Editorial

A Step Toward Safety in Tracheal Intubation

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Preoxygenation of a patient before induction of anesthesia increases the oxygen reserve in the lungs, delaying the risk of desaturation and allowing more time and safer work during intubation[1].

Critical care patients often require tracheal intubation in the intensive care unit (ICU), emergency department (ED) or, in every hospital setting where an emergency can occur. Instead of elective surgery, patients often have hemodynamic instability, severe respiratory failure, greater sensitivity to the adverse effects of sedatives, and cardiac or cerebrovascular disease[2]. Additionally, airway management is associated with a high rate of complications including severe hypoxia, hemodynamic deterioration, cardiac arrest, and death[2–4]. Furthermore, the incidence of difficult intubation is higher than that of elective intubation in the operating room (OR)[2], and hypoxemia during intubation increases the risk of cardiac arrest and death[3,4].

As endotracheal intubation is a common procedure and can often be complicated by serious events, more and more studies are focusing on pre-oxygenation and the use of Noninvasive Ventilation (NIV) or High Flow Nasal Cannula (HFNC) compared to the standard oxygen mask to improve the safety and efficacy of the procedure. Preoxygenation has a strong rationale for reducing the risk of hypoxia before intubation[2].

For example, a recent systematic review showed that preoxygenation with NIV reduces the risk of SpO_2<80% during intubation in comparison with conventional oxygen therapy (COT) (RR 0.28, 95% CI: 0.070-0.71). However, compared with NIV, HFNCs offer advantages, such as humidified and heated air, better compliance, and CO_2 washout. Besides being less tolerated, NIV is associated with complications, such as abdominal distension and PNX[5]. However, a recent analysis showed that HFNC resulted in longer apneas than NIV and that NIV was able to maintain higher oxygenation during intubation than both HFNC and COT. However, the same study also pointed out that NIV has to be removed during intubation compared to HFNC and that there are still too few studies on this topic[6].

Another review showed that HFNC reduced severe desaturation in patients with elective intubation in the OR but not in patients with respiratory failure in the ICU. In contrast, NIV applied for 3 minutes prior to intubation resulted in a better safety profile, reducing the incidence of severe desaturation episodes without NIV-related complications. Therefore, NIV can be considered a useful approach to preoxygenation in critically ill patients, especially hypoxemic patients, although it has only been evaluated in small trials[2].

One of the most recently published trials comparing the use of NIV to pre-oxygenate the patient before intubation with a standard oxygen

mask has shown a lower incidence of hypoxemia during intubation using NIV.

The results showed a clear advantage for NIV: only 9.1% of NIV patients developed hypoxemia compared with 18.5% in the oxygen mask group ($p<0.001$). Therefore, a reduction of almost 50% in the risk of desaturation is clinically relevant. Furthermore, patients in the NIV group showed a lower incidence of cardiac arrest (0.2% vs. 1.1%), suggesting that improved oxygenation could be translated into a reduction of more serious complications, including the risk of mortality[4].

Therefore, preoxygenation performed by devices such as HFNC or NIV, which guarantee the delivery of positive end-expiratory pressure (PEEP), can effectively prevent important clinical complications when compared to the standard oxygen mask.

While a standard oxygen mask can deliver an oxygen flow of up to 15 L/min[4,7], HFNC is widely used to deliver heated and humidified oxygen of up to 60 L/min[1,8]. High-flow gas delivery provides constant FiO_2 because it overcomes the patients' peak inspiratory flow. Recent meta-analyses have demonstrated the effectiveness of HFNC in generating positive pressures that improve oxygenation (through a slight level of lung recruitment) and ease CO_2 elimination, which is very useful in patients with acute respiratory failure[1,9]. HFNC weakness points are determined by the fact that patients with respiratory distress maintain their mouth opening, reducing the mean PEEP levels, while NIV allows them to deliver high levels of FiO_2, maintain positive intrathoracic pressure, and promote alveolar recruitment; hyperoxygenation achieved by combining HFNC and NIV seems to be more effective than single strategies[6]. As the use of NIV with pre-oxygenation appears to be effective in reducing the incidence of $SpO_2<80\%$ but HFNC is safer and more tolerated, further studies evaluating the combination of the two methods would be appropriate.

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