Correspondence

A recurring case of 'no trace, right place' during emergency tracheal intubations in the critical care setting

We wish to highlight a safety issue concerning the use of the Mapleson C circuit along with high fresh gas flows and the potential impact this could have on capnography. The authors have encountered a situation where despite successful tracheal intubation, there can be continued failure to detect carbon dioxide. This issue became apparent during the undertaking of a large number of emergency tracheal intubations in the current COVID-19 pandemic.

The cases involved patients with uneventful airway management and clear placement of a tracheal tube between the vocal cords using videolaryngoscopy. This was followed in all cases by the clinical confirmation of successful tracheal intubation but the absence of a capnographic trace. A commonly identified feature in all events was very high fresh gas flow to the Mapleson C circuit. This high flow was unintentional and frequently had been commenced by a clinician assisting with the tracheal intubation, before the arrival of the intubator. Furthermore, the high flow was initially unrecognised due to the urgent nature of the situation and the impact of personal protective equipment.

The standard oxygen flowmeter present in most wards or resuscitation bays displays flow graduations of up to 15 l.min^{-1}. The authors found that while often the last graduation marked is 15 l.min^{-1}, these devices are not flow-limited and when the valve is opened fully can generate flows much higher than this. Further investigation of the technical data supplied by the manufactures of several flowmeters reveals that the high flows produced when the valve is opened fully are referred to as 'flush' or 'flood' flows and can be as high as 90 l.min^{-1} [1]. The authors confirmed this by testing the flows generated from oxygen flowmeters encountered throughout their hospital including the auxiliary oxygen outlet present on the anaesthetic machine which produced 84 l.min^{-1} oxygen while a standard ward oxygen flowmeter achieved 75 l.min^{-1}.

When the situation was encountered again and the high flows identified, a capnographic trace could be produced by turning down the oxygen flow to the Mapleson C circuit. The exact cause of this phenomenon is yet to be determined but correspondence with the manufacturer of the Mapleson C circuit suggests that carbon dioxide washout is the likely cause. However, a number of confounders may also contribute and they include the flowmeters flush rate, the composition of the circuit, the type of heat and moisture exchange filter, the behaviour of the adjustable pressure limiting (APL) valve, the adequacy of the tracheal tube cuff and the patient's pulmonary compliance. A review of the technical data provided by the manufacturers of the Mapleson C circuit, revealed that with the APL valve set in the semi-closed position, a fresh gas flow of 50 l.min^{-1} will generate a resistance of 32 cmH_2O (Technical document, Armstrong Medical, Coleraine). The authors will explore these concepts further in a laboratory setting.

The current pandemic has seen oxygen capacity in hospitals come under strain due to the large number of COVID-19 patients [2, 3]. It is, therefore, imperative that we reduce the wastage of oxygen wherever possible.

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References

1. Precision Medical Inc. Flowmeters and specialty products. https://www.precisionmedical.com/media/1215/flowmeter-specialty-products-flyer.pdf (accessed 01/03/2021).
2. Campbell D. Coronavirus: London hospital almost runs out of oxygen for Covid-19 patients. *The Guardian* 2020. https://www.theguardian.com/society/2020/apr/02/london-hospital-almost-runs-out-oxygen-coronavirus-patients (accessed 01/03/2021).
3. Thornycroft P. Hospitals overwhelmed as Johannesburg runs out of oxygen. *The Telegraph* 2020. https://www.telegraph.co.uk/global-health/science-and-disease/hospitals-overwhelmed-johannesburg-runs-oxygen (accessed 02/03/2021).

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