



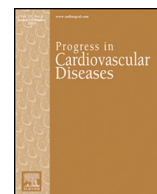
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We all need a yellow submarine!



To the Editor:

COVID-19 presents a challenge to our health care systems with no recent experience to inform our decisions for management of this crisis. One serious concern emphasized by the current experience in New York City is the disparity in available ventilators as compared to the potential need, as the number of hospitalized patients continues to climb. Many experts fear that decisions for who may and may not receive a ventilator could arise in the near future, and there have been discussions of who might be designated as “do not resuscitate” if the supply becomes compromised. Government officials have lauded their own efforts to ramp up production, but it is unlikely that our current approach to ventilation utilizing the technically sophisticated machines necessary to provide positive pressure ventilation can be augmented quickly enough utilizing this technology to keep up with critical demand if the more apocalyptic projections for patients requiring ventilation come to fruition. One government official reports that a plan is in progress to produce up to 80,000 ventilators within a year, a plan unlikely to meet the potential needs over the next 30 days. Thus “The Yellow Submarine”.

As recently as 1991, a bright yellow “Iron Lung” was used for ventilation of selected patients coming to the Pediatric ICU at Texas Children's Hospital. Walking through the unit occasionally one would encounter one of the muscular dystrophy patients in “The Yellow Submarine,” which proved perfect for this patient's needs. This decidedly low tech approach utilizing a negative pressure strategy is clearly difficult from a patient access perspective but provides a strategy for minimizing lung damage during acute viral illnesses in the patients with muscular dystrophy. In addition to the simplistic function not requiring computer chips or other technology that may be in short supply presented by “The Yellow Submarine,” this is also a technology that can be built quickly and simply, conceivably quickly enough to supplement the limited number of traditional ventilators, potentially averting a crisis presenting an immeasurably difficult ethical dilemma. While I am not advocating do it yourself projects, the level of technology necessary to build an iron lung is supported by instructions for building a serviceable WOODEN “Iron Lung” presented in a 1952 edition of *Popular Mechanics* (complete blue prints and instructions could be ordered from the publisher).¹ These do it yourself ventilators were built and used in some hospitals during the polio crisis setting a precedent for consideration in the current circumstances. Review of the instructions is reassuring that a functional negative pressure ventilator can be constructed quickly and efficiently with modern materials and construction techniques if the appropriate resources are allocated to fabricators

currently sitting idle. The technical requirements are not sophisticated and the necessary materials are readily available (although the wooden variety is not the optimal device). In the case of an emergency such as this, the hurdle of FDA approval should be expedited in a quick and efficient manner for compassionate use of an iron lung based device for a historically well proven technology.

The argument will be raised that this technology is old and no longer pertinent. Contrary to this concern is that the alternative is to provide no support if the number of patients in need of ventilatory support exceeds the number of devices available. The argument in favor of supporting a program to build negative pressure devices (iron lung prototypes) is that it should not be considered a last ditch attempt to provide care utilizing outdated medical therapy. Negative pressure ventilation does have advocates with studies demonstrating this strategy as equivalent, and in some circumstances, potentially superior to the positive pressure ventilation strategy currently in vogue.^{2,3,4} At the very least, these devices can be utilized in a stratified approach to providing care for COVID-19 patients using this strategy for patients requiring minimal assistance and potentially allowing available positive pressure ventilation to be utilized for the patients requiring more sophisticated ventilation strategies. If the experience proves that this strategy is equally effective, the transition to utilizing traditional ventilators may not be necessary.

In conclusion, while COVID-19 has precipitated a desperate time, prompt preparations to provide negative pressure ventilation should begin as soon as possible. This strategy presents an achievable solution in an appropriate time frame with efficacy based on historical precedent in the medical successes utilizing this low tech approach for the polio crisis.

References

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