

## **Simple ‘do it yourself’ circuit to ventilate two patients at once is technically feasible**

*But still not known if split ventilation pros outweigh cons so should only be used as last resort, say specialists*

A simple ‘do it yourself’ breathing circuit, using accessories that are readily available in intensive care, can be used to ventilate two critically ill patients at once, should clinicians be faced with equipment shortages, suggests research published online in the journal **Thorax**.

But although technically feasible, it isn’t clear if the pros of split ventilation outweigh the cons, and the approach is fraught with ethical issues, so this circuit should only be used as a last resort, say critical care and respiratory disease doctors in linked opinion pieces.

Prompted by the rapid rise in COVID-19 cases in the Lombardy region of Italy, and the prospect of a ventilator shortage, Italian doctors assembled and tested a simple, easily built breathing circuit on two ‘pretend’ patients.

The circuit comprised routine and readily accessible tubing and accessories found in intensive care and operating theatres.

The 15-hour tests confirmed that it would be technically feasible to use the circuit to ventilate two patients at the same time.

What’s more, the technique is safer for staff than manual bag ventilation and avoids the constant need for a ‘human ventilator’ to work the bag, so freeing up staff, say the researchers.

But the tests also showed that the level of ventilation provided wasn’t evenly distributed when lung function and capacity differed between the two ‘patients.’

It should therefore only be used as a last resort, caution the researchers, because of the need to closely match the physiology of both patients, and the impossibility of being able to monitor separately changes in each patient’s respiratory response.

There are also ethical issues to consider, they point out. “Indeed, the most difficult choice during such an emergency would be to either accept a grim triage reality (in which not all patients receive a ventilator), or accept the fact that trying to save two patients with one ventilator could mean harming at least one of them,” they write.

These concerns are picked up in a linked editorial by respiratory disease and critical care doctors from the University of Chicago.

The idea of ventilator sharing isn’t new, explain Drs Steven Pearson, Jesse Hall, and William Parker. It was first suggested in 2006, for coping with equipment shortages in dire emergencies, and has been revived in anticipation of ventilator supply problems during the COVID-19 pandemic.

But they warn that even if patients can be matched before ventilation, the dynamic nature of the respiratory response means that these initial characteristics could subsequently diverge.

Daily pauses in the sedation needed for mechanical ventilation to check on the patient’s

ability to breathe unaided--which seems to help patients recover--would be extremely difficult if two people were connected to the same device, they point out.

The technical challenges also require other resources in short supply: intensivists and respiratory therapists, they say.

During a severe equipment shortage, clinical decisions would need to be based on ensuring the greatest good for the greatest number of patients, they explain. But what would happen if two patients each had a 50% chance of survival with a single ventilator, but only 20% on split ventilation, they ask?

“Whether or not the benefit of providing support to one additional patient outweighs the harms suffered by the two patients receiving co-ventilation is an impossible question to answer at this point, given the lack of evidence and experience, and these harms are unlikely to be amenable to rigorous quantification at any point in the near future,” they write.

Ideally, in the absence of adequate supply, or other breathing support devices, patient (and family) consent should be obtained and strict protocols applied for the circumstances in which split ventilation can be used, and then only as a last resort, they emphasise.

“The role for co-ventilation appeals to the rule of rescue, the natural impulse to save those facing certain death, by freeing mechanical ventilators to support those in respiratory failure who would die without them,” they write.

“But to use the lifeboat analogy, is taking on more passengers than the boat was designed to accommodate, worth the risk of sinking the lifeboat?”

Given current supply and demand, doctors will most likely be faced with such decisions, they suggest. “Humankind should realise it has been forced into a lifeboat by this pandemic without the luxury of yesterday’s ethical postures until rescue arrives,” they conclude.

In a further linked commentary, emergency care doctors in Detroit and New York agree that one patient per ventilator is best. Their YouTube video, setting out the experimental technique for ventilating four patients at the same time, inspired the Italian doctors to experiment with the approach for two patients.

“Everyone agrees one patient on one ventilator will always be the gold standard,” write Drs Charlene Babcock and Lorenzo Paladino. “Use of one ventilator for two patients is clearly outside the manufacturer’s recommendations and only appropriate in dire circumstances during a disaster.”

But reporting on further experiences of the technique can only assist the understanding of how to expand ventilator options, they suggest.

“We commend the [Italian] authors of this study for further advancing documentation of this potential expansion of ventilator availability as a life-saving intervention during a disaster and hope the additional information we have provided may be informative,” they conclude.