Effect of wearing a surgical mask on short-term pulmonary gas exchange in patients immediately after anaesthesia

Sir,

During the novel coronavirus disease 2019 (COVID-19) pandemic, the universal application of surgical masks on patients may help prevent exposure to healthcare workers.\(^{[1,2]}\) After tracheal intubation under general anaesthesia, the production of airway secretions increases, and patients are more likely to develop a cough during recovery. Some reports recommend that a surgical mask must be applied to the patients in the operating room.\(^{[3,4]}\) In this study, we aimed to investigate changes in arterial blood gases in patients wearing a surgical mask immediately post-extubation after general anaesthesia.

This retrospective study was approved by the hospital ethics committee (#2021-006). The need for informed consent was waived by the committee, and the research content was made publicly accessible. Based on the data available from medical records, 56 patients (30 who wore a surgical mask and 26 who did not) who underwent surgery under general anaesthesia with invasive arterial line insertion and tracheal intubation between 25 January 2021 and 6 September 2021 were enrolled in the study. The study followed the principles of the Declaration of Helsinki and was conducted in a tertiary-level emergency medical centre. Patients with severe respiratory illness were excluded.

Variables such as age, gender, body weight, body mass index, the American Society of Anesthesiologists physical status, details of the surgery, anaesthesia time, operation time and blood gas values were collected.

After extubation following general anaesthesia, 3 L/min of oxygen therapy by a nasal cannula was used for the patients. After confirming that the patients were awake and their respiratory condition was stable, an arterial blood gas analysis was performed. Then, a surgical mask was placed over the nasal cannula, and after 5 min, a repeat blood gas analysis was performed. If no significant abnormalities were found, the patients were released from the operating room at the discretion of the anaesthesiologist.

Patients who underwent repeated blood gas analysis using the same oxygenation procedure without a surgical mask, before the COVID-19 pandemic, were selected as the controls.

The Wilcoxon signed-rank test was performed to investigate whether there was a difference in the partial pressures of oxygen (\(\text{PaO}_2\)) and carbon dioxide (\(\text{PaCO}_2\)) in patients before and after wearing a surgical mask. Statistical Package for Social Sciences software version 25 (International Business Machine Corporation., Armonk, New York) was used for analysis, and \(P\) values < 0.05 indicated significance.

There were no statistically significant differences in demographics between the groups, except for surgical details [Table 1]. Arterial \(\text{PaO}_2\) increased significantly from 109.5 (99.2–148.5) mmHg to 183.0 (145.5–204.0) mmHg \((P < 0.001)\), whereas the \(\text{PaCO}_2\) showed no statistically significant change [from 42.9 \([38.6–45.8]\) mmHg to 41.8 \([38.3–45.1]\) mmHg \((P = 0.665)\) before and after wearing a surgical mask] [Figure 1a and b].

There were no statistically significant changes in \(\text{PaO}_2\) [from 103.5 \([92.7–131.5]\) mm Hg to 108.0 \([91.2–135.8]\) mm Hg \((P = 0.839)\)] or \(\text{PaCO}_2\) [from 42.9 \([38.6–45.8]\) mm Hg to 44.1 \([42.0–46.4]\) mm Hg \((P = 0.186)\)] in patients without a mask [Figure 1c and d].

| Table 1: General characteristics of patients |
|---------------------------------------------|
| Characteristic                          | Patients with mask (n=30) | Patients without mask (n=26) | \(P\)  |
| Age, median (IQR), years                  | 76.0 (71.8-82.8)          | 76.5 (70.0-85.0)              | 0.675  |
| Male gender, n (%)                        | 15 (50.0)                 | 11 (42.3)                     | 0.601  |
| Height, median (IQR), cm                  | 156.0                     | 158.5                         | 0.353  |
| Weight, median (IQR), kg                  | 51.0 (44.3-58.9)          | 54.0 (47.4-61.0)              | 0.282  |
| Body mass index, median (IQR) kg/m\(^2\)  | 21.1 (18.5-24.1)          | 22.3 (18.9-23.7)              | 0.430  |
| ASA-PS, median (IQR)                      | II (II-III)               | II (II-II)                    | 0.301  |
| Anaesthesia time, median (IQR), min       | 222.0                     | 229.0                         | 0.681  |
| Surgical time, median (IQR), min          | 161.5                     | 171.5                         | 0.761  |

\(\text{IQR}=\text{interquartile range, ASA-PS=American Society of Anesthesiologists physical status, n=number}\)
The study showed that wearing a surgical mask over the nasal cannula significantly increased PaO\(_2\). This result is consistent with that reported in a previous study showing that oxygenation could be improved by wearing a surgical mask while wearing a high-flow nasal cannula and that wearing a surgical mask over an oxygen mask caused a greater increase in oxygen concentrations than wearing it under an oxygen mask.\(^{[5,6]}\)

This study has some limitations. It was a single-centre study with a retrospective design and a small number of cases. The hypothesis drawn from this study should be confirmed in a randomised study.

In conclusion, wearing a surgical mask over a nasal cannula after general anaesthesia to prevent droplet infection might also help improve oxygenation without increasing PaCO\(_2\) levels.

**Ethics approval**

This study was approved by the Clinical Research Ethics Committee of the Nagahama Red Cross Hospital (approval number: 2021-006).

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Nil.

**Conflicts of interest**
There are no conflicts of interest.

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Letters to Editor

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