# Practical of Oxygen Therapy in Anesthesiology

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**Abstract**

**Introduction:** Oxygen therapy is a necessary for patient care in perioperative, emergency medicine. Patients who are unable to maintain appropriate oxygen levels can receive oxygen therapy, which is a medical intervention. It is frequently used to treat respiratory distress brought on by a number of ailments, such as acute respiratory distress syndrome (ARDS), pneumonia, and chronic obstructive pulmonary disease (COPD). **Aims**: To evaluate the awareness and understanding of healthcare professionals about the potential risks and complications associated with oxygen therapy. Method: The questionnaire was administered to 70 members of the anesthesiology and critical care community. The questionnaire consisted of 20 questions to assess the perioperative, postoperative period, emergency, knowledge of current WHO recommendations oxygen therapy. Data were analyzed with SPSS software and calculating percentages using Chi-square test. **Result:** According to the study's findings, FiO2 ≥100% is typically used for induction and emergence from anesthesia, but FiO2 <80–100% is preferred for maintenance; patients with diseased lung tissue typically use higher values than those without. In critical emergency medicine, supplemental oxygen is often used in patients ≥80 years of age who present with respiratory distress, COPD, myocardial infarction, and stroke. Postoperative oxygen therapy is prescribed more frequently based on SpO2. **Conclusion**: The recent recommendations of the WHO of oxygen therapy on perioperative, postoperative period and emergency were followed by the most of anesthesiology and critical care community.

**Key words**

Oxygen therapy, preoperative, postoperative, emergency

## INTRODUCTION

Oxygen therapy is a necessary for patient care in perioperative, emergency. Oxygen therapy is a medical intervention that involves the administration of oxygen to patients who are unable to maintain adequate oxygen levels in their blood. It is frequently used to treat respiratory distress brought on by a number of ailments, such as acute respiratory distress syndrome (ARDS), pneumonia, and chronic obstructive pulmonary disease (COPD) (Renda ., 2018).

A large inspiratory fraction of oxygen (FiO2) favors the creation of reactive oxygen species and causes the release of inflammatory signals, which leads to cell apoptosis and death, even though oxygen can boost the oxidative neutrophilic immune defense (Hafner., 2017).High FiO2 was linked to atelectasis and poor hypoxic vasoconstriction in the clinical environment (Sylvester., 2012), increased shunt fraction, lung injury, and tracheobronchitis (Scharffenberg ., 2022).To lower the incidence of surgical site infections (SSI), the World Health Organization (WHO) advised using FiO2 of 80% during surgery and for up to 6 hours afterward in 2016 (Allegranzi ., 2016). However, Recent meta analyses have revealed that the efficacy of high FiO2 to minimize SSI may only apply to intubated surgical patients, or it may not even exist (Smith ., 2020). Furthermore, postoperative atelectasis and decreased pulmonary function have been linked to intraoperative high FiO2 levels (Koo ., 2019).

Supplemental oxygen may be used in critical emergency care to stop ischemic injuries. A high oxygen concentration also buys time to address the issue when it arises in acutely critical settings under anesthesia, such as when a technical issue with ventilation occurs. However, the effects of oxygen vary on the organ and the dose (Sepehrvand., 2019). The varied practices of oxygen usage and the lack of agreement might compromise patient safety and expose caregivers to potential legal consequences. It is obvious that understanding how oxygen is delivered may help to lower risks and enhance therapeutic practice. So for these reasons, we used the pretests survey and disrupted among of the membrane of Anesthesiology and Intensive Care staff to learn more about how oxygen is now used in anesthesia, critical care, and intensive care medicine.

## Methods

The questionnaire was administered to members of the anesthesiology and critical care community. The questionnaire consisted of 22 questions to assess the perioperative period, and emergency, knowledge of current WHO recommendations.

The sample size was 70. These pretested questionnaires were distributed in 6 hospital and clinic (Zawia Medical Center (ZMC), Sabratha Teaching Hospital (STH), Surman General Hospital (SGH), Tripoli Medical Hospital (TMH) and some private sanatoriums such as Royal and Albasaten clinic) This questionnaire is designed to see the extent to which his doctors and anesthesiologists follow the use of oxygen in operations and emergency.

The 70 questionnaires distributed (from 20/6/2023 to 30/7/2023) in hospital and clinic. The questionnaire was divided into 3 parts. The first part was specific to general questions and information on the nature of use and the number of cases received monthly in sanatoriums and hospitals, and then the second part was talking about the use of oxygen in the pre-operative period, concentrations used in the state of emergency, transportation and delivery and some other operations. The third part was related to the use of post-operative oxygen and whether all cases need to give additional oxygen or only those who have chronic diseases.

**Results**

70 medical membranes were participated in this study and fill up the survey. The anesthesiology was (n=45, 73%). The Intensive care medicine were about (n=17, 21,5%). Technician were (n=16, 20.3%). Most participated were board-certified in anesthesiology (n=, 72.9%), followed by pediatric/neonatal anesthesiology (n=13, 18.6%) and cardiac anesthesiology (n=5, 7.1%).

The respondents worked in university hospitals (n = 35; 32.7%). Most of them were and some of them worked in a private hospital (n=19; 17.8%). And the last of them worked in a specialized cardiac center/hospital (n=4; 3.7%) respondents worked in hospitals with ≤ 5 operating rooms (n=39; 55.7%) followed by 6-10 operation room (n=23; 32.9%

Most respondents preferred to know whether supplemental oxygen administration per month was less than 15 CAS (n = 19; 27.1%), but about a third of participants chose between 15 and 30 CAS (n = 14; 20%), followed by more than 80 (n = 13; 18.6%) and less than 51 TO 65 CASES (n=5; 7.1%)

**Oxygen therapy protocol**

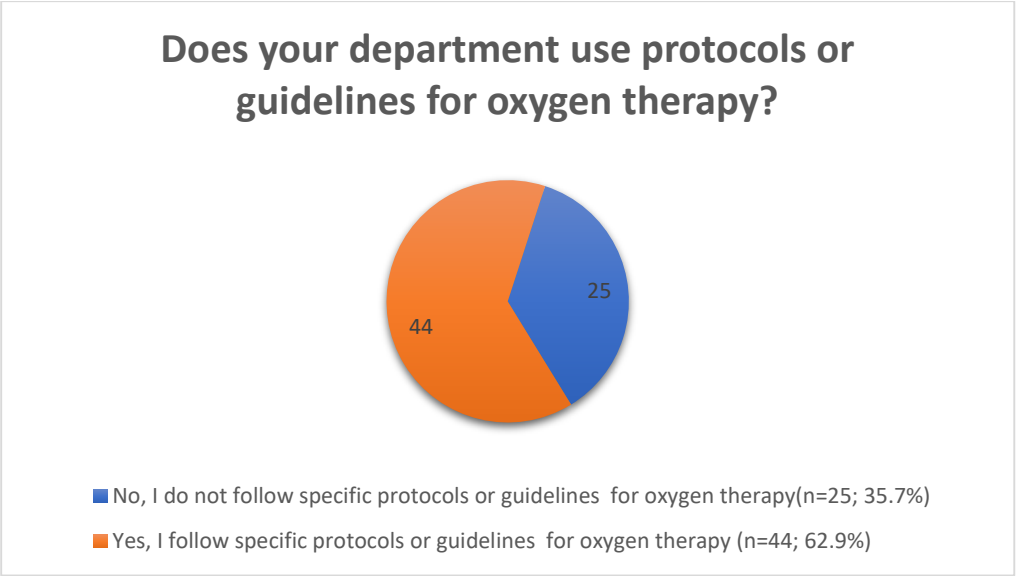


Figure1: protocol used for O2 therapy

62.9% (n = 44) of respondents reported that they had implemented specific oxygen therapy protocols or guidelines, and some of them, 35.7% (n = 25), reported that they had not implemented any protocols or guidelines specific guidelines for oxygen therapy.

**Use of oxygen in the perioperative setting**

For induction of anesthesia, most respondents preferred 100% FiO2 (n = 44), but approximately half of participants chose 80–100% FiO2 (n = 22) Some of them chose 60-80% (n=4)

While maintaining general anesthesia, the majority of respondents (n = 21; 30%) preferred a FiO2 between 80 and 100%, followed by a FiO2 between 60 and 80% (n = 18; 25.7%) and less than 11.4 % (n = 8) of participants with FiO2≥40%

At emergency, approximately 60% (n = 42) of participants preferred 100% FiO2, closely followed by participants with 80–100% FiO2 (n = 20; 28.6%) and less than 2.9% (n=2) of participants preferred 40-60% FiO2.

More than half of the respondents indicated that when patients are transferred from the operating room to the post-anesthesia care unit (PACU) or from the PACU to surgical wards, supplemental oxygen is used inconsistently, meaning it is used either usually (n =34; 48.6%) or occasionally (n =15; 21.4%). "Yes, sometimes", (n =6; 8.6%). " No, rarely", (n =34; 48.6%). "Yes, usually" (n=19; 27.1%). "Yes, almost always" (n=3; 4.3%). "No, never" (n=7, 10%)

**Administered oxygen to spontaneously breathing patients undergoing cesarean section**

Most respondents administered oxygen to spontaneously breathing patients undergoing cesarean section (yes, sometimes n = 32; 45.7%), and some of them did not administer it (no, never n = 16; 22, 9%) and (no, rarely n = 5). ;7.1%)

**Recommendations of the (WHO) on the prevention of surgical site (wound) infection regarding perioperative oxygenation**

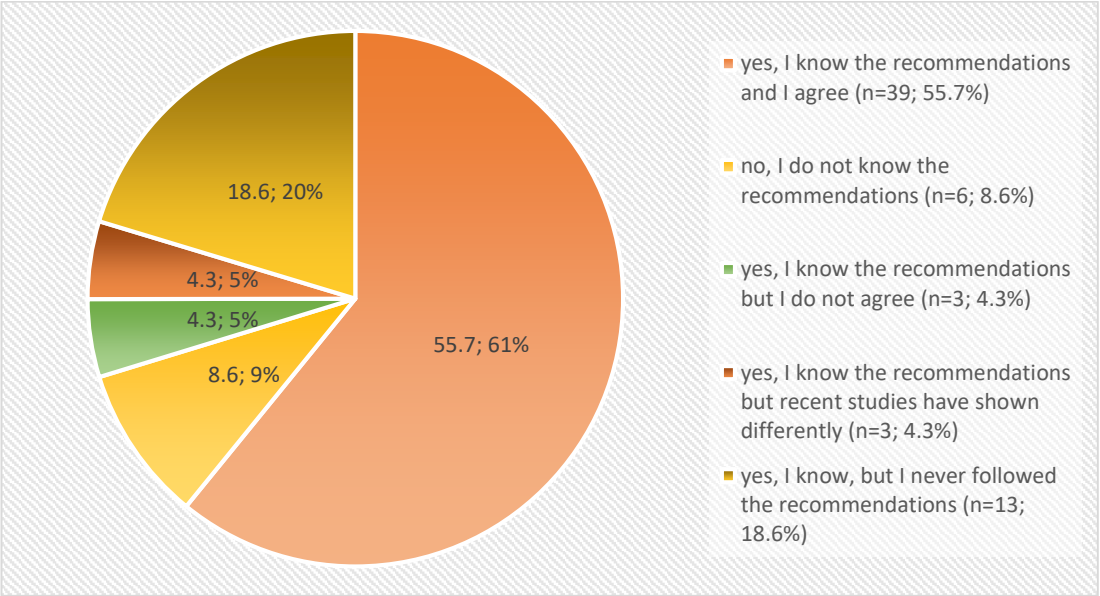


**Figure2: recommendations of the (WHO) on the prevention of surgical site (wound) infection regarding perioperative oxygenation**

About 8.6% (n=6) of those surveyed were not aware of the most recent WHO guidelines for perioperative oxygen therapy prevention. while 4.3% (n =3) knew but do not agree with them, 18.6% (n =13) have never followed those recommendations, and 4.3% (n =3) claim that recent studies diverge from them. Yet, 55.7% (n =39) of participants knew and agreed with the recommendations.

**Patients with healthy lungs, your general approach in patients with diseased lungs undergoing general anesthesia for surgery**

Most participants preferred in patients with healthy use higher oxygen fractions due to higher risk of hypoxemia (n=45; 64.3%), and some of them use lower oxygen fractions due to higher risk of lung injury (n=12; 17.1%), And the last of them not distinguish between them regarding use of oxygen fraction (n=10; 14.3%)

**Table 1 :compared with patient in healthy lunge and patient with diseased lungs undergoing GA for surgery**

| Compared | Frequency | Percent |
|---|---|---|

| | | |
|---|---|---|
| use higher oxygen fractions due to higher risk of hypoxemia | 45 | 64.35 |
| use lower oxygen fractions due to higher risk of lung injury | 12 | 17.1% |
| not distinguish between them regarding use of oxygen fraction | 10 | 14.3% |

**Oxygen Use in Surgical Post-Surgery Word**

SpO2 monitored in the post-surgery ward the majority of respondents, 44.3% (n=31), recommended this therapy only to high-risk patients, 12.9% (n=9) recommended regular oxygen supplementation, and 31.4% (n=22) recommended this therapy for patients who required relatively high doses of oxygen. Opioids. Around 5.7% (n = 4) never recommend the use of oxygen in the postoperative department

**Table 2: data registered in patient's records**

| | Frequency | Percent |
|---|---|---|
| Never | 13 | 18.6% |
| regularly, at certain time intervals (e.g., 4h) | 12 | 17.1% |
| data are registered automatically | 11 | 15.7% |
| when the SpO2 drops below certain limits | 13 | 18.6% |
| in high-risk patients | 19 | 27.1% |

The majority of respondents (n=19; 27.1%) stated that only high-risk patients were monitored by their facilities. 17.1% (n = 12) of all respondents said that even when oxygen is given in the postoperative department, SpO2 data is routinely recorded in the patient file., while only 15.7% (n = 11) stated that this data be recorded automatically, approximately 18.6% (n = 13)

reported that their facilities never documented SpO2 during postoperative oxygen administration.

**Recommend O2 therapy postoperatively on the post- surgery ward**

Most responded 17.1% (n=12) recommended this therapy only for high-risk patients, 7.1% (n=5) recommended regular oxygen supplementation and 7.1% (n=5) recommended this therapy for patients receiving relatively high opioid doses need. About 1.4% (n = 1) never recommend the use of oxygen in the postoperative department. 47.1% (n=33) depending on SpO2.

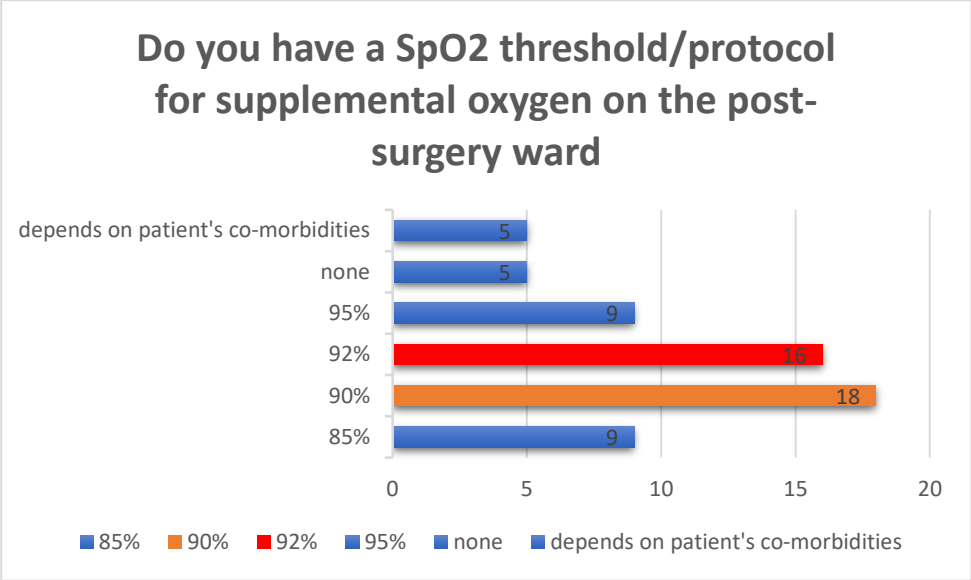


**Figure 3 protocol for supplemental oxygen**

About 7.1% (n = 5) of participants felt that patients' comorbidities should be taken into consideration when prescribing supplemental oxygen therapy on the surgical ward, whereas 7.1% (n = 5) of those colleagues did not base oxygen therapy decisions on SpO2 thresholds. More often, doctors who used SpO2 to inform their decisions about oxygen therapy reported that a 90% SpO2 threshold was preferred (n = 18; 25.7%), followed by 92% (n = 16; 22.9%), 95%, and 85% (n = 9; 12.9%).

**Supplemental oxygen to patients with (COPD) in Critical Emergency Medicine**

More than 78.6% (n =55) of respondents said they would use supplemental oxygen in patients with chronic obstructive pulmonary disease (COPD) at the recommendation of others (no, rarely n =12; 17.1% no, never n =3; 4.3%) or sometimes (yes, sometimes, n =24, 34.3%; yes, usually, n =22, 31.4%; almost always, n =9, 12.9%).

**Supplemental O2 to patients with MI in critical emergency medicine**

Supplemental oxygen was used (yes, almost always, or yes, usually by or no, rarely) in patients with acute myocardial infarction, according to 44.3 (n =31), 34.3% (n =24), and 8.6% (n =6) of respondents, respectively.

**Supplemental O2 to patients with stroke in Critical Emergency Medicine**

Respondents reported a pattern of stroke patients that was similar to that of myocardial infarction (yes, almost always; n =51, 72.9%; yes, usually; n =18, 25.7%;).

## Discussion

In this survey the most participants adhere to the most recent WHO guidelines on perioperative oxygen therapy. FiO2 ≥100% is frequently used for induction and emergence from anesthesia, whereas FiO2 <80–100% is favored for maintenance; individuals with damaged lungs are more likely to use greater levels than those without. SpO2 is used to prescribe postoperative oxygen treatment increasingly frequently; nonetheless, the widespread application of SpO2 monitoring is still restricted by the shortage of instruments. In the field of critical emergency medicine, patients who are 80 years of age or older and present with respiratory distress, COPD, myocardial infarction, or stroke often require supplemental oxygen. The majority of respondents to this survey agree with the WHO's recommendations regarding the perioperative use of oxygen.

Originally, anesthesiologists participated in the compilation of these recommendations. Anesthesiologists may have become less confident in the recommendations as a result of the scrutiny that some of the trials that supported them received (Schietroma et al., 2013) and one of them was retracted (Sista et al., 2014). Our findings also demonstrate that anesthesiologists' decisions about perioperative hyperoxia are unaffected by the most recent WHO updated analysis, which included new studies after the WHO guideline review was published (de Jonge et al., 2019) and eliminated dubious trials. One explanation for the limited acceptance of the analyses could be that the reduction in SSI caused by high perioperative FiO2 is restricted to surgical patients undergoing general anesthesia with tracheal intubation. We cannot, however, totally rule out the chance that the anesthesiology community has not yet adopted these recommendations as a standard practice.

It was expected that most respondents would use high FiO2 during induction and emergence from anesthesia. Despite the relatively low incidence of unexpected difficult intubation in the general surgical population (0.01% to 0.43–0.52%; Cook et al., 2011), high FiO2 increases the tolerable apnea time (the duration until SpO2 drops to 90%) by as much as 10 minutes (Bouroche et al., 2015), offering a significant safety margin. The findings suggest that FiO2 was lowered during anesthesia and until extubation after the airway was stabilized. This may be explained by worries about the development of atelectasis and oxygen toxicity.

According to Scharffenberg et al. (2020), those risks appear to have outweighed the potential benefits of high intraoperative FiO2 against postoperative nausea and vomiting as well as the

concern over acutely impaired oxygen transport from unintentional extubation and severe bleeding. Since this stage of anesthesia may be accompanied by impaired ventilation due to laryngospasm residual neuromuscular blockade, opioid-induced respiratory depression, the presence of secretions in the airways, and intrapulmonary shunt due to atelectasis, the use of higher FiO2 during extubation likely reflects the fear of desaturation. Relatively low percentage of participants using supplemental oxygen during that time suggests that there is less fear when patients are moved to the PACU or even the ward. The use of perioperative oxygen is not affected by the presence of lung disease in surgical patients, most likely because this subpopulation is not concerned about developing hypoxemia or worsening lung injury.

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Concern for patient safety could be one explanation for the finding that about two thirds of respondents advocate for SpO2 monitoring on the ward. Additionally, it could represent an effort to customize the use of extra oxygen. Despite this awareness, SpO2 is only sporadically documented, indicating that financial limitations may still be a barrier to enhancing patient safety during that time. In actuality, after surgery, pulmonary complications—particularly hypoxemia—are rather common (Leone et al., 2020). Since these scores consider non-invasively measured oxygen saturations, failing to measure SpO2 in the (postsurgical) ward could put patients at risk by preventing the early detection of deterioration. Particularly considering that the two most common excuses given for not measuring SpO2 were the scarcity of devices and the burden on nurses. According to our survey, immediate action is required to improve patient safety in this area. Remarkably, SpO2 levels as low as 90% are chosen as the oxygen therapy threshold when monitoring is employed. It's possible that anesthesiologists do not deduce a cause-and-effect link between those SpO2 readings and outcome indicators.

## Conclusions

The WHO's recommendations are followed by doctors filling out the survey regarding oxygen therapy, however this practice is not always supported by evidence. Patients who are 80 years of age or older and exhibit respiratory distress, COPD, myocardial infarction, or stroke often require the use of supplemental oxygen.

It is more common in the specialties of anesthesiology to fear hypoxemia. The respondents believe that oxygenation targets are important, but limited screen accessibility prevents oxygen treatment from being customized for each individual. Help with research, additional instruction on oxygen treatment, and improved observation skills are needed.

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