Routine Oxygen Administration In The PACU: Should Everybody Have It?
S Amanor-Boadu, B Osinaike, S Oyeleke

Citation

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, 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 SpO2 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 SpO2 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\textsubscript{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\textsubscript{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.

### Table 1: Patient characteristics.

<table>
<thead>
<tr>
<th>Gender</th>
<th>n=66</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>36.56 ± 17.10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>55.24 ± 17.06</td>
</tr>
<tr>
<td>ASA</td>
<td>1 = 51 2 = 12 3 = 3</td>
</tr>
<tr>
<td>Mean duration of anaesthesia (mins)</td>
<td>121.35 ± 51.70</td>
</tr>
<tr>
<td>Type of Anaesthesia</td>
<td>GA - 58 (88%) Regional - 8 (12%)</td>
</tr>
<tr>
<td>Oxygen administered in PACU</td>
<td>Yes - 34 (52%) No - 32 (48 %)</td>
</tr>
<tr>
<td>Complications</td>
<td>Hypotension - 1 Hypertension - 10 Worsening - 2 Pain - 33</td>
</tr>
</tbody>
</table>

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%.

### Table 2: Incidence of desaturation.

<table>
<thead>
<tr>
<th>Time</th>
<th>Mean oxygen saturation in hypoxaemia grp. (%)</th>
<th>Mean oxygen saturation in all pts. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On arrival</td>
<td>92.25± 1.39 (12.1)</td>
<td>97.12±2.46</td>
</tr>
</tbody>
</table>

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.
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.

**DISCUSSION**

In this study, we found the incidence of hypoxaemia on arrival in PACU to be 12 %. Though hypoxaemia is traditionally taken as SpO₂ reading of ≤ 90 % (a PaO₂ 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 upon with values as high as 30 %, hypoxaemia in those studies were defined as SpO₂ reading of ≤ 90 %. One of the authors, Jakob et al, 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, age, abdominal surgery especially upper abdomen, and anaesthetic technique. Postoperative hypoxaemia results predominantly from two mechanisms: (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 apnoeic 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., 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. 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.7

Only one of the patients that was admitted into the PACU with SpO₂ of greater than 94 % became hypoxaemic during admission in the PACU. This finding is supported by DiBenedetto et al., they studied five hundred patients breathing room air postoperatively and those with SpO₂ 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 SpO₂ of less than 94 % should have oxygen in PACU. However Audrey et al. reported that in patients at low risk of developing postoperative hypoxaemia, SpO₂ values of ≤ 92 % should be the trigger for instituting oxygen therapy.

An author 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, 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 because the lowest mean oxygen saturation in the no oxygen group was 97.50 ± 2.26 % and only one of the patients actually had SpO₂ 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 SpO₂ 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.

References

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