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### Introduction

To decrease the risk of surgical fires, the Joint Commission recommends supplying open delivery systems such as nasal cannulae, consistent with patient needs, with gas mixtures not exceeding  $30\% O_2^{-1}$ . The tapered (aka "Christmas tree") male outlet of an auxiliary ball-in-tube (ABIT) oxygen flowmeter is currently the only gas outlet on anesthesia machines that accepts the tapered female inlet of nasal cannulae without requiring any effort or modifications. This convenience comes at a Table 1 potential cost: the ABIT O<sub>2</sub> flowmeter delivers only 100% O<sub>2</sub> which increases the risk of surgical fire. Setting the anesthesia machine air and  $O_2$  flowmeters to a 7:1 ratio (e.g., 3.5 L/min air, 0.5 L/min  $O_2$ ) will deliver a 30% O<sub>2</sub> mixture at the Y-piece or auxiliary common gas outlet (ACGO)<sup>2</sup>. An adapter from a 5 mm endotracheal tube can be used to connect the nasal cannula inlet to either the Y-piece or the ACGO<sup>2</sup>. However, the flow from nasal cannulae prongs may be lower than set when supplied via the Y-piece<sup>3</sup>. We measured the outflow of a nasal cannula when supplied from different sources.



# Effect of gas supply source for fire risk reduction on nasal cannula flow

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### Methods

We routed the gas outflow (4 L/min) from the prongs of a nasal cannula (MicroStream Smart CapnoLine+O<sub>2</sub>, Medtronic, Minneapolis, MN) through the flow sensor (n=3) of a flow monitor (NICO, Respironics, Murraysville, PA). The nasal cannula was supplied from an anesthesia machine (Aestiva, GE Healthcare, Madison, WI) via 3 different gas sources: ABIT O<sub>2</sub> flowmeter  $(100\% O_2)$ , Y-piece  $(30\% O_2)$  and ACGO  $(30\% O_2)$ . When using the Y-piece, the adjustable pressure limiting valve (APL, aka "pop-off" valve) was fully closed with the selector switch set to "Bag". When using the ACGO, the ACGO lever was lowered to divert the common gas outflow from the flowmeter bank to the ACGO.

	Ball in tube	Y-piece	Y-piece	ACGO
	NC output (LPM)	NC output (LPM)	P (cmH2O)	NC output (LPM)
4 LPM (3.5 LPM air, 0.5 LPM O2)	4.4	3.7	29	2.4
	4.3	3.7	30	2.2
	4.5	3.7	30	2.5
Average outflow (LPM)	4.4	3.7		2.4
Standard deviation (LPM)	0.06	0.03		0.15



Fig 1: ABIT

Fig 2: Y-Piece Samsun (Sem ) Lampotang, PhD slampotang@anest.ufl.edu Fig 3: ACGO

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# Results

Outflow was 4.4±0.06, 3.7±0.03 and 2.4±0.15 L/min for the ABIT, Y-piece and ACGO respectively. See Table.

## Conclusions

Even though the ABIT O<sub>2</sub> flowmeter provides no flow drop-off, the risk of surgical fire due to delivering only 100% O<sub>2</sub> remains of concern. Consistent with patient oxygenation needs, clinicians might need to use higher flows (while maintaining 30% O<sub>2</sub> delivery) to compensate for flow drop-off when using the Y-piece or ACGO to supply nasal cannulae. Leakage through the fully closed APL valve  $(70 \text{ cmH}_2\text{O} \text{ pop-off pressure})$  when using the Y-piece has been suggested as a cause for flow drop-off; however, this hypothesis seems to be inconsistent with the observed airway pressures of 30 cmH<sub>2</sub>O (consistent with the manual 3L bag becoming infinitely compliant at about 30 cmH<sub>2</sub>O). Further investigation into the flow drop-off is warranted.

### References

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