

Acute shortage of Oxygen in COVID- 19 Pandemic: Contributing factors, Oxygen Prescription Vs Consumption and way forward for rational use

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Abstract

Oxygen administration is an important aspect in the treatment management of COVID 19 patients. The second wave of COVID-19 pandemic hit the South-Asian countries hard, particularly India, where COVID-19 cases increased at an unprecedented rate. As the number of cases continued to rise exponentially, scarce hospital resources already running thin, and critical care units were overburdened. As oxygen therapy is the cornerstone of management for patients with moderate and severe COVID-19, rational use of oxygen during the crisis cannot be overemphasized. Procurement, maintenance of oxygen supply system, coupled with avoiding misuse and wastage of oxygen is of paramount importance to better utilize the scarce resources amidst the peaks of a pandemic.¹ This study was conducted to assess the factors contributing in acute shortage of oxygen and wastage of oxygen at actual delivery point i.e. the

bedside of the patient and strategies to prevent wastage were developed.

Access to oxygen therapy and only one-fifth of patients who needed medical oxygen received it.² This further highlights the need of multi centric interventions for judicious use of oxygen. It is not unknown that India faced a severe oxygen crisis during the second wave of the Pandemic. A study led by the Indian Institute of Technology (IIT)-Kanpur claims that around 10-15 per cent oxygen wastage could have been avoided by hospitals during the second wave in Uttar Pradesh. The study was conducted in 57 medical colleges across the state and found that wrong use of oxygen-related equipment and leakage from oxygen masks or nozzles. The study mentions that this wastage could have been avoided if the health care staff was more careful².

On this basis, oxygen wastage was observed at multiple locations hence consumption of oxygen audit was conducted with following objectives:

Keywords: COVID 19, Oxygen, pandemic

Introduction

Medical oxygen is a critical component in the treatment of COVID-19 affected patients. Consumption of oxygen was of vital importance during COVID 19 pandemic. Rational use of oxygen needs comprehensive interventions, especially in countries like India and other Asian countries where indigenous production of oxygen is not adequate to meet the current medical demand. Nearly 20% of patients with COVID-19 require hospitalization for oxygen therapy.¹ According to one estimate, even before the pandemic, nine in ten hospitals in low- and middle- income countries (LMICs) lacked

Objectives

1. To assess contributing factors for acute shortage of oxygen in covid-19 pandemic.
2. To assess the oxygen prescription vs oxygen consumption
3. To prepare the strategic plan for rational use and prevention of wastage

Methodology

Study was conducted with descriptive exploratory approach at dedicated COVID-19 hospital wherein average daily occupancy of covid patient was 300-350 patients. Daily consumption of oxygen of entire hospital were calculated progressively. Oxygen consumption by using different oxygen devices for invasive ventilation (IMV) or Non-Invasive mechanical ventilation (NIV, HFNO) along with oxygen delivery by nasal canula, simple oxygen mask, reservoir bag were calculated for entire hospital daily.

Daily supply vs demand was noted with factors contributing to delay or inadequate supply. Different

factors affecting on maintaining oxygen pressure was assessed.

To understand the pattern of oxygen prescription vs consumption 123 COVID 19 patients on oxygen were assessed for prescription (requirement) and actual consumption of oxygen (flow) by simple random method. Patients on invasive and noninvasive ventilators were excluded and only patients who received oxygen with flowmeter were included in the study. Record of prescription was verified from patient case record and compared with actual flow of oxygen at the patient bedside. Gaps were evaluated and different factors affecting were noted. Data was collected from five different COVID 19 care areas.

Results

Analysis revealed that followings are the factors associated with acute shortage of oxygen and wastage of oxygen at the bedside.

1. Acute gap in Supply vs Demand
2. Delay in supply due to heavy workload on liquid O2 supplier which was managed in with routine skilled manpower like vehicle drivers and other arrangements of transportations.
3. Oxygen pressure fluctuations at user end due to sudden rise in demand at end point.
4. Inadequate knowledge to the patients regarding prevention of wastage.
5. Lack of monitoring by hospital staff due to heavy workload and manpower shortages.
6. Oxygen mask was left open by the patients while performing activities such as food consumption, usage of washroom facility, etc.

The findings related to oxygen prescription vs consumption revealed that, the prescription of 47 (38%) patients did not match the actual flow of oxygen resulting into average wastage of oxygen 2 liter/min/patient (2 X

47 X 60 X 24) 1,35,360 lit of oxygen was wasted in 24 hours. In view of increasing number of patients requiring oxygen overall consumption of the hospital was increased from 3.5 MT to 7.5 MT.

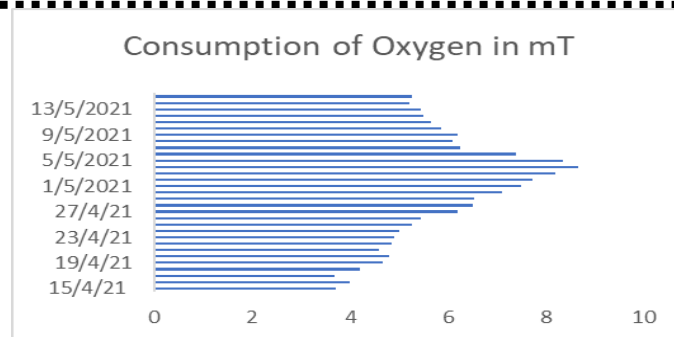
Action implemented

1. Discouraged the use of high O₂ consumption devise such as “High frequency nasal oxygen”(HFNO)
2. Rational segregation of all ventilators devises at all over the hospital to maintain the pressure equilibrium across the hospital.
3. Use of predefined number of oxygen devises at different critical care areas to manage the oxygen pressure.
4. Arrangement of back-up system by performing MOU with other hospital to provide emergency aid in situation like “Non Availability of oxygen” or leakage of oxygen like issue.
5. Education to the patient in all three shifts by hospital staff with loud announcement regarding prevention of wastage.
6. Daily surveillance by in charge nurses for consumption VS prescription.
7. Display of patient education material at each bed end.
8. Announcement on PA system regarding judicious use of oxygen.

After 15 days of implementation of above intervention, data was reassessed and findings concluded that:

1. Prescription Vs consumption did match the actual flow of oxygen with 85% of patients with reduction of overall oxygen requirement from 5.6 MT to 5.2 MT. (During reassessment number of patients were increased drastically)

Graph 1:



Key recommendations for nursing care of oxygenated patients

- Discourage the use of High frequency nasal oxygen machine (HFNO) during acute shortage.
- Oxygen pressure monitoring gauge at different locations of hospital for early identification of oxygen leakage.
- Arrangement of back-up and emergency support from other stake holders.
- Frequent testing of back-up and emergency support through mock drills
- Oxygen Flowmeters must remain turned off at all times except when in use
- Masks must not be left on beds with flow meters left open.
- Hospital staff must be aware of the importance of this as there are two consequences arising from failure to turn off the flow meters when not in use like fire or explosion risk and wasteful and costly discharge of Oxygen.

Conclusion

Interventions were found to be effective in reduction of oxygen consumption and elimination of factors affecting on poor oxygen consumption during acute shortage of oxygen. As the world has been gearing up for the subsequent wave of pandemic it is of prime importance that we prevent the wastage of oxygen which is one of the important treatment modalities for management of moderate to severe cases of COVID 19.

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