Adapting a tertiary-care hospital operating room ventilation system to maximize safety in COVID-19 patients

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Introduction

The majority of operating rooms in the US are positive pressure environments. The CDC recommends placement of COVID-positive patients in negative pressure environments during aerosol-generating procedures [1]. Most ventilation systems are not equipped to reverse airflow to create a negative pressure environment.

Objective

To rapidly and temporarily convert standard positive pressure operating room to a negative pressure environment

Methods

This is a description of a novel technique performed at a single tertiary-care hospital. Two negative pressure exhaust machines equipped with high-efficiency particulate air (HEPA) filters were installed. An anteroom with its own negative pressure exhaust machine was set up to facilitate donning and doffing of personal protective equipment. Exhaust vents were sealed and pressure differentials were monitored at all times. Air flow was measured using an air capture hood. No modifications were made to the operating room's existing ventilation system or infrastructure.

Results

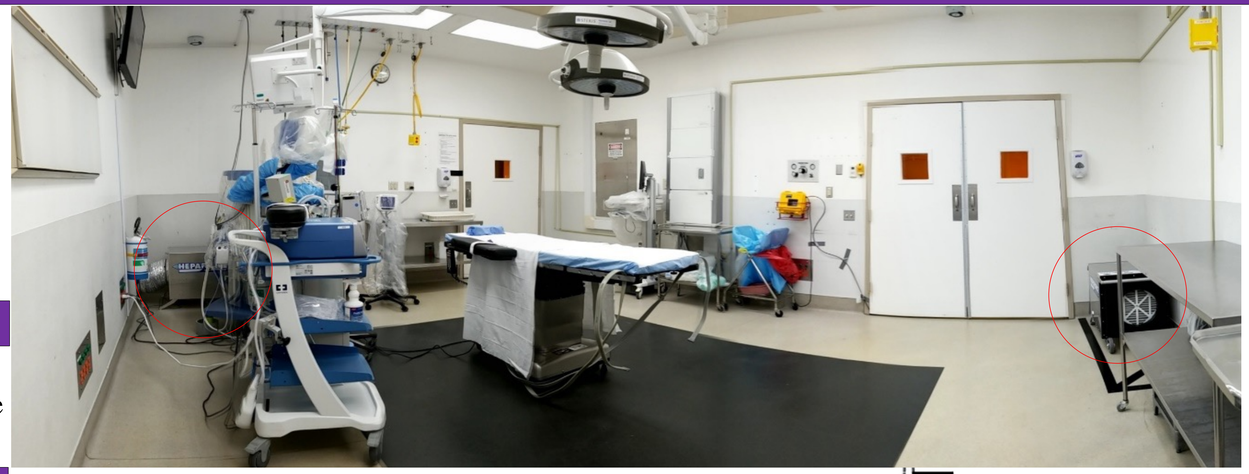


Figure 1: Picture of operating room from vantage point
Red circles indicate location of negative pressure exhaust machines. Vantage point as labeled in Figure 2 below.

	Before Modifications (Positive Pressure)	After Modifications (Negative Pressure)
OR	+0.118 WC	-0.022 WC
Anteroom		-0.180 WC
Air Supply	1275 cfm +20 ACH	1275 cfm +20 ACH
Air Exhaust	-312 cfm -5 ACH	-1657 cfm -26 ACH
Differentials: CFM **ACH**	**+963 cfm** **+15 ACH**	**-382 cfm** **-6 ACH**

Table: Measured Differentials
Abbreviations: WC = water column in inches (1 WC = 248.84 Pascals). ACH = air exchanges per hour; cfm = cubic feet per minute

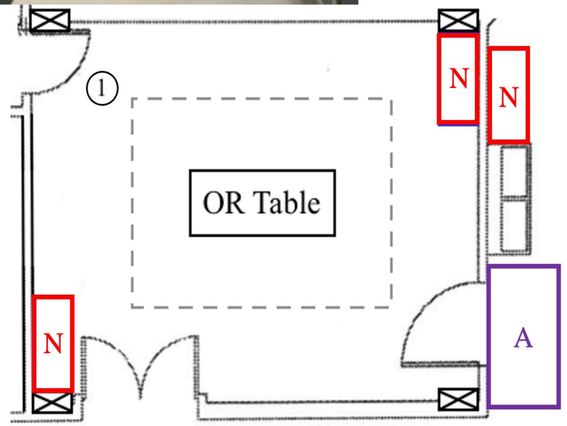


Figure 2: Schematic of operating room layout
Red boxes indicate location of negative pressure exhaust machines. Boxes marked with "X" represent exhaust vents. Purple box indicate anteroom. Dotted line marks ceiling panels of air inflow. Circled #1 indicates vantage point for Figure 1.

Discussion

Negative pressure environments prevent contaminated air from escaping a room with an airborne infection, including COVID-19 [2-3]. After modifications, the operating room was successfully converted from a positive to negative pressure environment that exceeded CDC guidelines [1]. These modifications can be implemented expeditiously and economically at most standard tertiary-care hospitals.

Conclusion

Healthcare facilities can quickly apply this strategy to safely care for COVID-19 patients.

Disclosures

The authors have no conflicts of interest or financial ties to disclose.

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