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ORIGINAL ARTICLE

Audit on Oxygen prescription and administration in adult inpatient wards at Mater Dei Hospital

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Background

Oxygen is one of the most common therapeutic agents utilised in both hospital emergency department (ED) and medical wards, therefore correct administration is paramount. The primary aim of this audit was to assess current local implementation of guidelines on oxygen prescription in the ED and medical wards, along with adequate documentation in treatment charts or plans.

Methods

This audit involved data collection for a total of 5 weeks (in the months of November 2021 to December 2021) from patients who were being assessed at ED and then subsequently admitted to medical wards in Mater Dei Hospital (Malta).

Results

300 patients were recruited over the period of 5 weeks, all having a presenting complaint of 'shortness of breath'; oxygen was administered to 82.7% (n=248) of patients. 260 were given a plan on oxygen administration, out of whom 253 had an oxygen prescription written in the management plan (only 92 also had documentation on the treatment chart as well).

Regarding the oxygen delivery being delivered in the ward, only 163 (62.7%) matched with the latest plan, whilst 86 (33.1%) did not match and 11 (4.2%) were started on NIV. When comparing the data to the audit performed in 2011, the greatest differences were regarding the lack of oxygen prescription in the treatment chart (35.4% in this audit, compared to 51.8% previously) and correct oxygen administration, being much higher (62.7%) when compared to the older values (7.1%).

Conclusion

Oxygen should be clearly mentioned in management plans and correctly written on treatment charts, the lack of which could lead to inappropriate oxygen administration. A designated oxygen prescription sheet could be utilised for possible improvements.

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Oxygen is one of the most common therapeutic agents utilised in both hospital emergency department (ED) and medical wards. According to the British Thoracic Society guidelines[1], oxygen should be prescribed on concentrations adequate to achieve target saturations of 94-98% for acutely ill patients, or 88-92% in those patient who are at increased risk of hypercapnic respiratory failure. Therefore appropriate prescription, Oxygen Saturation (SpO_2) charting, and management of oxygen delivery is very important as both hypoxia and excess oxygen supply may be harmful.

The primary aim of this audit was to assess current local implementation of guidelines on oxygen prescription in the ED and medical wards, along with adequate documentation in treatment charts or plans. This served to identify any relationship between good documentation of prescribed oxygen in treatment charts and eventual correct oxygen delivery.

MATERIALS AND METHODS

This audit involved data collection for a total of 5 weeks (in the months of November 2021 to December 2021) from patients who were being assessed at ED and then subsequently admitted to medical wards in Mater Dei Hospital (Malta). The data was audited in accordance with British Thoracic Society guidelines, collected through review of treatment charts, notes at the emergency department and the patient's file once admitted in the medical ward, along with assessment of the actual oxygen delivery in the ward setting.

A self-constructed data collection form was used to maintain full confidentiality and no possible patient identification. The data collected was then compared to international data and previous audits carried out locally[2,3] with the aim of improving local guidelines on oxygen prescription and delivery.

An anonymized data set was kept on a private Mater Dei Hospital intranet network which can only be accessed using an authorized government account. Only investigators were able to access the data collected and this was kept until statistical analysis was performed and was deleted once analysis was performed.

The patients were not contacted at any stage of the data collection, analysis and study reporting.

The data included:

- Age
- Gender
- Admission date
- Diagnosis
- Smoking History
- Admission Ward (Medical/Surgical)
- Admission on Normal Bed/Telemetry/Monitor
- SpO_2 at ED (on Room Air and on Oxygen)
- Arterial Blood Gases at ED (on Room Air or on Oxygen)
- Oxygen delivery at ED (type of mask used and flow rate)
- Oxygen prescription in management plan
- Whether there was Oxygen prescription in treatment chart
- Whether there was SpO_2 charting ordered in admission plan
- Ward oxygen administration (mask used and flow rate)
- Repeat Arterial Blood Gases ordered

The following were the inclusion criteria included in the dataset:

- Patients admitted to medical inpatient wards with the following conditions (and had a presenting complaining of 'Shortness of Breath'):
  - Exacerbation of congestive heart failure
  - Acute Coronary Syndrome
  - Asthma exacerbation
  - COPD exacerbation
  - Pneumonia/ Bronchitis
  - Pleural effusions
  - Pulmonary Fibrosis
  - Lung Malignancy
  - Pulmonary Embolism
  - Shortness of Breath (SOB) requiring oxygen.

The following exclusion criteria were applied:

- Patients admitted to intensive care unit (ICU)
- Patient with age less than 16 years
- Patients positive for SARS-CoV-2

RESULTS

300 patients were recruited over the period of 5 weeks, all having presenting complaints of "shortness of breath". Table 1 shows the different

Table 1 *Diagnoses of patients along with frequency of SpO2 documentation at the ED*

Diagnosis	% of Total Patients	SpO_2 Documented (% of patients)
ACS	0.3% (n=1)	1 (100%)
Asthma	8.7% (n=26)	24 (92.3%)
CHF Exacerbation	30% (n=90)	84 (93.3%)
COPD Exacerbation	21.3% (n=64)	48 (75%)
Lung Fibrosis	2% (n=6)	4 (66.7%)
Lung Malignancy	1.7% (n=5)	5 (100%)
Pulmonary Embolism	2.7% (n=8)	7 (87.5%)
Pleural Effusion	1.7% (n=5)	5 (100%)
Pneumonia	25.7% (n=77)	67 (87%)
Unclear Diagnosis	6% (n=18)	17 (94.4%)
Total Number	300	262

ACS: Acute Coronary Syndrome, CHF: Congestive Heart Failure, COPD: Chronic Obstructive Pulmonary Disease

diagnoses in this patient group as well as the frequency of whether SpO_2 was documented at the ED

Figure 1 summarises SpO_2 documentation at the ED on whether there was specification of the oxygen delivery device or if taken on room air; a total of 262 patients had this documentation in their notes.

Oxygen was administered to 82.7% (n=248) of patients, out of whom 83.9% (n=208) had an arterial blood gas (ABG) taken. With regards to the patients who had an ABG taken, 60 (28.8%) were on room air, 139 (66.8%) were on oxygen and in 9 (4.3%) this was not specified. Hypoxaemic (type 1) respiratory failure was predominant in ABGs comprising 73.6% (n=153) of results, with hypercapnic (type 2) respiratory failure evident in 23.1% (n=48) and normal values in 3.4% (n=7).

A total of 248 (82.7%) patients were administered oxygen at the ED, 238 of whom (96%) had oxygen flow rate documented in the "treatment given" section of the notes, 4 (1.6%) were given nebulisers only and 6 (2.4%) had no documentation at all. 11 patients (4.4%) were given oxygen when this was not indicated, the latter was determined by the presence of an SpO_2 on room air of more than 94% (or more than 88% in hypercapnic respiratory failure).

With regards to oxygen prescription, 260 were given a plan on oxygen administration, out of whom 253 had an oxygen prescription written in the management plan. As demonstrated in **Figure 2**, from the latter 253 patients, only 92 also had documentation on the treatment chart as well. Seven patients had documentation on the treatment chart only.

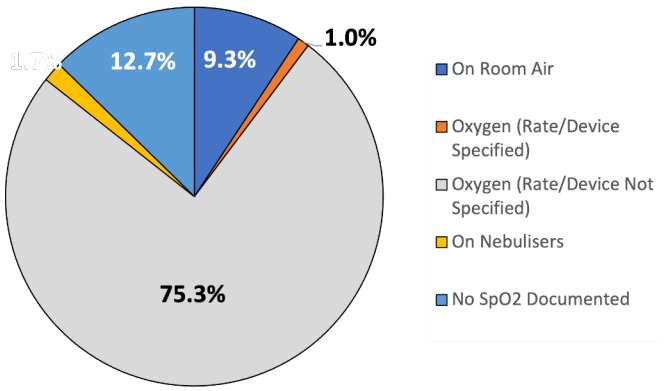

Figure 1 *Documentation of SpO2 depending on oxygen delivery device or on room air (at the ED)*

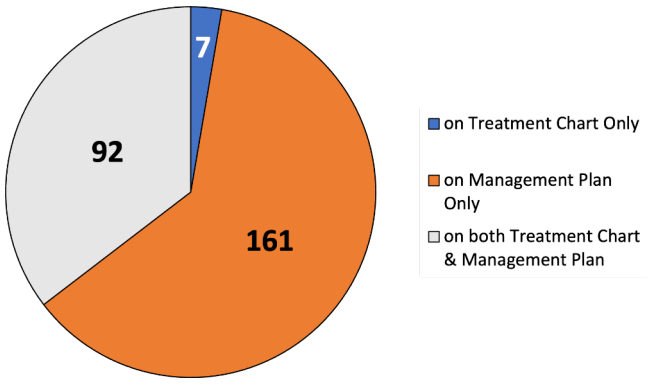

Figure 2 *Oxygen prescription documentation, demonstrating the number of patients in each*

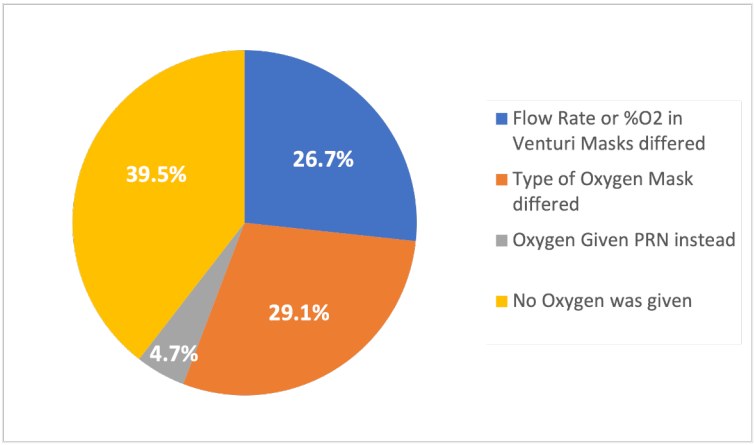

Figure 3 *Patients whose Oxygen delivery was not matching with the last management plan and/or treatment chart*

283 (97.7%) patients had SpO_2 monitoring as part of their management plan, and in 58 (19.3%) repeat ABGs were requested.

When comparing those 260 patients who had an oxygen administration plan (in the latest management plan and/or treatment chart), and the oxygen delivery being actually delivered in the ward, only 163 (62.7%) matched, whilst 86 (33.1%) did not match and 11 (4.2%) were started on NIV in the ward. The reasons for why those 86 patients' oxygen delivery did not match to the latest prescription is summarised in Figure 3.

DISCUSSION

In the data collection period for this audit, the majority of the cohort were admitted for CHF exacerbation, COPD exacerbation and pneumonia (in total comprising 231 patients, therefore 77% of the total). Indication for oxygen was defined as the recording of an SpO_2 on room air of less than 94% (or less than 88% in those who had a history of chronic hypercapnic (type 2) respiratory failure); a total of 248 (82.7%) patients were administered oxygen. 11 of the latter (4.4% of those given oxygen) did not have an indication for oxygen, but this was still unfortunately administered; whilst the number may seem low, it should be clear that both hypoxia and hyperoxaemia are related to increased mortality(4), the latter of which is less often recognized.

Documentation is paramount in inpatient management, especially in the acute setting. Regretfully from the data collected during this period, 38 patients (12.7%) had no documentation of saturations prior to admission to an inpatient ward; this could have led to an inaccurate representation of whether patients had oxygen indicated or not from the initial time of their admission. More so, from the patients who had a documented SpO_2, in 75.3% (n=226) this was taken on oxygen with no flow rate or device being specified, whilst only 3 patients (1%) had a specified mask or rate whilst on oxygen. Only 28 patients had documentation of SpO_2 while on room air.

Titration of oxygen could be done only if there is proper documentation of the flow rate and delivery mask from initial assessment, especially in those who had arterial blood gases obtained (n=208). In reference to the latter, 9 patients (4.3%) had no documented oxygen flow rate which was administered at the time of sampling. Data was however better with regards to the documentation of oxygen flow rates and devices in the section where "treatment given" was written, with 96% (n=239) being documented.

It is clear that more attention needs to be addressed with regards to oxygen prescription in treatment charts, with only 99 patients (38.1% of those who were prescribed oxygen for the inpatient stay) having this. Clear Oxygen prescription in both treatment charts and management plans would also allow nursing staff to administer oxygen more accurately, as evidenced by the data in this audit with 86 patients (33.1%) having a different oxygen prescription compared to the treatment chart and/or latest management plan (34 of these patients having no oxygen given). It is important to note that a reason for patients not being administered oxygen was possibly the fact that there was no clinical indication (that is having normal saturations on room air); however, this should be made clear by updating the latest management plan and treatment chart, since this would avoid inadequate administration of oxygen.

When comparing this data to a previous local audit performed in the same hospital with regards to oxygen prescription[2,3], values differed significantly. The audit performed in 2011[2] recruited 248 patients, compared to 300 patients in this audit. Table 2 summarises the differences in data when comparing the two audits.

Several striking differences can be noted when comparing the data to the audit performed in 2011, particularly the lack of oxygen prescription in the treatment chart (35.4% in this audit, compared to 51.8% previously). However correct oxygen administration was noted to be much higher (62.7%) when compared to the older values (7.1%), although this is still not ideal. Improvements such as having a separate prescription sheet for oxygen in the file of all patients admitted to hospital could lead to better outcomes, as well as possibly having a designated

Table 2 *The differences in data collected between an audit performed in 2011 and the current audit*

	Audit in 2011	Current Audit
Number of Patients	248	300
SpO2 documentation on admission	92.7%	87.3%
ABGs taken	93.5%	69.3%
Oxygen prescribed on treatment chart	51.8%	38.1%
Oxygen prescribed in management plan	34.1%	50.6%
Oxygen correctly administered in the ward	7.1%	62.7%

area for oxygen prescription in online documentation (which has become much more utilised from the ED since the start of the COVID-19 pandemic).

Several limitations can be identified, first of all having patients from a short period of time (5 weeks) and the fact that these were not randomly selected.

CONCLUSION

Oxygen should be clearly mentioned in management plans and correctly written on treatment charts, the lack of which could lead to inappropriate oxygen administration. A designated oxygen prescription sheet could be utilized for possible improvements.

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