RETRACTION NOTICE: Conservative oxygen supplementation versus usual oxygen supplementation among septic medical intensive care units patients: A before-after investigation

At the request of the Journal Editor and SAGE Publications, the following article has been retracted.

Conservative oxygen supplementation versus usual oxygen supplementation among septic medical intensive care units patients: A before-after investigation. DOI: 10.1177/00368504211016953

Following publication of the article the journal became aware that the study may have been written and submitted by a third-party agency which was not disclosed at the time of submission. Concerns were also raised about the study design, which has been reported as a retrospective analysis of routinely collected data but involves comparison between a novel intervention and routine clinical care.

The corresponding author noted that they did not use a third-party agency but did not respond to the remaining concerns raised about their research.

Given the concerns about the intervention and lack of consent procedures for participants, the journal editor retracts this article.
RETRACTED Conservative oxygen supplementation versus usual oxygen supplementation among septic medical intensive care units patients: A before-after investigation

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Abstract
Patients admitted in the intensive care unit (ICU) are always managed with excessive high fraction of inspired oxygen and have hyperoxia for a significant period of time, which has potential harms. The guidelines for the management of patients in ICUs do not provide the target values for partial pressure of oxygen or arterial oxyhemoglobin saturations. The study was a before-after investigation comparing two time periods in which different oxygenation strategies were applied. Data of oxygen control, outcome measures, and mortality of a total of 273 patients (>18 years) admitted at least for 2 days in ICUs and received treatment for the sepsis were retrospectively collected and analyzed. Patients were received usual oxygen supplementation (targeted partial pressure of oxygen: 150 mmHg; a high fraction of inspired oxygen: 0.4; UOS cohort; n = 142) or conservative oxygen supplementation (targeted partial pressure of oxygen: 70–100 mmHg; a high fraction of inspired oxygen as low as possible; COS cohort; n = 131). Mechanical ventilation-free hours were significantly higher for patients of COS cohort than those of UOS cohort (77.99 ± 21.26 h/patient vs 70.01 ± 23.57 h/patient, p = 0.016). ICUs length of stays of patients of COS cohort was fewer
than those of UOS cohort (7.05 ± 2.13 days/patient vs 7.69 ± 2.43 days/patients, \( p = 0.016 \)). The probability of survival of patients was higher among patients of COS cohort than those of UOS cohort (\( p = 0.049 \)). A higher number of patients from UOS cohort needed vasopressors than those from COS cohort (55 vs 35, \( p = 0.039 \)). Conservative oxygen supplementation to maintain partial pressure of oxygen was improved outcome measures and decreases mortality as compared to that of usual oxygen supplementation.

**Level of Evidence:** III.

**Technical Efficacy Stage:** 4.

**Keywords**
Fraction of inspired oxygen, hyperoxia, hypoxemia, intensive care units, mechanical ventilation, oxygen supplementation, partial pressure of oxygen, sepsis, vasopressor

**Introduction**

Acute hypoxemia often occurs in hospitalized patients and is usually prevented by supplementation of oxygen with the infusion gas.\(^1\) The supplementation of oxygen is consistently supported by the guidelines for the management of patients but in the clinical practice the guidelines do not provide the target values for partial pressure of oxygen or arterial oxyhemoglobin saturations to overcome hypoxemia without effect of hyperoxia.\(^2,3\) The optimal oxygen supplementation regimen for critically ill patients remains unclear.\(^4\)

Lack of optimum oxygen management can unnecessarily lead patients to hyperoxia and have the risk of potential iatrogenic damage (e.g. interstitial fibrosis, tracheobronchitis, atelectasis, and peripheral vasoconstriction).\(^1\) Also, high fraction of inspired oxygen administration is associated with long-term mortality\(^5\) and supplemental oxygen therapy may have the risk of myocardial injuries.\(^6\) Hyperoxia after cerebral ischemia, cardiac arrest\(^7\) and cardiac surgery\(^8\) is also associated with clinical uncertainty. Even though so many potential harms of hyperoxia is reported, treatment guidelines and clinicians both recommended high-flow, high-concentration oxygen administration for management of critically ill patients for frequent achievement of super normal value of partial pressure of oxygen for critically ill patients.\(^9\) Patients admitted in the intensive care unit (ICU) are always managed with excessive high fraction of inspired oxygen and have hyperoxia for a significant period of time.\(^10\)

The study was a before-after investigation comparing two time periods in which different oxygenation strategies (conservative oxygen supplementation and usual oxygen supplementation) applied to maintain partial pressure of oxygen.

**Materials and methods**

**Ethical approval and consent to participate**

The designed protocol (AHNU/CL/15/2020 dated 22 November 2020) of the established study was approved by the affiliated hospital of Nantong University review board and the Chinese Society of Intensive Care Medicine. The study reporting adheres to the law of China and the V2008 Declarations of Helsinki. The written
informed consent for participation of patients was not required for this study (routine practice for oxygen supplementation for critically ill patients). The anonymized information of patients was used for analysis and publication in the form of the article. Being retrospective study, the study protocol was not registered in the Chinese clinical trial registry.

**Inclusion criteria**

Patients age > 18 years, admitted in the ICUs, received treatment for the sepsis (life-threatening organ failure; Sequential Organ Failure Assessment (SOFA) score ≥ 2)\(^1\) and spent at least 2 days in ICU(s) during treatment were included in the analysis.

**Exclusion criteria**

Patients younger than 18 years, ICU readmission (for any reason(s)), pregnancies, chronic obstructive pulmonary disease, and acute respiratory distress syndrome were excluded from analysis. Also, patients with incomplete data regarding pathology were excluded from analysis.

**Sample size calculation**

The study made assumption that there are 27% ICUs mortality of patients during treatment who have developed sepsis.\(^2\) The sample size was calculated on the basis that there would be 27% mortality of patients who admitted in ICU(s) at least for 2 days for management of sepsis and differences in mortality of more than 5% between patients of both cohorts is significant (two-sided type-I error (\(\alpha = 0.05\)) and 80% power calculation (\(\beta = 0.2\)) at 95% of confidence level. The sample size (minimum patients required in each cohort) was calculated as 130.

**Cohorts**

A total of 142 patients were received usual oxygen supplementation (UOS cohort) and 131 patients were received conservative oxygen supplementation (COS cohort). Two different oxygenation protocols (usual and conservative) in use at the same time in the ICUs of the institute (both protocols are not published yet by institute). Both strategies are standard ICU practice of institute. A high-flow nasal cannula was used for oxygen supplementation in patients if patient was not mechanically ventilated.

**Usual oxygen supplementation**

Patients were received a high fraction of inspired oxygen for at least 0.4 to make partial pressure of oxygen up to 150 mmHg and saturation of peripheral oxygen between 97% and 100%. If saturation of peripheral oxygen was not achieved a high fraction of inspired oxygen was increased.
**Conservative oxygen supplementation**

Patients were received a high fraction of inspired oxygen as low as possible to make partial pressure of oxygen between 70 and 100 mmHg and saturation of peripheral oxygen between 94% and 98%. If partial pressure of oxygen increased more than 100 mmHg and/or saturation of peripheral oxygen increased more than 98%, a high fraction of inspired oxygen was decreased. Supplemental oxygen was administered if saturation of peripheral oxygen was decreased less than 94%.

Emergency physicians with at least 3-years of experiences of the institute were involved in oxygen supplementation, intubation or extubation, and ventilator settings. Arterial blood gas was analyzed and other laboratory tests were performed on daily basis by pathologists at least 3-years of experiences of the institute.

**Characteristics at oxygen supplementation**

Data regarding demographical and clinical conditions (age, sex, cancer/carcinoma/sarcoma) and severity of illness (Simplified Acute Physiology Score–II (SAPS II) score) and SOFA score of patients admitted in the ICUs at the time of oxygen supplementation were retrospectively collected and analyzed.

**SAPS II score**

It was included 15 variables (11 physiological variable, the Glasgow Coma Scale, age, the reason for admission, and disease variables). The total score is 163. The higher the score more is severity of illness.13

**Outcome measures**

Data regarding the time-weighted average of a high fraction of inspired oxygen and partial pressure of oxygen until the death or the discharge from ICU(s), invasive and/or noninvasive mechanical ventilation mechanical ventilation-free hours, use of invasive and/or noninvasive mechanical ventilation or not, use of the other interventions (therapies administration for septic treatment(s) and vasopressors to achieve mean arterial pressure of 65 mmHg), urine output, pathological data, ICUs mortality, any new organ failure (SOFA score ≥ 2), new respiratory tract and bloodstream infections (pathologically documented), hospital mortality, and survival were retrospectively collected and analyzed.

**The time-weighted average value**

The time-weighted average value of a high fraction of inspired oxygen and partial pressure of oxygen were calculated as per equation (1).1
The time-weighted average value =
\[
\frac{\text{The average value of two consecutive measurements} \times \text{Time between two consecutive measurements (hour)}}{24}
\]  
(1)

SOFA score
SOFA was accessed daily for each vital organ (renal components, coagulation, liver, respiratory, and cardiovascular). The SOFA score was ranged between 0 and 4. The score of 2 or more was considered as organ failure and score of 3 or more was considered as septic shock.\textsuperscript{14}

Survival
Alive discharge of patients from the hospital were considered to have survived.\textsuperscript{1}

Statistical analysis
SPSS, 26.0, IBM corporation, Armonk, NY, USA was used for statistical analysis purposes. Categorical variables are presented as frequency (percentages) and continuous and ordinal variables are presented as mean ± standard deviation (SD). The unpaired \(t\)-test for mean data and the Fisher exact test or the Chi-square test of Independence for frequency data were performed for statistical analysis. The log-rank test was used for evaluation of effect of oxygen supplementation on mortality.\textsuperscript{1} Univariate following multivariate analysis was performed for evaluation of association of characteristics of patients for ICUs mortality.\textsuperscript{4} All results were considered significant if \(p < 0.05\).

Results
Study population
From 15 January 2018 to 15 November 2020, a total of 315 patients have developed sepsis and admitted in a total of five ICUs of the affiliated hospital of Nantong University, Nantong, China and Gongli Hospital, Pudong New Area, Shanghai, China for 2 days or more time of period during treatments. Among them five patients were younger than 18 years, 13 patients were readmission of ICUs, one female patient had pregnancy, two patients had chronic obstructive pulmonary disease, three patients had acute respiratory distress syndrome, and complete data regarding pathology of 18 patients were not available in the hospital records of the institute. Therefore, data of these patients (\(n = 42\)) were excluded from analysis. Data of oxygen control, outcome measures, and mortality of a total of 273 patients were included in the analysis. The flow diagram for management of oxygen supplementation to maintain partial pressure of oxygen of patients admitted in ICUs for treatment of sepsis is reported in Figure 1.
Characteristics at oxygen supplementation

All patients admitted in the ICUs were due to medical condition(s). None of patient admitted in the ICUs for perioperative management of hypoxemia. The demographical and clinical conditions of patients admitted in the ICUs at the time of oxygen supplantation and severity of illness are reported in the Table 1. There were no significant differences for the demographical and clinical conditions and SAPS II score of patients at the time of oxygen supplantation to maintain partial pressure of oxygen between both cohorts ($p > 0.05$ for all parameters). All patients were put on $\beta$-lactam antibiotics treatment. There was no significance difference ($p = 0.968$) for treatment and adjunctive therapies administration as part of septic treatment(s) in the institutional internal protocol or treatments for sepsis of patients were equally distributed across the two cohorts.

Figure 1. The flow diagram for management of oxygen supplementation to maintain partial pressure of oxygen of patients admitted in the intensive care units for treatment of sepsis.
Oxygen control

The time-weighted average partial pressure of oxygen per patient during ICUs was higher in patients of UOS cohort than those of COS cohort (125.20 ± 18.19 mmHg/

Table 1. The demographical and clinical conditions, severity of illness, and provided treatments of patients at the time of oxygen supplantation in the intensive care units.

| Parameters                          | Cohorts    | Comparisons |
|-------------------------------------|------------|-------------|
|                                     | UOS        | COS         |
| Oxygen supplantation                | Usual      | Conservative |
| Numbers of patients                 | 142        | 131         | p-value    |
| Age (years)                         |            |             |
| Minimum                             | 49         | 49          | 0.141      |
| Maximum                             | 75         | 76          |            |
| Mean ± SD                           | 65.82 ± 8.15 | 64.32 ± 8.55 |            |
| Sex                                 |            |             |
| Male                                | 85 (60)    | 77 (59)     | 0.902      |
| Female                              | 57 (40)    | 54 (41)     |            |
| Sepsis: SOFA ≥ 2 responsible organ(s) or component | | |
| Kidney                              | 45 (32)    | 42 (32)     | 0.301      |
| Heart                               | 31 (22)    | 38 (29)     |            |
| Lung                                | 12 (8)     | 13 (8)      |            |
| Liver                               | 18 (13)    | 16 (12)     |            |
| Hemorrhagic                         | 36 (25)    | 31 (24)     |            |
| Septic shock: SOFA ≥ 3              | 35 (25)    | 31 (24)     | 0.888      |
| Cancer/carcinoma/sarcoma            | 32 (23)    | 31 (24)     | 0.886      |
| SAPS II                             |            |             |
| Minimum                             | 30         | 31          | 0.289      |
| Maximum                             | 55         | 57          |            |
| Mean ± SD                           | 39.12 ± 7.15 | 38.14 ± 8.11 |            |
| Any adjunctive therapies administration as part of septic treatment(s) | | |
| Steroid                             | 65 (46)    | 59 (45)     | 0.968      |
| Blood purification                  | 58 (41)    | 52 (40)     |            |
| Immunoglobulins                     | 32 (23)    | 31 (24)     |            |
| Patients required mechanical ventilation (invasive or and non-invasive) | | |
|                                     | 101 (71)   | 88 (67)     | 0.513      |

SAPS II: simplified acute physiology score–II: The total score is 163. The higher the score more is severity of illness; SOFA: sequential organ failure assessment.

Categorical variables are presented as frequency (percentages) and continuous variables are presented as mean ± standard deviation (SD). The unpaired t-test for continuous variables and the Fischer exact test (for two row and two columns) or the Chi-square test of independence (for larger contingency tables) for categorical variables were performed for statistical analysis. Results were considered significant if p < 0.05.
The time-weighted average partial pressure of oxygen during ICUs were fewer in the UOS cohort than COS cohort (4 vs 25, \( p < 0.0001 \)). Also, the numbers of patients with value of the time-weighted average partial pressure of oxygen less than 100 mmHg during ICUs were fewer in the UOS cohort than COS cohort (19 vs 127, \( p < 0.0001 \)). The details of the time-weighted average partial pressure of oxygen are reported in Figure 2.

The time-weighted average high fraction of inspired oxygen per patient during ICUs was higher in patients of UOS cohort than those of COS cohort (0.39 \( \pm \) 0.04 mmHg/patient (minimum: 0.275 mmHg; Maximum: 0.459 mmHg) vs 0.35 \( \pm \) 0.04 mmHg/patient (minimum: 0.265 mmHg; Maximum: 0.407 mmHg), \( p < 0.0001 \), Figure 3).

**Outcome measures**

There were no significant differences for urine output (\( p = 0.107 \)), ICUs mortality (\( p = 0.074 \)), hospital mortality (\( p = 0.284 \)), failure of kidney, heart, lung, and/or liver during ICUs stays, any new one vital organ (kidney, heart, lung, or liver) failure during ICUs stays (\( p = 0.287 \)), length of hospital stays, new respiratory tract infection(s) during ICUs stays, new bloodstream infection(s) during ICUs stays (\( p = 0.179 \)), and total numbers of new pathologically documented infections (respiratory tract plus bloodstream infections) during ICUs stays (\( p = 0.156 \)) between patients of both cohorts. The details of outcome measures are reported in Table 2. Invasive and/or noninvasive mechanical ventilation-free hours were significantly higher for patients of COS cohort than those of UOS cohort (77.99 \( \pm \) 21.26 h/patient vs 70.01 \( \pm \) 23.57 h/patient, \( p = 0.016 \), Figure 4). Length of ICUs stays of patients of COS cohort was fewer than those of UOS cohort.
Table 2. Outcome measures.

| Parameters | Cohorts | | | Comparisons |
|---|---|---|---|
| | UOS | COS | p-value |
| Numbers of patients | 142 | 131 | |
| ICU mortality | 29 (20) | 16 (12) | 0.074 |
| Hospital mortality | 45 (32) | 33 (25) | 0.284 |
| New organ failure during ICUs stays | | | |
| Kidney | 19 (13) | 15 (11) | 0.715 |
| Heart | 8 (6) | 5 (4) | 0.576 |
| Lung | 4 (3) | 1 (1) | 0.372 |
| Liver | 1 (1) | 1 (1) | 0.999 |
| New pathologically documented infections during ICUs stays | | | |
| Respiratory tract | 25 (18) | 19 (15) | 0.514 |
| Bloodstream infections | 14 (10) | 7 (5) | 0.179 |
| Length hospital of stays | 20.18 ± 2.64 | 19.63 ± 1.99 | 0.055 |
| Urine output (L/day/patient) | 1.52 ± 0.25 | 1.47 ± 0.26 | 0.107 |

ICU: intensive care unit.

Categorical variables are presented as frequency (percentages) and continuous variables are presented as mean ± standard deviation (SD). The unpaired t-test for continuous variables and the Fischer exact test for categorical variable were performed for statistical analysis. Results were considered significant if p < 0.05.
(7.05 ± 2.13 days/patient vs 7.69 ± 2.43 days/patients, \( p = 0.016 \), Figure 5). A total of 55 (39%) patients from UOS cohort and 35 (27%) patients from COS cohort were needed vasopressors to achieve mean arterial pressure of 65 mmHg (\( p = 0.039 \)).

**Survival**

The follow-up time for patients of UOS cohort were 23.12 ± 3.15 days/patient (minimum: 15 days and maximum: 40 days). The follow-up time for patients of COS cohort were 20.21 ± 2.89 days/patient (minimum: 13 days and maximum: 37 days).
The probability of survival of patients was higher among patients of COS cohort than those of UOS cohort ($p = 0.049$, Figure 6).

Mortality

Patients who had the time-weighted average partial pressure of oxygen 81–100 mmHg or 101–120 mmHg during ICUs had fewer ICUs mortality than those who had the time-weighted average partial pressure of oxygen <80 mmHg or >120 mmHg during ICUs (Table 3). If the mean time-weighted average partial pressure of oxygen during ICUs is taken on horizontal axis and the mortality of

![Figure 6. Probability of survival of patients.](image)

**Table 3.** Mortality of patients during intensive care units according to different values of the time-weighted average partial pressure of oxygen during intensive care units.

| The time-weighted average partial pressure of oxygen during intensive care units | Mortality of patients during intensive care units |
|---|---|
| Total numbers of intensive care units’ mortality | 45 |
| <80 mmHg | 15 (33) |
| 81–100 mmHg | 7 (16) |
| 101–120 mmHg | 6 (13) |
| >120 mmHg | 17 (38) |

Data are presented as frequency (percentages).

The probability of survival of patients was higher among patients of COS cohort than those of UOS cohort ($p = 0.049$, Figure 6).
patients during ICUs were taken on vertical axis, then it is given ‘U’-shaped curve (Figure 7).

SAPS II value less than 38 ($p = 0.043$), length of ICU(s) stays more than 6 days ($p = 0.041$), requirements of mechanical ventilation ($p = 0.039$), and development of septic shock (SOFA $\geq 3$, $p = 0.045$) were responsible for ICUs mortality of patients (Table 4).

**Discussion**

The current study reported that conservative oxygen supplementation to maintain partial pressure of oxygen was improved outcome measures as compared to that of usual oxygen supplementation in patients admitted in ICUs for treatment of sepsis. The results of outcome measures of the current study agreed with those of a randomized clinical trial on critically ill patients$^1$ and a prospective before-and-after trial$^{15}$ but not agreed with those of a randomized clinical trial on critically ill patients.$^{16}$ The reason behind such controversies among the results of the outcome measures is that a randomized clinical trial on critically ill patients$^{16}$ has used large sample size lead to type-II error. However, post hoc analysis on sepsis patients of

**Figure 7.** Relationship between the average time-weighted partial pressure of oxygen during intensive care units and mortality of patients during intensive care units.
Australia and New Zealand is recommending usual oxygen supplementation to maintain partial pressure of oxygen in patients admitted in ICUs for treatment of sepsis. The reason behind such controversies among the results is that a post hoc analysis is performed with limited power. Also, the inclusion criteria of a post hoc analysis is not strictly followed the definition of sepsis. The current study is recommending conservative oxygen supplementation to maintain partial pressure of oxygen in patients admitted in ICUs for treatment of sepsis.

The study reported ‘U’ shaped relationship between the time-weighted average partial pressure of oxygen during ICUs and mortality of patients during ICUs. The results of relationship between partial pressure of oxygen during ICUs and mortality of patients during ICUs are parallel with that of a randomized clinical trial on critically ill patients, retrospective, observational studies on critically ill patients, and retrospective cohort study in patients following cardiac surgery. The time-weighted average partial pressure of oxygen should be near 100 mmHg to increase survival of patients.

The study reported that mechanical ventilation-free hours were significantly higher for patients of the COS cohort than those of the UOS cohort. The results of mechanical ventilation-free hours of the current study consistent with those of a randomized clinical trial on critically ill patients. Excessive oxygen supplementation exacerbates the preexisting disease(s) condition and hindered recovery. The exposure of oxygen to patients was optimum in the patients of the COS cohort.

### Table 4. The risk factor for mortality of patients during intensive care units.

| Total numbers of ICUs mortality | 45 |
|---------------------------------|--|
| Parameters                      | Odd ratio | 95% confidence interval | p-value |
| Age (≤ 60 years vs ≥ 60 years)  | 0.981     | 0.651–0.982             | 0.053   |
| Sex (women vs men)              | 0.821     | 0.667–0.963             | 0.065   |
| Sepsis: SOFA ≥ 2 responsible organ(s) or component |
| Kidney                          | 0.975     | 0.665–0.959             | 0.055   |
| Heart                           | 0.963     | 0.663–0.962             | 0.054   |
| Lung                            | 0.955     | 0.667–0.965             | 0.053   |
| Liver                           | 0.949     | 0.660–0.968             | 0.058   |
| Cancer/carcinoma/sarcoma (presence vs absence) | 0.963 | 0.665–0.961 | 0.053 |
| SAPS II (≤ 38* vs ≥ 38)         | 1.231     | 0.641–0.983             | 0.043   |
| Length of ICU(s) stays (≤ 6 days vs > 6 days*) | 1.272 | 0.645–0.988 | 0.041 |
| Artificial respiration (requirements of mechanical ventilation* vs no-mechanical ventilation) | 1.421 | 0.612–0.987 | 0.039 |
| Septic shock: SOFA ≥ 3 (absence vs presence*) | 1.121 | 0.651–0.978 | 0.045 |

**ICU**: intensive care unit; **SAPS II**: simplified acute physiology score–II; The total score is 163. The higher the score more is severity of illness; **SOFA**: sequential organ failure assessment.

Multivariate analysis. Alive discharge of ICUs was considered as reference standard. A p-value less than 0.05 and odd ratio more 1 were considered significant.

*Significant parameter for ICUs mortality of patients.
than those of the UOS cohort. The current study is recommending conservative oxygen supplementation in ICUs for recovery.

The study reported that ICUs length of stays of patients of the COS cohort was fewer than those of the UOS cohort. The results of ICUs length of stays of patients of the current study were not parallel with those of randomized clinical trials on critically ill patients\(^1,16\) and a post hoc analysis on sepsis patients.\(^17\) Imbalance of the demographical and clinical conditions and severity of illness of the included patients of ICU-ROX study\(^1,17\) and a large sample size of a randomized clinical trial\(^16\) are responsible for these controversial results. The conservative oxygen supplementation may decrease the preexisting disease(s) condition.

The study reported that significant fewer numbers of patients who received conservative oxygen supplementation were needed vasopressors to achieve mean arterial pressure of 65 mmHg than those who received usual oxygen supplementation. Hypoxemia during maintenance of partial pressure of oxygen has the detrimental effects of reactive oxygen species on the endothelial cells, with derangements in endothelial nitric oxide production and therefore alterations in microvascular perfusion, which needed vasopressors.\(^20\) Conservative oxygen supplementation is safe than usual oxygen supplementation.

The study reported that the SAPS II value < 38, ICUs hospital stay > 6 days, the requirements of mechanical ventilation, and development of septic shock were intendent parameters for ICUs mortality of patients. The results of the risk of ICUs mortality of patients of the current study agreed with those of a randomized clinical trial on critically ill patients.\(^1\) These parameters are severity of sepsis patients.

Several limitations of the study have to be reported, for example, non-randomized retrospective study and lack of randomized control trial. The sample size was calculated on the basis of mortality during ICUs but not on the basis of hyperoxia of patients during ICUs. It might be important to assess what was the proportion of surgical and medical patients included in this study. The perioperative management of hyperoxia is another important chapter which seems to tear apart from current evidence in critically ill population.\(^5,21\) However, the study did not include patients who required the perioperative management of hyperoxia. Data regarding the hospital stays and before ICUs admission were also affects the conditions of patients, for example, if patients in the conservative group received long periods (>48 h) of oxygen supplementation before ICUs during hospital stay. It may be useful to specify this issue but such data were not reported in the study.

**Conclusions**

Conservative oxygen supplementation to maintain partial pressure of oxygen may improve outcome measures and decrease mortality of patients in the intensive care units as compared to those of usual oxygen supplementation to maintain partial pressure of oxygen in patients admitted in intensive care units for treatment of sepsis.
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Authors’ contributions
All authors have read and approved the manuscript for publication. YP and XY were project administrators, contributed equally to supervision, resources, methodology, and literature review of the study. YZ contributed to methodology, conceptualization, data curation, software, and literature review of the study. LW contributed to methodology, literature review, formal analysis, and investigation of the study, draft, and edited the manuscript for intellectual content. All authors agree to be accountable for all aspects of work ensuring integrity and accuracy.

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Availability of data and materials
The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

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