Frequency of Undiagnosed Hypoxia in Patients admitted in Chest wards of Nishtar Hospital Multan using pulse oximeter

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Author Contributions

MWT TK MAM conceived idea, MWT MAM drafted the study, SP HGM AN collected data, MAM HGM did statistics analysis and interpretation, MAM AN critical review manuscript, All approved final version to be published

Declaration of conflicting interests

The authors declare that there is no conflict of interest.

Abstract

Background: Presence of hypoxia in hospitalized patients may prove as an indicator for any serious medical problem which may have severe outcomes. In most of the patients Clinical evaluation cannot detect hypoxia, and hence, it remains unnoticed/undiagnosed in the hospital settings. In hospital settings, Undiagnosed hypoxia can prove life threatening. Proper management of hypoxia depends upon early diagnosis. The detection of hypoxia is generally difficult and is usually ignored because the clinical signs and symptoms are non-specific and are related to different underlying characteristics.

Objective: Objective of the present study was to determine the frequency of undiagnosed hypoxia in patients admitted due to any medical illness in chest wards of Nishtar hospital Multan using pulse oximeter.

Methodology: This study was done Pulmonology Department, Nishtar Hospital Multan. A total of 309 study cases admitted in chest ward were registered in this study using non-probability consecutive sampling technique from 15-08-2015 to 15-02-2017. Informed consent was taken from each study participants and their Oxygen saturation levels were measured using pulse oximeter

Results: Of these 309 study cases, 183 (59.2 %) were male and 126 (40.8 %) were female patients with their mean age of our study cases was 42.13 ± 14.46 years 165 (53.39 %) were in the range of age groups 41 to 60 years. Mean duration of hospitalization of our study cases was 3.37 ± 1.97 days. Mean Oxygen saturation rate of our study cases was 93.98 ± 4.01 percent (minimum rate was 82 % while maximum was 103 %). Mean Heart rate of our study cases was 93.69 ± 18.02 per minute. Majority of our study cases were admitted in hospital due to Tuberculosis i.e. 104 (33.7%). Followed by those having chronic obstructive pulmonary disease 68 (22%), Pleural effusion 41 (13.3%), Interstitial lung disease 35 (11.3%), pulmonary embolism and pneumonia each 18 (5.8%) and asthma 25 (8.1%). In our study cases, Hypoxia was observed in 40 (12.9%), while it was absent in 269 (87.1%) of our study cases.

Conclusion: Higher frequencies of Undiagnosed Hypoxia have been observed in patients admitted in chest medicine wards of Nishtar Hospital Multan using pulse oximeter. Hypoxia was significantly more prevalent in male gender and with increasing age. Hypoxia was significantly more common in patients with COPD.

Key Words: Undiagnosed Hypoxia; Oxygen Saturation; Pulse Oximeter

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Introduction

Undiagnosed hypoxia can be fatal. Hypoxia may be the presentation of underlying critical medical condition. If not promptly diagnosed and corrected, can have its serious impacts in term of mortality and morbidity. Un-diagnosed hypoxia, which often remains un-treated, has already been reported among indoor patients from different hospital settings. In rural Zambia, higher prevalence of undiagnosed hypoxemia was reported among children and adults admitted at a district hospital.[1] Diagnosis of hypoxia remains often un-noticed due to non – specific clinical features and may be associated to various underlying conditions.[2] Symptoms of hypoxia varies from altered mental state, cyanosis, dyspnea, tachypnea, hypoventilation, arrhythmias, peripheral vasodilatation, systemic hypotension to gastrointestinal symptoms like nausea and vomiting. Clinical evaluation of patients is mandatory to suspect tissue hypoxia which must then be confirmed by pulse oximeter (hand held device used to check saturation of oxygen in arterial blood called SpO_2). Clinical evaluation alone is not sufficient to diagnose hypoxia with accuracy and reliability. So tissue hypoxia mostly remains misdiagnosed or undiagnosed in limited resources settings where we mostly rely on clinical evaluation. Pulse oximetry is the accepted standard for detection of hypoxaemia.[3] Pulse oximetry is highly cost effective and can accurately and reliably measure hypoxemia, identifying 20–30% more cases than do clinical signs alone.[4,5] Yet pulse oximetry is frequently unavailable in low-resource settings because of perceived cost, insufficient supply, and absence of policies, guidelines and training.[6] Pulse oximetry could transform the diagnosis of hypoxemia in low-resource settings, ensuring that oxygen is used efficiently and rationally, Easing timely referral decisions, reducing treatment failure rates, and decreasing health-care costs.[7] Role of pulse oximetry is well established in developed countries as the fifth vital sign in patients of all ages.[8] Some studies conducted in Papua New Guinea have already demonstrated that employment of pulse oximeter, oxygen concentrators and continuous training session regarding their benefits helped to reduce mortality in pediatric pneumonia.[9-11] Pulse oximetry is a technology that is used routinely for diagnosis of hypoxemia in high-income countries[12] and has been shown in large trials to be more effective than clinical judgment in the detection of hypoxemia.[13] In Pakistan, pulse oximeter is not available in all hospitals and where available, it is not a routine practice to use pulse oximeter in patients with suspected hypoxia, instead supplemental oxygen is provided which correct hypoxia but underlying serious disease remained hidden. Consequently the disease will drag this patient in to overwhelmed stage or complication. Countries like Pakistan cannot bear this extra burden of complications of diseases.

If admitted patients are routinely screened for hypoxia with pulse oximeter this extra burden on economy of country can easily be cutdown and mortality and morbidity can be curtailed. In the previous study[1] conducted in Zambia, Undiagnosed hypoxemia was reported in inpatients with 7.8% prevalence.[1]

To our knowledge very limited data is available regarding research on undiagnosed hypoxia in Pakistan. By conducting this study, we wanted to

Table 1. Stratification of Hypoxia with regards to pattern of diseases (n = 309)

Diseases	Hypoxia		P-value
	Yes	No	
	(n = 40)	(n = 269)	
Tuberculosis (n = 104)	03	101	
COPD (n = 68)	18	50	
ILD (n = 35)	04	31	0.001
Pleural Effusion (n = 41)	06	35	
Pulmonary Embolism (n = 18)	04	14	
Pneumonia (n = 18)	02	16	
Asthma (n = 25)	03	22	
Total	**40**	**269**	309

determine the frequency of undiagnosed hypoxia in patients that are admitted with any medical illness in chest wards of NHM, using pulse oximeter. Results of this study will help us to understand the burden of undiagnosed hypoxia in admitted patients which will enable us to emphasize the need for routine use of pulse oximeter in admitted patients along with their vitals in daily monitoring charts so as early recognition and treatment of critical medical diseases can be made possible. There is no such study conducted in our local population so the results of this study have generated useful database of our local population at National level. The findings of this study will also help our local researchers to plan their future more advanced studies on this topic.

Table 2. Stratification of Gender with regards to pattern of diseases (n = 309)

Diseases	Gender		P-value
	Male	Female	
	(n = 183)	(n = 126)	
Tuberculosis (n = 104)	53	51	
COPD (n = 68)	59	09	
ILD (n = 35)	18	17	0.000
Pleural Effusion (n = 41)	17	24	
Pulmonary Embolism (n = 18)	09	09	
Pneumonia (n = 18)	18	00	
Asthma (n = 25)	09	16	
Total	**183**	**126**	**309**

Methodology

Patients were selected from the chest wards of Nishtar hospital Multan. Patients admitted due to any medical illness in chest ward of either sex aged 20 – 60 years were included in our study. Already diagnosed respiratory failure patients, with B.P. less than 90/60 mm of Hg, patients on Inotropic support, patients on supplemental oxygen therapy, patients with co-morbid conditions like peripheral vascular disease, congestive cardiac failure, shock, septicemia and terminally ill (documented on previous record or bedside history sheet) were excluded from our study. Sample size is 309 patients that was calculated by Epi – info software of CDC using; Level of significance (95%), Anticipated population proportion (p) =7.81, margin of error (d) =3%. Informed consent was taken from patients or from the closest relatives (husband/wife/parents) for those who were unconscious. Demographic data like age, gender, weight, and either already diagnosed case of respiratory failure or not, were collected from bedside history sheet, in specially designed proforma. Patients fulfilling inclusion and exclusion criteria were included in study. Pulse oximeter (oximeter plus C21, Inc, Roslyn, NY) was applied on the right index finger and allowing the signal to equilibrate for 5 sec. When the waveform was of high quality and the saturation became stable for 5 s, the level was recorded. If the finger had nail paint it was cleared with help of nail paint remover and then pulse oximeter was applied. SpO_2 less than 90% was taken as alarming of impending hypoxia and duty doctor responsible was informed so that supplemental inhalational oxygen could immediately be provided to the patient. I measured my oxygen saturation level at the beginning of each day of data collection to serve as a control and confirmed that the oximeter was functioning properly. All measurements were obtained at rest. Data was entered using software SPSS version 18. Descriptive statistics was applied. Numerical data like age, hospital stay and rate of oxygen saturation have been described in terms of mean and standard deviation. The nominal data like gender and undiagnosed hypoxia, detected by pulse oximeter have been described as frequencies and percentages. Effect modifiers like age, pattern of diseases and gender were controlled by stratification. Post-stratification, chi square test was applied (at 0.05 level of significance, 95 %CI) to see the effect of these on frequency of undiagnosed hypoxia.

Table 3. Distribution of Oxygen saturation level with regards to Hypoxia (n = 309

Hypoxia	Oxygen saturation (%)		P-value
	Mean	Standard Deviation	
Yes	86.50	2.23	0.000
No	95.10	2.86	

Results

A total of 309 study cases admitted in chest medicine ward were included. Of these 309 study cases, 183 (59.2 %) were male and 126 (40.8 %) were female patients. Mean age of our study cases was 42.13 ± 14.46 years and 165 (53.39 %) were in the range of age groups 41 to 60 years. Mean duration hospitalization of our study cases was 3.37 ± 1.97 days (minimum duration was 01 day while maximum was 10 days). Mean Oxygen saturation rate of our study cases was 93.98 ± 4.01 percent (minimum rate was 82 % while maximum was 103 %). Mean Heart rate of our study cases was 93.69 ± 18.02 per minute (minimum 82 per minute while maximum was 103 per minutes). Majority of our study cases were admitted in hospital due to Tuberculosis i.e. 104 (33.7%). Followed by those having chronic obstructive pulmonary disease 68 (22%), Pleural effusion 41 (13.3%), Interstitial lung disease 35 (11.3%), pulomonary embolism and pneumonia each 18 (5.8%) and asthma 25 (8.1%).

In our study cases, Hypoxia was observed in 40 (12.9%), while it was absent in 269 (87.1%) of our study cases.

Hypoxia was stratified with regards to gender, age, pattern of diseases. When hypoxia was stratified with regards to gender, it was noted that it was seen in 27 male patients and 13 female patients and p-value was calculated to be p=0.302. Hypoxia was significantly associated with increasing age and it was more prevalent in age group 51-60 years of age (p=0.000). Moreover hypoxia was significantly more seen in the patients admitted in hospital due to COPD (p=0.001).

Discussion

Hypoxia has been reported to be a common entity and often remains undiagnosed, untreated and unnoticed among admitted patients.[1,2,14,15] Pulse oximeter has been reported to be a reliable indicator to measure oxygenation status of these patients, although certain limitations have been shown, such as in low cardiac output states, anemic patients and CO_2 retention. Varying rates of hypoxia from 7.8 % to 40 % have been reported from different population subsets 14 with higher proportions of hypoxia being reported in stroke patients.[16]

A total of 309 study cases admitted in chest medicine ward, were included in this study. Of these 309 study cases, 183 (59.2 %) were male and 126 (40.8 %) were female patients. Singh et al[2] reported 74 % male patients and 26 % female patients. Foran et al1 reported 52 % female patients while 48% male patients in their study, these findings are different from that of our findings.

Mean age of our study cases was 42.13 ± 14.46 years and 165 (53.39 %) were in the range of age groups 41 to 60 years. Foran et al[1] reported mean age of their study cases to be 24.3 years which is quite low than that of age of our study cases. The reason for this difference is due to their selection criteria which involves inclusion of children as well (age range was 1 month to 75 years).

Most of the authors[1,2,14,16] have reported in literature, the majority of patients with Oxygen saturation levels more than 90%. Mean Oxygen saturation rate of our study cases was 93.98 ± 4.01 percent (minimum rate was 82 % while maximum was 103 %). Our findings

Table 4. Distribution of duration of Hospitalization with regards to Hypoxia (n = 309)

Hypoxia	Duration of Hospitalization (In days)		P-value
	Mean	Standard Deviation	
Yes	3.49	2.04	0.004
No	2.53	1.17	

are in compliance with those of Foran et al[1] and Singh et al.[2]

Most of the studies conducted on the subject have been carried out in admitted patients of hospitals including all specialties while our study comprised of only those patients admitted in chest medicine. Other studies have reported varying frequencies of hypoxia in patients admitted in different wards. Foran et al[1] reported hypoxia in patients of tuberculosis and pneumonia. Majority of our study cases were admitted in hospital due to Tuberculosis i.e. 104 (33.7%), Followed by those having chronic obstructive pulmonary disease 68 (22%), Pleural effusion 41 (13.3%), Interstitial lung disease 35 (11.3%), pulmonary embolism and pneumonia each 18 (5.8%) and asthma 25 (8.1%). In our study results, hypoxia was significantly more prevalent in patients with COPD.

Various authors have reported undiagnosed hypoxia in hospitalized patients using pulse oximeter. In our study cases, Hypoxia was observed in 40 (12.9%), while it was absent in 269 (87.1%) of our study cases. A study conducted by Foran et al[1] reported 9% frequency of Hypoxia among adult patients admitted in hospital patients. Singh et al[2] reported 10.38 % frequency of undiagnosed hypoxia among all patients admitted in different wards of hospitals. Tariq et al14 reported 8.44 % undiagnosed hypoxia in admitted patients.

Authors have described hypoxia being more prevalent in male gender.[1,2,14] In our study, When hypoxia was stratified with regards to gender, it was noted that it was seen in 27 male patients and 13 female patients and p-value was calculated to be p=0.302. Singh et al[2] also reported hypoxia being significantly more prevalent in male patients.

Hypoxia was significantly associated with increasing age and it was more prevalent in age group 51-60 years of age (p=0.000). Similar findings have been reported by Foran et al.[1]

Our study results are in compliance with those of reported from different countries. The results have indicated that undiagnosed hypoxia is present in our population with considerable frequency rates.

Conclusion

Higher frequencies of Undiagnosed Hypoxia have been observed in patients admitted in chest medicine wards of Nishtar Hospital Multan using pulse oximeter. Hypoxia was significantly more prevalent in male gender and with increasing age. Hypoxia was significantly more common in patients with COPD. Hypoxia can be detected in hospital settings using pulse oximeter to avoid further adverse outcomes. Pulse oximeter provides simple, reliable and non-invasive mode of detection of Hypoxia. The results of the study emphasize the importance of vital monitoring among all hospitalized patients. This will help to decrease future adverse medical conditions and improve the quality of life of the patients which will lead to decrease the burden on hospital authorities and manifest in national health economies.

Further research work is recommended from different parts of country to confirm our findings so that national guidelines may be formulated in this regard.

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