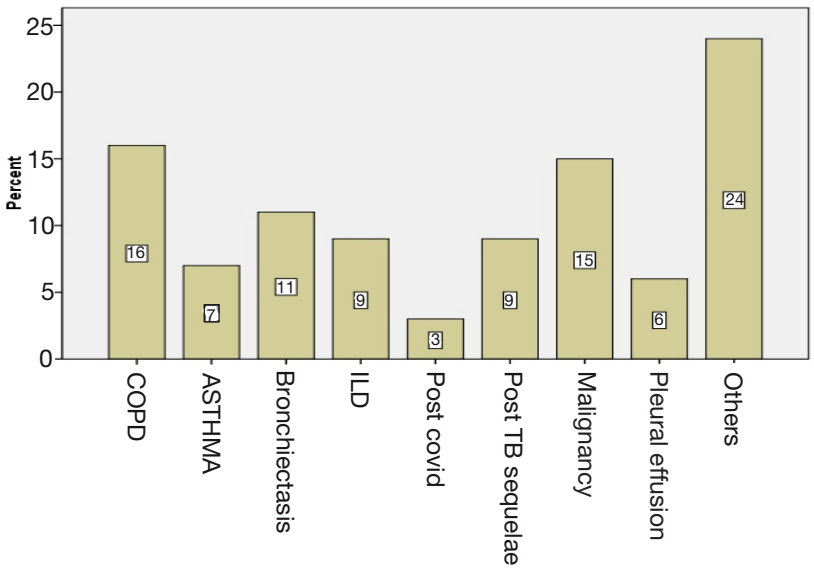

Figure 1. Various causes of Respiratory failure

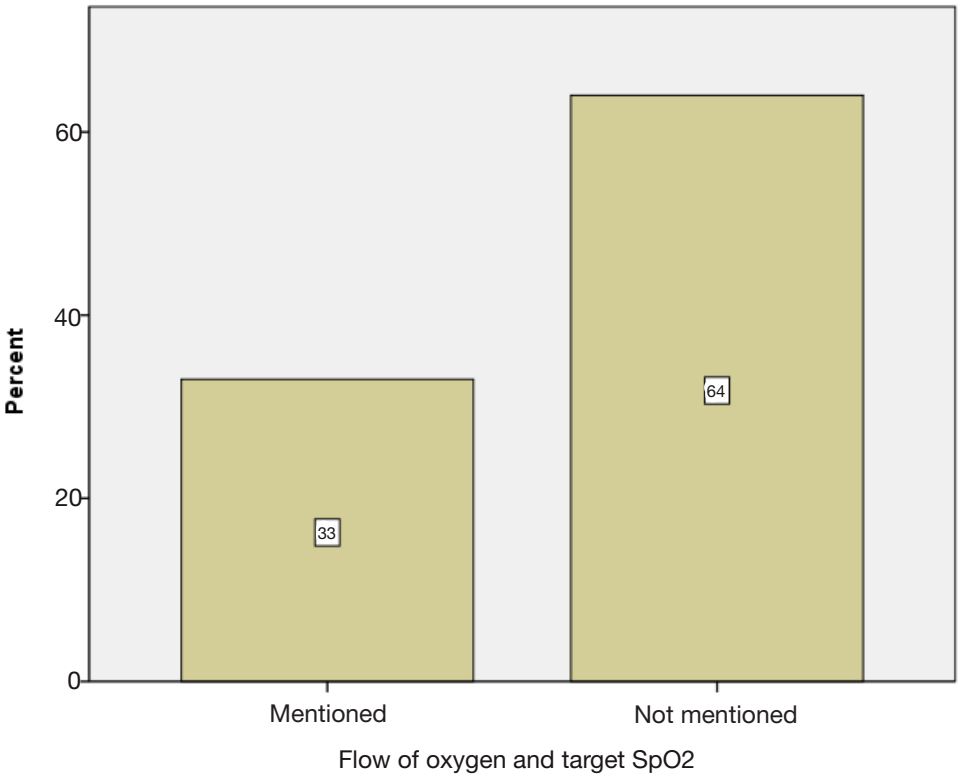

Figure 2. Oxygen prescription.

therapy.[9]

Our Audit showed that ABGs were performed in 87% of cases and 82% received a correct diagnosis of respiratory failure which is below the BTS standard. To our knowledge, no local data is available for comparison, however a similar diagnostic problem has been reported by other studies conducted abroad. According to one study, ABGs were performed in 90.8% of their patients and 54.5% had no diagnosis of RF while 33.3% received an incorrect diagnosis. Agreement between diagnosis of RF and ABG values was found to be insufficient in about half the cases.[10] Another study has shown the ABGs measurement in 81% of patients presented with the diagnosis of COPD.[11]

Moreover, 36% of our patients had type 2 respiratory failure and all were given oxygen via venturi device and those in need of BiPAP had received ventilatory support (5/5). The result is encouraging and this may be because we have the expertise and facilities available in our specialized unit.

Oxygen was prescribed to 96% of our patients on their charts while only 33% were showing SpO2 target documented, suggesting a wide gap with standards. The literature shows extremely variable results in various setups. One of the studies conducted in medical wards of New Zealand (2005) shows only 8% of patients receiving oxygen had it prescribed in their medication chart. Most of the oxygen prescriptions (75%) were inadequate which has the potential for serious clinical consequences.[12] Similarly, another study showed that only 61% of patients in RF were prescribed oxygen, 95% had a target SpO2 documented, and 63% had correctly received the target SpO2.[13] Another multicentre study showed 93.4% had the oxygen prescribed, 82.4% were fixed-dose, and only 11.6% had all the prescribed parameters documented. The absence of o2 therapy duration and monitoring were the most frequent errors.[14]

The wide variation in results may be due to the existence of a significant discrepancy in prescribing practices among various departments. According to one study, only 51.7% of all the patients had correct oxygen prescriptions. Among these, the respiratory unit performed the d best (77.5%) followed by the surgical department (52.5%) and other specialities (25%).[15]

Various interventions have been tried to improve oxygen prescription practices. A recent study (2021) from Qatar shows a lack of adherence to standard oxygen therapy prescription practices. The indications, target oxygen,

and duration of oxygen therapy were documented in less than half of the patients. Various education sessions, nurse-led reminders, and re-inforced teaching classes led to a significant improvement in safe oxygen prescriptions.[16]

Another study also suggests that education on oxygen therapy improved oxygen delivery to the patients admitted to a respiratory unit.[17]

Lastly, a review of eleven studies conducted from 200 to 2014 showed a significant post-intervention improvement in oxygen therapy prescriptions and delivery.[18]

Conclusion

Overall, the study identifies significant deficiencies in both oxygen prescription practices and diagnostic documentation in the management of respiratory conditions within the healthcare setting. Addressing these issues is crucial for improving patient outcomes and ensuring appropriate respiratory care delivery. Efforts should be directed towards enhancing documentation standards, providing education and training for healthcare providers on oxygen therapy protocols, and implementing quality improvement initiatives to optimize respiratory care practices.

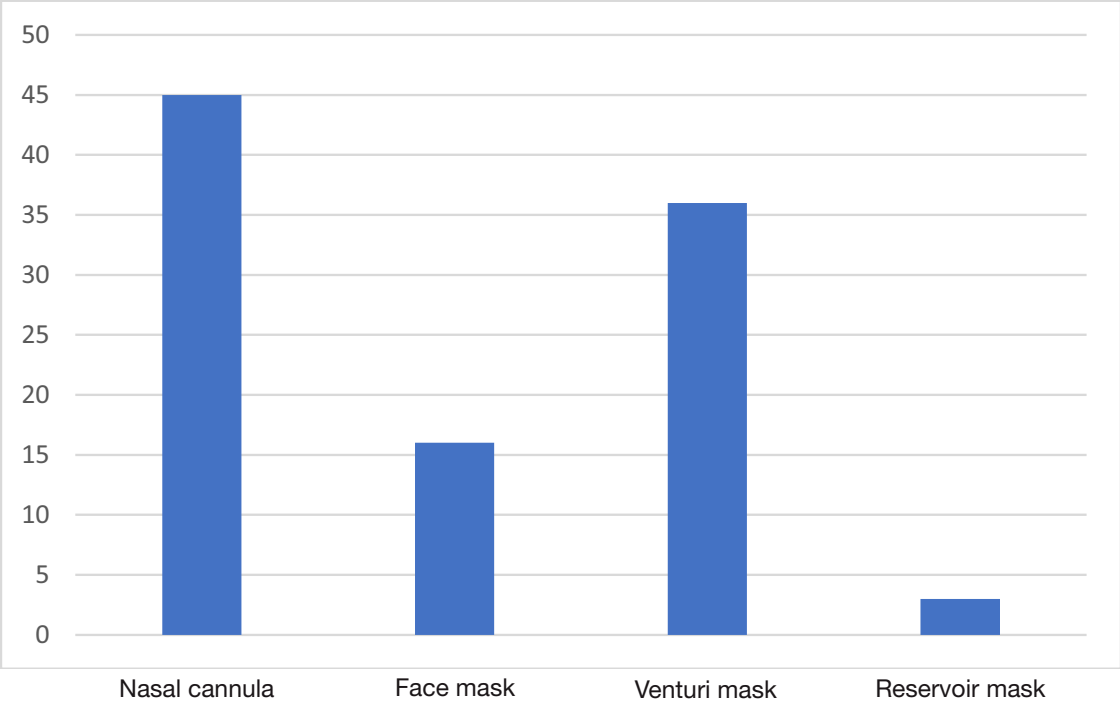

Figure 3. Oxygen delivery devices used (%) in management of RF.

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