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NEWS ANALYSIS

Covid-19: When to start invasive ventilation is “the million dollar question”

Options for ventilating covid-19 patients have expanded since the first wave of the pandemic, but doctors are unsure of the best management pathway because evidence is lacking, reports **Ingrid Torjesen**

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During the first wave of the covid-19 pandemic, almost three quarters of patients who were admitted to critical care received invasive ventilation, and one in two received it within 24 hours of admission.¹ Now the numbers are around half that. Most receive non-invasive respiratory support instead, such as high flow nasal oxygen or continuous positive airway pressure (CPAP) by machine.

The pace of the move away from invasive ventilation varies among hospitals and has been driven by greater clinical experience of treating covid patients, by data associating invasive ventilation with higher mortality,¹ and by the ventilation options available.

When to move patients from facemask CPAP to a ventilator “is really the million dollar question,” said an intensive care consultant from Surrey, who asked to remain anonymous. “We’ve had people who have had CPAP for weeks, maybe even a month, but they prefer to carry on with it than go on a ventilator. We haven’t really had good data to tell us what the right thing to do is. I hope that’s coming through quickly, because then I would be more confident in my approach.”

Annemarie Docherty, honorary consultant in critical care and researcher at the University of Edinburgh, agreed. “We’ve all adopted CPAP and non-invasive ventilation on no evidence, maybe an anecdote, which is the first time that we’ve ever done anything sort of on Twitter, and it’s not innocuous,” she said. “We’re seeing lots of patients with injuries to their lungs, just from the non-invasive mask—so there’s definitely a group of patients for whom we are doing harm, and we should be moving earlier towards intubating them, I think.”

Mervyn Singer, professor of intensive care medicine at University College London, said, “The argument is that if you persist for a long time, just the heavy breathing might cause lung damage of its own. There are one or two hospitals that still adamantly say that you need to invasively ventilate everybody and that you shouldn’t be non-invasively ventilating.”

Trial under way

No good evidence currently exists from clinical trials on the use of non-invasive respiratory support such as high flow nasal oxygen outside critical care settings, said Manu Shankar-Hari, professor of critical care medicine at Guy’s and St Thomas’ Hospital NHS

Foundation Trust. “The RECOVERY-RS trial will address that partly,” he said. This trial compares high flow nasal oxygen and CPAP with standard of care (normal oxygen through a mask or nasal cannula), and patients will be given invasive ventilation if clinically required.

But Singer said, “The question I would have loved RECOVERY-RS to ask is when the right time is to start invasive ventilation, because in our practice we start relatively late because of resource limitations.”

Harms of delaying

The danger in providing such non-invasive forms of respiratory support on a medical ward is that, eventually, when patients don’t respond or they deteriorate and require a more invasive form of respiratory support, they are much more unwell, said Shankar-Hari. And he highlighted that it’s often younger patients who initially receive respiratory support on medical wards because they’re more able to cope with the symptoms when admitted to hospital, at least initially.

If the strain on hospitals continues to increase it will be these patients on medical wards who are at particular risk, Docherty warned. “Probably the biggest [additional] mortality will come among patients who can’t get into intensive care because they are not flagged as deteriorating, because there’s not enough people to review them,” she said. “When patients are intubated, they’re a bit more stable.”

Renal support

The reduction in the proportion of patients receiving invasive ventilation has been accompanied by a fall in the proportion requiring renal support. This may be because invasive ventilation can affect the kidneys in a number of ways, said Singer.

Patients with covid-19 require heavy sedation for invasive ventilation, and these drugs often cause a dramatic drop in blood pressure. Vasopressor catecholamines, such as norepinephrine, are then given to elevate the blood pressure and can have an adverse impact on the kidneys by affecting intrarenal perfusion.

Furthermore, said Singer, “When you put somebody on a ventilator you’re giving positive pressure ventilation, which also has a negative effect on the kidney through an increase in renal venous pressure

and congestion. There is also a tendency to keep patients on ventilators quite dry to 'protect the lungs,' and that too can compromise renal perfusion."

Oxygen supplies

High flow respiratory support such as CPAP also requires more oxygen than invasive ventilation or a facemask, and supplying oxygen for patients with covid-19 is causing issues for some hospitals.

Already this year St Helier Hospital in Sutton, south London, had to transfer some patients to other hospitals because its ageing infrastructure could not provide sufficient quantities. A spokeswoman for Epsom and St Helier University Hospitals Trust said that a new vaporiser had now been installed at the hospital that would treble the piped oxygen supply available to patients.

While more patients are in hospital now than in the first wave, in some ways working conditions are less stressful because there is no longer a shortage of personal protective equipment, and doctors now have some evidence and experience to inform their care decisions, said the intensive care consultant from Surrey.

"In the first wave everyone was understandably panicked until we knew what the best thing to do was, so they were doing lots of unusual things, which made me very stressed," said the consultant. "I didn't like it. People were desperate, perhaps just keen to help, but they were doing odd things which were potentially harmful."

New variant

The recent large rise in the number of covid cases has been attributed to the greater transmissibility of a new variant that was first identified spreading across London and the south east of England. So far no evidence has shown that this variant is more virulent or pathogenic or that it leads to a greater proportion of patients needing intensive care, and the Intensive Care National Audit and Research Centre hopes to be able to confirm this.

Its director, Kathy Rowan, said, "We may be able to look by region and time period, to see if there were any difference in patient characteristics and outcomes in London and the south east creeping in at the point where we felt the new variant became dominant."

Trends in critical care in England, Wales, and Northern Ireland		
	Second wave (patients admitted 1 Sep to 31 Dec 2020)	First wave (patients admitted to 31 Aug 2020)
Total covid hospital admissions*	142 553	129 459
Covid patients admitted to critical care	10 149 (7.1%)	10 935 (8.4%)
Discharged	4927 (48.5%)	6623 (60.6%)
Died	2994 (29.5%)	4311 (39.4%)
Still receiving care	2228 (22.0%)	1 (0.0%)
Percentage of patients receiving invasive ventilation within first 24 hours	24.9% (2216/9563)**	54.3% (5866/10 935)
Advanced respiratory support at any point	3427 (43.7%)	7878 (72.1%)
Basic respiratory support only	4073 (51.9%)	2790 (25.5%)
No respiratory support	343 (4.4%)	264 (2.4%)
Mean age of critical care patients (years)	60.4	58.8
Mean length of hospital stay before intensive care admission (days)	3.0	2.5
Patients requiring renal support	1107 (14.1%)	2926 (26.8%)
Duration of critical care for survivors (median days)	6	12
Duration of critical care for non-survivors (median days)	10	9
Advanced respiratory: invasive ventilation, bilevel positive airway pressure (BPAP) by trans-laryngeal tube or tracheostomy, continuous positive airway pressure (CPAP) by trans-laryngeal tube, extracorporeal respiratory support.		
Basic respiratory: >50% oxygen by facemask, close observation because of potential for acute deterioration, physiotherapy/suction to clear secretions at least two hourly, recently extubated after a period of mechanical ventilation, mask/hood CPAP/BPAP, non-invasive ventilation, CPAP by tracheostomy, intubated to protect airway.		
Adapted from Intensive Care National Audit and Research Centre (ICNARC) report on covid-19 in critical care: England, Wales, and Northern Ireland, 31 Dec 2020.		
* Total number of patients from https://coronavirus.data.gov.uk/details/healthcare .		
** Data not available for all patients.		

Correction: On 25 January 2021 we amended Manu Shankar-Hari's role and affiliation in the "Trial under way" section.

1 Intensive Care National Audit and Research Centre. ICNARC report on covid-19 in critical care: England, Wales and Northern Ireland 31 December 2020. <https://www.icnarc.org/Our-Audit/Audits/Cmp/Reports>.