

Excess oxygen during surgery linked to higher risk of organ damage

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Giving patients excess levels of oxygen during surgery is associated with a higher risk of subsequent kidney, heart, and lung injury, finds a large U.S. study published by *The BMJ* today.

Although the absolute risk remains low, this study suggests it is time to reconsider the liberal use of oxygen during general anesthesia, say experts in a linked editorial.

Oxygen is routinely given to almost all patients undergoing [surgery](#) with general anesthesia to help prevent hypoxia (dangerously [low oxygen levels](#)), and the World Health Organization recommends liberal use of oxygen to reduce the risk of infection.

During surgery, arterial blood hemoglobin oxygen saturation (SpO₂) is continuously measured, enabling doctors to adjust the dose of oxygen to a target level. A normal SpO₂ is 94-95%. Giving oxygen in excess of that required to saturate hemoglobin—known as supraphysiological oxygen—is common.

Supraphysiological oxygen can harm the body's cells and tissues, but the clinical relevance of these effects during surgery remain uncertain, and previous trials have not been able to detect any meaningful effects on organs.

To address this knowledge gap, a team of U.S. researchers examined whether supraphysiological oxygen administration during surgery is associated with lower or higher postoperative kidney, heart, and [lung injury](#).

Their findings are based on data for over 350,000 patients (average age 59; 52% women; 70% white) undergoing surgery with [general anesthesia](#) and endotracheal intubation (a breathing tube placed into the windpipe) at 42 medical centers across the United States between January 2016 and November 2018.

Background information on factors such as age, sex, race, weight (BMI), and medical history was collected, and patients were screened for

kidney, heart, and lung injury before and after their surgery. The researchers then used an algorithm to calculate the amount of oxygen given above air level (21%) against the time spent with oxygen saturation at or above 92% throughout surgery.

Medical records were used to track cases of acute kidney, myocardial, and lung injury as well as 30 day mortality, hospital length of stay, and stroke. The average duration of surgery was 205 minutes. Acute kidney injury was diagnosed in 6.5% of patients, myocardial injury in 2.8%, and lung injury in 4.4%.

After accounting for baseline factors and other potentially influential variables, increased oxygen exposure during surgery was associated with a higher risk of organ injury.

For example, patients at the upper end (75th percentile) of oxygen levels had 26% greater odds of acute kidney injury, 12% greater odds of myocardial injury, and 14% greater odds of lung injury compared with patients at the lower end (25th percentile).

Patients at the 75th percentile of oxygen levels also had 9% greater odds of stroke and 6% greater odds of 30 day mortality than patients at the 25th percentile.

However, patients at the 75th percentile had a slightly shorter length of stay compared with patients at the 25th percentile, an effect unchanged after excluding patients who died before discharge.

These are observational findings, so can't establish cause, and the researchers acknowledge that not all patients were screened for kidney and heart injury after their surgery, nor were they able to consider factors such as diet, lifestyle, and medication use, which can influence susceptibility to organ injury.

Nevertheless, this was a large study, drawn from geographically diverse populations, ensuring precision and generalizability of the results. Findings were similar after additional analyses, providing greater confidence in their conclusions.

Based on their findings, the researchers say, "A large clinical trial to detect small but clinically significant effects on organ injury and patient centered outcomes is needed to guide oxygen administration during surgery."

This, and previous research, shows that oxygen can be a double-edged sword, point out experts in a linked editorial.

They suggest that future research on this topic could deal with some of the study's acknowledged limitations and could also measure [cognitive impairment](#) because experimental evidence suggests that brain tissue is particularly vulnerable to redox imbalance.

Research collaborations between biochemists and anesthesiologists should be encouraged, they add, "especially to identify cause-effect relationships between supraphysiological oxygen administration and organ injury."

More information: Oxygen administration during surgery and postoperative organ injury: observational cohort study, *The BMJ* (2022). [DOI: 10.1136/bmj-2022-070941](https://doi.org/10.1136/bmj-2022-070941)

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