Routine Oxygen Administration In The PACU: Should Everybody Have It?

S Amanor-Boadu, B Osinaike, S Oyeleke

Citation

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Abstract

Aim: To determine which group/s of patients should receive supplemental oxygen in the PACU.

Methods: Sixty-six patients were involved in this observational study. Without altering PACU care, oxygen saturations were noted from arrival to discharge from PACU.Patients were assigned to two groups i.e. those that had supplemental oxygen and those who did not.

Results: Incidence of hypoxaemia on arrival to PACU was 12 %, mean oxygen saturation in the hypoxaemic group was 92.25 ±1.39 % and mean oxygen saturation for all patients arriving in the PACU was 97.12 ± 2.46 %. More patients that had general anaesthesia and procedures of the head and neck received supplemental oxygen. Mean oxygen saturation values were similar between the two groups.

Conclusion: Postoperative oxygen therapy should be reserved for patients with SpO2 of less than 94 % on arrival in the PACU. In this time of economic pressure on medicine, this will allow significant cost savings.

INTRODUCTION

One of the goals of the post anaesthesia care unit (PACU) is to prevent and treat respiratory complications following surgery and anaesthesia. Supplementary oxygen administered to patients in the PACU is a safe, simple and usually effective method to prophylactically ensure adequate oxygenation in most patients recovering from anaesthesia. Comroe[1] in 1947 demonstrated that few physicians are capable of detecting mild degrees of arterial blood desaturation by the perception of “surface blueness”.

The practice in most centres is to routinely give oxygen to postoperative patients irrespective of the type of surgery or technique of anaesthesia employed. In the absence of an adequate non-invasive monitoring device, this is a wise practice, however with the use of pulse oximetry, which allows the non-invasive monitoring of oxygen saturation to indicate the need for oxygen therapy this practice may be an unwarranted expenses.

The purpose of this study was to determine which group/s of patients will benefit from supplemental oxygen in the PACU.

METHODS

This prospective observational study was carried out at the post anaesthesia care unit (PACU) of the University College Hospital, Ibadan. In this study, routine PACU care was not altered and oxygen desaturation was taken as SpO_2 reading ≤ 94%.

Upon admission to the PACU some patients had 2 to 3 l/min of oxygen by facemask while others did not, this was based on the discretion of the PACU staff. During transportation to the PACU oxygen was not administered, but patients were put in the recovery position. While in the PACU, patients were monitored in our usual manner with measurements of blood pressure and pulse rate at least every ten minutes and when indicated by the type of surgery and the patient's physical conditions, continuous electrocardiography.

Finger pulse oximeters (NONIN, Onyx, USA) were used for the SpO_2 readings. All patients who had undergone elective operations under general and spinal anaesthesia were involved in the study. The patients had undergone head and neck, airway, anterior chest wall, abdominal and peripheral surgical procedures. Excluded were patients who had local

anaesthesia for minor procedures and patients with pre-operative SpO_2 value of ≤ 94%.

Sixty-six patients were involved in the study. Observation and monitoring started immediately upon arrival in the PACU and continued until discharge. The oximeter was applied to the index finger of the hand opposite to the blood pressure cuff within a minute of arrival of patients in the PACU.The observer, a research assistant monitored oxygenation with the pulse oximeters continuously and recorded the SpO_2 values throughout the period of stay in PACU. Patient's age, sex, ASA physical status, weight, nature of surgery, duration of anaesthesia and surgery and the anaesthetic technique used were all noted.

All patients received preanaesthetic medication with diazepam orally night before and at 6am on the day of surgery. General anesthesia was provided with intravenous (Thiopentone or Propofol) or inhalational induction (Halothane or Isoflurane). Maintenance was mostly provided by volatile anaesthetics with nitrous oxide/oxygen and fentanyl. Patients that required neuromuscular blockade had pancuronium or atracurium, effect of which was adequately reversed with neostigmine at the end of the surgery. Patients that received spinal anaesthesia were not given any supplementary sedation intraoperatively.

Patients were transferred to the PACU when vital signs were stable and could respond to commands.

The incidence of hypoxaemia on arrival in PACU is reported as percentage. Statistical analysis was performed using SPSS version 10.0.

Results are presented in tables and figures and expressed as mean ± SD and number of patients/percentage. Statistical association was determined using the chi-square test for categorical variables and the t-test for continuous variables. A p-value of less than 0.05 was considered significant.

RESULTS

Sixty-six patients, 26 males and 40 females were studied. Table 1 presents the demographic data, duration and technique of anaesthesia, oxygen administration in the PACU and complications.

Figure 1

Table 1: Patient characteristics.

	n=66	Mean ± SD
Gender	Male=26 Female= 40	
Age (years)		36.56 ± 17.10
Weight (kg)		55.24 ± 17.06
ASA	1 = 51 2 = 12 3 = 3	
Mean duration of anaesthesia (mins)		121.35 ± 51.70
Type of Anaesthesia	GA – 58 (88%) Regional- 8 (12%)	
Oxygen administered in PACU	Yes – 34 (52%) No – 32 (48 %)	
Complications	Hypotension - 1 Hypertension – 10 Vomiting – 2 Pain - 33	

In Table 2, the incidence of hypoxaemia upon arrival to the PACU in our patient population was 12.2%, the mean oxygen saturation in the hypoxaemic group was 92.25 ± 1.39%and the mean for all patients on arrival in PACU was 97.12 ± 2.46%.

Figure 2

Table 2: Incidence of desaturation.

Time	Mean oxygen saturation in hypoxaemia grp. (%)	Mean oxygen saturation in all pts. (%)
On arrival	92.25± 1.39 (12.1)	97.12±2.46

Table 3 shows the pattern of oxygen saturation on arrival in the PACU, 12 % (8) of the patients had oxygen saturation on arrival ≤ 94%, while 88 % had values ≥ 95%. Table 3 also shows that patients in the group with desaturation are older than those without desaturation (47.75±19.64 yrs to 34.33±15.32 yrs, P= 0.04). All the patients with oxygen desaturation on arrival had general anaesthesia while in the other group without desaturation, 86% of patients had general anaesthesia and 14% spinal anaesthesia (P = 0.2). Also more patients, 50% in the desaturation group had undergone surgical procedures for the head and airway, while only 15% had the same procedures in the group without desaturation.

Figure 3

Table 3: Pattern of oxygen desaturation on arrival in the PACU.

	$SaO_2 \leq 94\%$ n= 8(12.1%)	$SaO_2 \geq 95\%$ n= 58(87.9%)	P-value
Age (yrs)	47.75±19.64	34.33±15.32	0.04
Gender	Male=3 (44%) Female= 5 (56%)	Male= 24 (41%) Female= 34 (59%)	0.9
Weight (kg)	54.86±19.57	55.31±16.83	0.09
Mean SaO_2(%)	92.25±1.39	98.12±1.48	0.0001
Type of anaesthesia	GA - 100%	GA – 50(86%) RA – 8(14%)	0.26
Mean duration of anaesthesia(mins)	118.75±43.73	120.27±49.01	0.8
Type of surgical operation	Head +ENT-4 (50%) Ant. Chest-1 (12.5%) Abd. – 3 (37.5%)	Head +ENT-17 (29%) Ant. Chest-1 (2%) Abd. – 22 (38%) Others – 18 (31%)	0.5

Characteristics of those patients that had supplemental oxygen administered in the PACU and those who did not are shown in Table 4. Almost all the patients that had supplemental oxygen had general anaesthesia 97%, while 81% of patients amongst those that did not receive oxygen in the PACU had general anaesthesia (P=0.02). Also, more of the patients that had surgical procedures of the head and airway received oxygen on arrival in the PACU, while a larger percentage of patients in the no oxygen group had surgical procedures of the perineum and limbs.

Figure 4

Table 4: Characteristics of the supplemental oxygen and no supplemental oxygen group.

	Supplemental O_2 n= 34	No supplemental O_2 n= 32	P-value
Age(yrs)	39.76±18.78	33.16±14.65	0.11
ASA	1- 25 2- 9	1- 26 2- 3 3- 3	
Mean weight	58.67±16.63	50.67±17.00	0.13
Type of anaesthesia	GA- 33 (97%) RA- 1(3%)	GA- 25(81%) RA- 19(19%)	0.02
Mean duration of anaesthesia (mins)	123.47±47.24	119.09±56.74	0.73
Type of surgical operation	Head +ENT-15 (44%) Ant. Chest-1 (30%) Abd. – 14 (41%) Others- 4(12%)	Head +ENT-6 (19%) Ant. Chest-2 (6%) Abd. – 11 (34%) Others- 13(41%)	0.12

Table 5 shows the mean oxygen saturation of the supplemental oxygen group and no supplemental oxygen group from arrival in the PACU to discharge (shown graphically in Figure 1). There are statistically significant changes at 5, 10, 20 and 60 minutes (P=0.004, 0.001, 0.002 and 0.04 respectively).

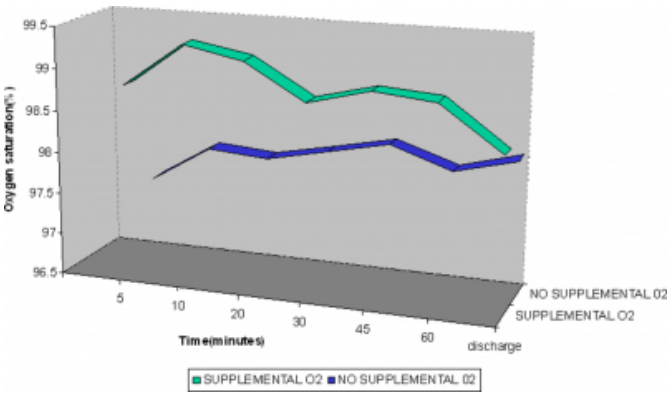
Figure 5

Table 5: Mean oxygen saturation during PACU stay in the supplemental oxygen and no supplemental oxygen group.

Time	Mean saturation in the supplemental gp.	Mean oxygen saturation in the no supplemental gp.	P-value
5 mins	98.82±6.52	97.50±2.26	0.004
10mins	99.35±4.28	98.03±2.18	0.001
20mins	99.21±4.43	98.19±2.10	0.002
30mins	98.79±5.30	98.13±2.03	0.13
45mins	98.97±1.48	98.19±2.10	0.11
60mins	98.91±1.69	97.94±2.12	0.04
Discharge	98.38±1.88	98.13±2.03	0.59

Figure 6

Figure 1: Graphical representation of the mean oxygen saturation during PACU stay.



DISCUSSION

In this study, we found the incidence of hypoxaemia on arrival in PACU to be 12 %. Though hypoxaemia is traditionally taken as SpO_2 reading of ≤ 90 % (a PaO_2 of 60mmHg), we chose 94% as our cutoff to allow a higher trigger value for patients not given oxygen in the PACU.

This incidence of 12% is lower than what was reported in similar studies [2,3,4,5] with values as high as 30 %, hypoxaemia in those studies were defined as SpO_2 reading of ≤ 90 %. One of the authors, Jakob et al [2]

actually reported an incidence of 32 %. In that study, about 42 % of the patients were obese and the patients had a mean age of 54years compared to our study with no obese patients and mean age was about 37years.Also, those patients who had regional anaesthesia in that study were also given

fentanyl and /or midazolam intraoperatively.

Significant correlation has been shown between early postoperative desaturation and obesity [3,6], age [3,5], abdominal surgery especially upper abdomen [5], and anaesthetic technique [2].Postoperative hypoxaemia results predominantly from two mechanisms [7];(a) gas exchange is impaired during anaesthesia as a result of reduced tone in the muscles of the chest wall and probably alterations in bronchomotor and vascular tone and resulting changes persist into the postoperative period. (b) abnormality of control of breathing which results in hypoventilation or occasional apnoiec episodes. The use of opioids sparingly either because of fear of overdose or unavailability may be related to the lower incidence of postoperative hypoxaemia we reported and not necessarily as a result of better practice.

The mean oxygen saturation of 97.12 ± 2.46 % on arrival in PACU observed in this study is similar to that reported by Gift et al [8], however they excluded patients at high risk for hypoxaemia i.e. those having surgery to the thorax, upper abdomen or neurosurgical procedures. However a similar study by Canet et al [9] reported mean oxygen saturations of 90.4 to 93.9 % upon arrival in PACU.The oxygen saturation level at the time of arrival in the PACU is important in predicting those most at risk of developing hypoxaemia [8] .

Only one of the patients that was admitted into the PACU with SpO_2 of greater than 94 % became hypoxeamic during admission in the PACU.This finding is supported by DiBenedetto et al [10],they studied five hundred patients breathing room air postoperatively and those with SpO_2 of less than 94 % were given supplemental oxygen. They concluded that supplemental oxygen was unnecessary in 63 % of patients for the duration of their stay in the PACU, hence they recommended that only patients with SpO_2 of less than 94 % should have oxygen in PACU.However Audrey et al reported that in patients at low risk of developing postoperative hypoxaemia, SpO_2 values of ≤ 92 % should be the trigger for instituting oxygen therapy.

An author [10]suggested that supplemental oxygen administration in the PACU is out of habit rather than as a result of individual patient need. This is most likely the case in our environment where the use of pulse oximetry is just gaining ground. It is obvious from this study that there is a tendency to provide oxygen therapy to patients that had general anaesthesia for procedures on the head and airway compared to those who had regional anaesthesia and procedures on the abdomen, perineum and extremities.

In comparison with previous studies [10,11], our study revealed that about 50 % of patients were not given routine oxygen in the PACU.Of this group of patients, 81 % had general anaesthesia and 19 % spinal anaesthesia. There were no significant differences in age and duration of anaesthesia amongst those that had oxygen and those who did not. Though there were statistically significant changes in the mean oxygen saturations between the two groups at 5, 10, 20 and 60 minutes, these were not clinically significant. This is so because the lowest mean oxygen saturation in the no oxygen group was 97.50 ± 2.26 % and only one of the patients actually had SpO_2 of less than 94 % but above 90% during admission in the PACU.This finding questions the routine administration of oxygen to all patients in the PACU.

We conclude that postoperative oxygen therapy should be reserved for patients with SpO_2 of less than 94 % on arrival in the PACU. Especially in this time of economic pressure on medicine, this will allow significant cost savings.

CORRESPONDENCE TO

Dr B.B. Osinaike
Dept. of Anaesthesia,
P.M.B. 5116,
University College Hospital,
Ibadan, Nigeria.

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Author Information

Simbo Amanor-Boadu, FMCA,FWACS
Consultant anaesthetist, Study Centre, Post anaesthesia care unit (PACU), University College Hospital

Babatunde Osinaike, FMCA
Senior Registrar, Study centre, Post anaesthesia care unit (PACU), University College Hospital

Stephen Oyeleke, DA
Senior Registrar, Study centre, Post anaesthesia care unit (PACU), University College Hospital