A comparative study of end-tidal oxygen (EtO₂) during preoxygenation with oxygen-prefilled anesthesia breathing system versus non-prefilled anesthesia breathing system

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Background and Goal of Study: One minute deep breathing technique is a widely accepted method for preoxygenation, especially in the emergency situations, to increase oxygen reserves and delayed onset of desaturation during apnea in the induction period. This is usually performed without prefilling oxygen in the anesthesia breathing system. Thus, the patient does not receive 100% oxygen initially. The goal of this study is to compare the efficacy of preoxygenation between oxygen-prefilled system and non-prefilled system.

Materials and Methods: 40 adults, 18 –65 years old with ASA I and II, undergoing elective surgery under general anesthesia were randomly assigned into oxygen-prefilled group, which the anesthesia breathing system was prefilled with oxygen by using the oxygen flush pressurized to 30 cmH₂O for 10 seconds before applying a tight-fitting mask, and non-prefilled group. Then preoxygenation by deep breathing technique with oxygen flow of 6 L min were applied in both groups. The end-tidal oxygen concentration (EtO₂), the fraction of inspired oxygen concentration (FiO₂), the end-tidal carbon dioxide concentration (EtCO₂), respiratory rate (RR), and expiratory volume were recorded every 15 seconds until 2 minutes. Data were analyzed with chi-square test and student t-test.

Results: Demographic data were similar in both groups, as were the expiratory volume and respiratory rate (Table 1). The measured *inspired oxygen concentrations in prefilled group* were significantly *higher* than non-prefilled group (Figure 1). The *end-tidal oxygen concentrations in prefilled group* were also significantly *higher* than non-prefilled group at all evaluated times (Figure 2). The mean EtO₂ values at 1 minute was significantly higher in prefilled group, compared to non-prefilled group (77.85 ± 4.64% vs. 66.95 ± 6.61%; p < 0.001) and also at 2 minute (86.05 ± 3.49% vs. 81.20 ± 5.06%; p < 0.01). There were 15 patients (75%) in prefilled group and 7 patients (35%) in non-prefilled group with EtO₂ ≥ 85% at 2 minute which are significantly difference (p < 0.001).

Table 1 Demographic data			
	Prefilled	Non-prefilled	P-value
Male	7 (35%)	6 (30%)	0.74
Age (y)	40.35 ± 13.25	40 ± 14.62	0.94
BMI (kg/m ²)	23.40 ± 3.27	22.79 ± 3.10	0.54
ASA I	14 (70%)	11 (55%)	0.33
Hct ≥30%	20 (100%)	18 (90%)	0.49
SpO ₂ (%)	99.20 ± 1.56	99.35 ± 0.99	0.72
Expiratory volume			
1 st minute (ml)	1184.58 ± 461.18	1039.48 ± 373.08	0.28
2 nd minute (ml)	1225.68 ± 477.80	1150.11 ± 316.12	0.56
Respiratory rate			
1 st minute (/min)	9.65 ± 3.57	10.40 ± 4.20	0.55
2 nd minute (/min)	9.65 ± 4.00	10.25 ± 4.30	0.65

Fig.1 Comparison of fraction of inspired oxygen (FiO₂) over 2 minutes

Fig.2 Comparison of end-tidal oxygen concentration (EtO₂) over 2 minutes

Conclusions: Preoxygenation with oxygen-prefilled anesthesia breathing system is more efficient than non-prefilled anesthesia breathing system. However, it still provided suboptimal preoxygenation. So for emergency situations, extending the duration of deep breathing at least 2 minutes using oxygen-prefilled system with high fresh gas flow should be recommended.

References

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