Conservative Oxygen Therapy for Vented ICU Patients?

Key Article

- *Martin DS, et al. Conservative oxygen therapy in mechanically ventilated critically ill adult patients. The UK-ROX Randomized Clinical Trial. JAMA. 2025. Published online June 12, 2025.*

Background

- Oxygen is one of the most commonly delivered therapies to ICU patients.
- We know that hypoxemia is bad for critically ill patients. As such, a liberal approach to the administration of supplemental oxygen is common.
- However, we also have evidence to suggest that too much oxygen may also be harmful to critically ill patients.
- Achieving a balance between too little and too much oxygen is critical to ensure optimal outcomes for critically ill patients.
- To date, clinical trials have not been able to conclusively determine whether a conservative or liberal approach to oxygen delivery is beneficial for ICU patients.
- A recent meta-analysis that included over 10,000 patients reported no difference in mortality between a conservative and liberal approach to oxygen therapy.
- Notwithstanding, additional evidence from large-scale trials is needed to more definitely determine whether conservative oxygen therapy is beneficial, or harmful, to patients receiving mechanical ventilation.

Objective

- To assess whether a conservative oxygen therapy strategy by targeting an SpO2 88%-92% reduced 90-day mortality compared to usual oxygen therapy in adult ICU patients receiving mechanical ventilation.

Methods

- Multicenter, pragmatic, registry-embedded, randomized trial
- 97 adult ICUs in England, Wales, and Northern Ireland
- Patients - Included
    - 18 years of age or older
    - Receiving invasive mechanical ventilation following an unplanned ICU admission OR
    - Where invasive mechanical ventilation was started in the ICU
    - Were able to be enrolled within 12 hours of initiation of ventilation
- Patients – Excluded
    - Receipt of ECMO
    - Were randomized in the trial within the previous 90 days
    - Clinician considered that the intervention was needed or contraindicated
- Intervention
    - Patients randomized in a 1:1 ratio
        - Conservative oxygen therapy

        - Received the lowest FiO2 possible to maintain an SpO2 at 90%
        - Sites instructed to set alarms if the SpO2 fell below 88% or exceeded 92% once the patient was within range
        - Deviations were allowed if there were major discrepancies between ABG and SpO2 values, a high FiO2 was needed to prevent life-threatening illness, or patient condition changed that would have precluded continuation of the trial.
        - Clinicians permitted to alter other therapies as needed
    - Usual oxygen therapy
        - Patients received supplemental oxygen at the discretion of the treating clinician.
        - No minimal FiO2 was mandated and no upper limit SpO2 alarm was set.
- Primary outcome
    - All-cause mortality at 90 days
- Secondary outcomes
    - ICU LOS
    - Hospital LOS
    - Days alive and free of organ support at 30 days
    - ICU and hospital mortality at hospital DC
    - 60-day and 1-year mortality
- Sample size
    - Investigators determined a sample size of 16,500 patients to detect an absolute risk reduction of 2.5%-34.5% with conservative oxygen therapy.

Results

- A total of 16,434 patients were included in the primary analysis
    - Conservative oxygen therapy: 8,230 patients
    - Usual oxygen therapy: 8,204 patients
    - Groups were similar at baseline
        - Median Age: 60 years
        - 38% female
        - Median time to randomization after first receiving MV: 5 hours in both groups
- Oxygen Exposure
    - Median FiO2
        - Conservative oxygen therapy: 0.31
        - Usual oxygen therapy: 0.35
        - Total exposure was 29% lower in the conservative oxygen therapy group
    - Median SpO2
        - Conservative oxygen therapy: 93%
        - Usual oxygen therapy: 95%
    - Time spent within an SpO2 range of 88%-92%
        - Conservative oxygen therapy: 63 hours
        - Usual oxygen therapy: 27 hours
- Adherence to Protocol
    - Conservative oxygen therapy
        - 42% had at least 1 period of nonadherence representing 11% of their total time in the ICU

        - 2,271 period of nonadherence of 3 hours or more
            - Staffing issues, other clinical priorities, clinical decision to suspend intervention
- Primary Outcome – All-cause 90-day mortality
    - Conservative oxygen therapy: 35.4%
    - Usual oxygen therapy: 34.9%
- Secondary Outcomes
    - Mortality at ICU discharge, 60-days, 1-year were not different between groups
    - ICU and hospital LOS among survivors were not different between groups
    - Days alive and free of organ support at 30-days were not different between groups
- Serious Adverse Events
    - Conservative oxygen therapy: 0.7%
    - Usual oxygen therapy: 0.4%

Limitations Identified by Authors

- Unblinded clinical trial
- Large number of patients excluded due to the intervention either being indicated or contraindicated
- Large % of nonadherence to conservative oxygen therapy protocol
- Usual care comparator? Was there enough separation between the groups?

Take Home Points

- A conservative oxygen therapy approach that targeted an SpO2 of 90% did not reduce 90-day all-cause mortality in adult ICU patients receiving mechanical ventilation when compared to usual oxygen therapy.