

COVID-19: Very Rapid Updates and Safety (ViRUS)

Problems during the use of anaesthetic machine ventilators with Covid-19 patients when no more dedicated ICU ventilators are available. These include: HME filter blockage, high inspired CO₂ with spent soda lime and loss of ventilatory flow during suction.

What happened?

1. HME filter blocking with water when used with the circle system on the anaesthetic machine, leading to a fall in tidal volumes and increased airway pressures.
2. Under recognition of the need to change soda-lime, leading to hypercapnia. There is an increase in inspired CO₂ and hence end-tidal CO₂.
3. Loss of tidal volume when suction used if fresh gas flows are low, because anaesthesia ventilators do not normally compensate for the loss of available flow.

Why might this be more likely than usual to happen during the COVID-19 pandemic?

Many ICUs have received many patients in need of mechanical ventilation and so have exceeded their capacity of dedicated intensive care ventilators. Therefore, they have had to use anaesthesia machine ventilator systems as well.

How could this have been identified early in its course/how it could have been prevented or mitigated if recognised earlier?

Normally intensive care ventilators vent expired gases, but anaesthetic machines have a circle system which recirculates gas leading to extra humidity, and in addition they produce extra water when absorbing CO₂ with soda lime. The HME filter can become water-logged and obstruct ventilation if not changed every 4-6 hours or more frequently in some patients.

ICU nurses are not familiar with these machines so initially awareness of these issues was much lower. This is compounded by patients being nursed with non-icu trained nursing staff.

Soda-lime needs changing at least every 24 hours or more frequently in some cases. This needs to be recognised by observing soda lime colour change and being vigilant and setting alarms to detect any inspired CO₂ developing.

Many manufacturers have recommended using high fresh gas flows (equivalent to 150% minute volume in the case of some companies) to flush the circle, so avoiding CO₂ accumulation, excessive humidity and to reduce the risk of soda lime exhaustion with the need for frequent changes.

How have you managed to resolve this issue or create a work around?

Education of staff so they understand the difference between dedicated ICU ventilators and anaesthesia machine ventilators. Consciously checking these issues on ward rounds 3/day. Changing HME when any concern regarding a rise in pressures/fall in tidal volume. Regular frequent planned changes of HME filters.

Avoiding saline nebulisers in those without sputum issues, as these can make HME filter occlusion even worse.

Using higher fresh gas flows and fully understanding the difference between fresh gas flows to the circle and the ventilator settings/inspired oxygen being received by the patient