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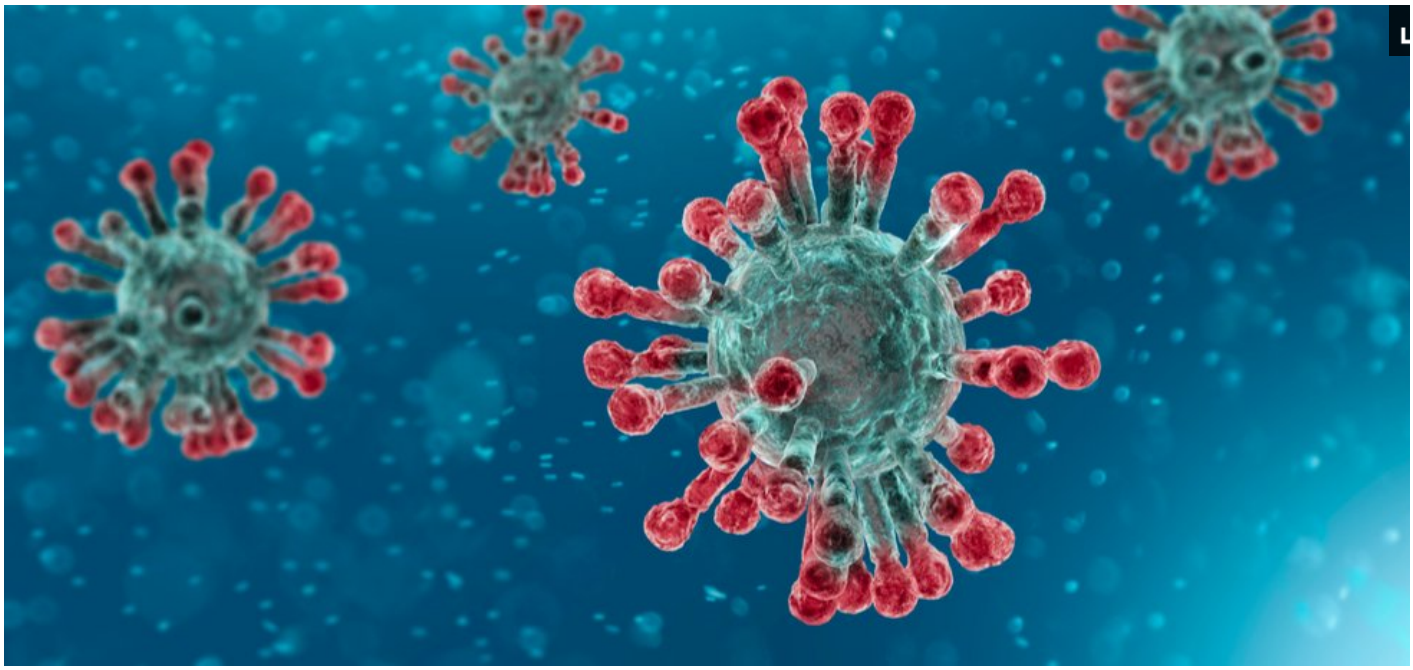
Preventing complications in Covid-19 patients via airway management systems

by Robert A Ratzlaff

Dr. Robert A Ratzlaff, intensivist/anaesthesiologist and system medical director of critical care at Bon Secours Richmond, USA discusses the use of novel airway management systems in the prevention of complications in Covid-19 patients.



The world is currently facing one of its most widespread viral pandemics in human history, the Covid-19 (coronavirus disease 2019) pandemic. The virus that is responsible for this pandemic is known as the Severe Acute Respiratory Syndrome CoronaVirus 2 (SARS-CoV-2).

Coronaviruses are a family of viruses that cause respiratory tract infections that can range from mild to lethal. Mild illnesses include symptoms similar to that of the common cold (which is also caused by other viruses, predominantly rhinoviruses), while more lethal varieties are caused by Middle East Respiratory Syndrome CoronaVirus (MERS-CoV), SARS-CoV, and the novel SARS-CoV-2 .

Since the onset of the Covid-19 pandemic, research has emerged showing superinfections (e.g. Ventilator-Associated Pneumonia (VAP)) to be among the most common complications of severe acute respiratory syndrome.[1]

Over the years, various studies indicated a worrying trend, where people who have prolonged stays in the Intensive Care Unit (ICU), and more particularly ventilated patients, are likely t develop secondary infections.[2,3] These patients include Covid-19 patients who, at times, remain ventilated for several weeks. Recent research suggests that around fifty percent of patients who died from Covid-19 had a secondary bacterial or fungal infection.[3] This data is consistent with surveys of past viral pandemics, which attribute the high death rate to secondary bacterial infections, including superinfection.[4.]

Covid-19 patients and ventilator-associated pneumonia

Preliminary studies and anecdotal evidence from high-burden Covid-19 areas suggest that superinfections are common, and more particularly, VAP.[1] Critically ill patients intubated with Covid-19 are at higher risk for developing VAP and other infections typical for all critically ill patients (e.g. central line or urinary tract infections).[1] This is most likely due to high viral burden causing immunosuppression as well as the total length of their illness.

Bacterial co-infections such as pneumonia pose a severe threa to high-risk Covid-19 patients, with many factors coming together to create critical, life-threatening, and, in some cases, deadly complications that cannot be ignored by the health care community.[5,6] The relatively high incidence of severe infections and mortality in Covid-19 patients is attributed in part to secondary infections, alongside the lack of natural immunity

and viral replication in the lower respiratory tract, leading to severe lung injury and acute respiratory distress syndrome.[6]

There are several guidelines and bundle strategies for reducing the occurrence of VAP, including ones that aim at minimising the aspiration of subglottic secretions into the lower respiratory tract and lungs. One approach is Continuous Control of the airway Cuff Pressure (CCCP). Another preventive strategy is Subglottic Secretion Drainage (SSD).[7,8]

Among significant troubling residual symptoms reported by mechanically ventilated Covid-19 patients was difficulty in swallowing or speaking.[9] These complications are associated with uncontrolled, over-inflation of the airway endotracheal cuff, which applies constant pressure on the tracheal tissue. These findings are consistent with previous studies, which demonstrated that many orally intubated ARDS survivors have dysphagia symptoms that persist beyond hospital discharge.[10]

Airway management solutions

Over the years, several airway management systems have been developed, which offer partial solutions. These solutions offered automated cuff pressure control and airways with suction lines operating in conjunction with automated, intermittent suction regulators. All these devices performed only one of these functions. As both functions are essential for proper airway management, the routine practice is to use one of the techniques or a combination of the two. The

challenge that arises from using this practice is that these two functions are not synchronised.[2]

In response to this challenge, Hospitech Respiration, an Israeli medical device company, has developed the AnapnoGuard (AG system. This new innovative system significantly reduces ventilation complications in intubated patients (e.g. over pressurised EndoTracheal Tube (ETT) cuffs and subglottic secretions reaching the tracheobronchial tree) and minimises the exposure of clinical teams to the SARS-CoV-2 virus. The system consists of the AG100s control unit and the AG ETT multi-lumen airway. What sets the AG apart from other solutions is that it is the only device on the market which performs both functions in synchrony and operates in closed-loop control. The system's two main functions are continuous monitoring of leaks around the cuff and continuous subglottic suction. The ETT cuff pressure is adjusted based on the carbon dioxide (CO_2) level in the subglottic space with automated adjustment of the airway cuff pressure accordingly to seal the leak at minimal pressure. The AG also utilises an automatic rinsing and evacuation of subglottic secretion from above the endotracheal tube's cuf hence limiting secretions that pool and travel distally to the lungs.

The AG is regulatory approved by the FDA/510(k), CE, CFDA (China), and AMAR (Israel). Studies designed to evaluate the efficacy of the AG100s demonstrated the ability to effectively

control the ETT cuff pressure[11,2] and to significantly reduce ventilation complications such as VAP.[2]

A prospective, single-centre, open-label, randomised, controlled feasibility and safety trial demonstrated that patient enrolled in the AG group had a trend to reduced VAP (14.8% vs. 40%; p = 0.06).[2] Another study demonstrated that the use of automatic cuff pressure control based on subglottic measurements of CO_2 levels is an effective method for ETT cuf pressure optimisation (reducing the leaks by tenfold). The technique is safe and can be utilised with any intubated patient.[11] To date, more than 600 patients have been treated successfully with the AG system in hospitals in Israel, Europe, the US, and China.

The AG system has also been used for over two years in severa leading hospitals in China. In particular, in China's Hubei Province at Tongi University Hospital, the original epicentre of the Covid-19 pandemic, where it was used to treat ventilated Covid-19 patients.

Although ventilator-associated pneumonia and the length of time on the ventilator has been a concern that affected the standard of care in ICUs across the globe, the outbreak of Covid-19 has highlighted the need for a tested and proven solution that will significantly reduce ventilation complications and the level of mortality rate among intubated patients. It is clear that the AG system fills this void in an innovative way to provide better care for our patients amid the current Covid-19 pandemic.

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