



The Comparative Study of Optimal Fresh Gas Flow Used in Lack-Plus and Lack's Circuit on Spontaneously Breathing Anaesthetized Adults

Theerapongpakdee S^{1*}, Sathitkarnmanee T¹, Sucher S¹, Thanananun M², Nonlhaopol D²

^{1,2}Department of Anesthesiology, Faculty of Medicine, Khon Kaen University, Khon Kaen, 40002 Thailand.

* Corresponding author, Email: Sunchai.th@gmail.com

Oral

Background and objective: Lack's circuit is a modified co-axial Mapleson A breathing system that is commonly used in spontaneously breathing anaesthetized adults. Lack-Plus circuit is a modified Lack circuit with additional intraluminal one-way valve and active gas scavenging system which can minimize fresh gas flow (FGF), save anaesthetic gas and decrease operating room environment pollution. Thus, the objective of this study was to compare the Lack-Plus and Lack's circuit on the minimal FGF requirement with no and clinically acceptable rebreathing in spontaneously breathing anaesthetized adults, and to invent the Lack-Plus circuit.

Material and Method: Our study was a randomized cross-over study. Twenty-four adult patients with BMI \leq 30 kg/m², under elective peripheral surgery in supine position with ASA physical status I-II were enrolled. They were allocated into group 1 (LP-L) starting with Lack-Plus then switching to Lack's circuit or group 2 (L-LP) in reversed pattern. After induction and intubation, anesthesia was maintained with 50% N₂O/O₂ and Desflurane 4 to 6% and fentanyl titration to control optimal respiratory rate in the range of 10 to 16/

min. Starting with the first circuit, all patients were spontaneously breathing with FGF 4 L/min for 10 minutes, and then gradually decreased by 0.5 L/min every five minutes. End-tidal CO₂ (ETCO₂), inspired minimum CO₂ (ImCO₂), mean arterial pressure (MAP) and oxygen saturation (SpO₂) were recorded until rebreathing (ImCO₂ > 0 mmHg) occurred and continued until the FGF was 2.5 L/min. The anesthesia breathing circuit was then switched to the other and the procedure repeated.

Results: The minimal FGF at the point of rebreathing of Lack-Plus and Lack's circuit were 2.7 ± 0.8 and 3.3 ± 0.5 L/min respectively; $p < 0.001$. At the FGF 2.5 L/min, ImCO₂ were 1.5 ± 2.0 and 4.2 ± 2.6 mmHg respectively; $p < 0.001$.

Conclusion: Lack-Plus circuit can be used safely, effectively, and requires less FGF than Lack's circuit in spontaneously breathing anaesthetized adults.

Keywords: Lack-Plus circuit; Lack circuit; Fresh gas flow; Spontaneous breathing; Anaesthesia

