NEWPORT'S NEW e500 VENTILATOR

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Because we have a great number of new readers we thought that a small re-introduction to what this review column is all about might be in order. First, let us be clear when we say that neither we, nor the university, receive any compensation from the manufacturers of the equipment we analyze and review. Second, we control the text of the review from start to finish. Editorial changes only occur for purposes of space management – and with consultation with the authors. Third, we decide upon what piece of equipment we're going to review based on what's new, what might have an important impact on practice, and/or what tickles our collective fantasy, since, between myself, Bethene Gregg RRT and Mike Czervinski RRT, we enjoy almost 100 years in the field. After our decision as to *what* piece of equipment we will review is made, FOCUS arranges for the equipment to be brought to the University where we are given a comprehensive on-site in-service by the manufacturer. The equipment is then left with us for a minimum of two weeks during which time we put the equipment through its paces in our laboratory. A review is then written and submitted; a methodology that has worked well for nearly five years now.

Newport e500

We first discuss the general appearance and physical characteristics of a device. Next, we follow with an examination of the manufacturer's support and support materials including their technical and application manuals. We then continue by discussing our analysis methods and of course, our findings. We finish by summarizing the report, making conclusions and recommendations. In this issue of FOCUS we review the new Newport e500 Ventilator.

The Newport e500 Ventilator

The first thing we wish to say about Newport's new ventilator is that it is designed to be used across a wide range of patient age categories from infants to adults using a variety of breathe types and modes of ventilation while providing safety backup ventilation in all of those modes. It provides an impressive array of monitoring capabilities and numerous audible and visual alarm capabilities, as well. In a nutshell, the e500 has many features designed to make it both user friendly and patient safe. In our opinion it meets those goals quite nicely

Physical Description

The e500 ventilator consists of three distinct modules – a Control Panel Module (CPM), a Graphics/Data Display Module (GDM), and a Gas Delivery Unit (GDU). It has environmental operating ranges of 10-95% RH non-condensing, 0-13, 124 feet (0-4000 M), 21 to 31 in Hg (700 - 1060 kPa); its storage ranges are the same except for pressure which are 15 to 31 in Hg (500 -1060 kPa). The ventilator has external connections for remote alarms, external alarm silence and an external 12V DC battery.

Manuals

We were provided with an *Operations* manual and a *User Support* manual. Both of these were well designed and logical in their presentation. Each had plenty of white space for notes and comments, and graphics were used liberally to aid comprehension. The User Support Manual employed slide print-outs using PowerPoint's 6 per page print format. The graphics of the slide print-outs were excellent and readable. The section on waveforms was outstanding as well, providing an excellent introduction to this often difficult topic. The Operations Manual also was very good at explaining the interactions of controls and modes of ventilation. Both manuals were well indexed and easy to use. Use of a glossary made definition of proprietary terms easy and the inclusion of several research papers clarified theory.

Data Management

The Newport e500 has an RS 232C connector for central monitoring systems and a parallel port interface for HP deskjet 895 color printer (or equivalent type printers). The ventilator also includes an event trend log capable of displaying the 600 most recent ventilation settings, alarm changes and alarm violation events.

Test Conditions

We examined the following as they pertain to using the e500: ease of circuit connection, ventilator performance verification, mode changes, alarm conditions, and operation under "leak" conditions. The e500 can operate from a single gas source provided the gas is connected to the ventilator's air inlet. The circuit requires that the internal diameter of the proximal airway pressure line does not exceed 1/8 inch. The expiratory line condensation collection cup is small and will be replaced with a larger version in the near future.

Initial verification of ventilator performance (usually called the leak test) is initiated by pressing the Preset Ventilator Settings button at the same time the unit is powered on. The patient wye

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can be blocked prior to powering the ventilator on. The operator is then required to turn the flow trigger knob until C 1 is displayed in the trigger window. There are a total of 11 comprehensive pre-use checks accessed by turning the flow trigger knob. After setting C1 the operator is instructed to initiate the leak test by pressing the Expiratory Hold button and then pressing it again while the system is pressurized to 30 cm H2O. The Preset Ventilator Settings button is then held for 2 seconds to exit the Checks menu. In addition to accessing Pre-use Checks, the Preset Ventilator Setting button allows the operator to adjust the settings in a new mode *prior* to actually activating the mode, a nifty feature of the e500.

Modes

The e500's modes of ventilation consist of Assist-Control, SIMV with Pressure Support, and Spontaneous (CPAP with Pressure Support). Mandatory breaths are volume controlled, pressure controlled, or volume-targeted pressure controlled. In volume-targeted pressure controlled mode, a Spontaneous breath is always a volume-targeted pressure supported breath with the operator set level of CPAP. The flow cycle level for pressure supported and volume-targeted pressure supported breaths is adjusted from 5 – 50% of peak flow by touching *Setup* on the graphics screen and setting the Expiratory Threshold. Other than the features accessed by the graphics screen, all the main parameters for ventilation: FIO2, tidal volume, peak flow/inspiratory time, frequency, pressure support, pressure limit, and flow trigger are set with the simple turn of a knob. Yes, a knob! We like the fact that the e500 uses knobs because knobs eliminate the need to touch-screen through layers of menus just to adjust primary controls. About the only uncommon feature concerning the modes was the pressure limit. The pressure limit in pressure control mode sets the actual target pressure and is not a pressure change above PEEP. For example a pressure limit of 20 cm H2O in pressure control mode with 5 cm H2O of PEEP would give a pressure change of 15 cm H2O. However, the pressure support setting is above PEEP.

The pressure limit also serves as the maximum pressure target for the volume-targeted pressure controlled breaths. If the target volume is not delivered by the time target pressure is equal to the pressure limit, an alarm sounds, the Operator indicator lights, and a message "vol target not met" is displayed. If the patient's minute volume falls below the set Low Minute Ventilation Alarm during this time, the Backup Ventilation visual indicator illuminates and the patient receives ventilator breaths at the current control settings with the exception of frequency, which changes to 1.5 times the set frequency with a minimum of 15 breaths/minute for adults, until the delivered minute ventilation is 10% above the Low Minute Ventilation alarm setting. At that time backup ventilation ceases but will start again should the patient's minute ventilation fall below the Low Minute Ventilation Alarm setting. If the mode is the Spontaneous mode for any breath type, Backup Ventilation is pressure controlled ventilation at a pressure limit of 15 cm H2O above baseline pressure with an inspiratory time of 1.0 seconds for adults and 0.6 seconds for Ped/Infant at breathing frequencies of 12 and 20 breaths/minute, respectively. However, if any ventilation adjustments are made, Backup Ventilation is delayed for 60 seconds to allow the patient to stabilize to the new setting.

Another mode-related novelty that we liked on the e500 is the manual inspiration button. Inspiration continues for as long as the button is pressed, allowing for resuscitation breathing or operator-directed post-suctioning breaths (the 100% suction button delivers 100% immediately). If the manual inspiration button is held down in volume control, the peak flow setting is maintained but the set tidal volume is overridden. In pressure control the pressure limit is maintained but the inspiratory time is overridden. In volume-targeted pressure control the pressure used to achieve the target volume is maintained but the inspiratory time is overridden. In Spontaneous mode the airway pressure will go to baseline pressure plus 15 cm H2O. The maximum inspiratory time for a manual breath is 5 seconds. A manual inspiration is terminated if the airway pressure equals the high airway pressure alarm.

An alarm feature on the e500 that all ventilators should have (but often don't) is the Pre-Silence Alarm. Holding the audible alarm silence button down for 2 seconds (until you hear a second beep) will prevent all silenceable audible alarms and inhibit gas delivery during a patient disconnection. This feature prevents the spray of condensation that typically occurs when a patient on PEEP/CPAP is disconnected, definitely a nice feature.

Finally, we tested the e500 in all modes in the presence of a leak of 15 LPM. The Leak Compensation feature of the e500 prevented auto-triggering with a flow trigger of 2 LPM. With Leak Compensation on and accessed via the graphics screen through Setup, the e500 automatically adjusts the bias flow up to 15 LPM for adults and up to 8 LPM for Ped/Infants in order to maintain an end expiratory base flow of 3 LPM. We judged a leak of 15 LPM to be a large leak for adults. The leak dropped the tidal volume by 50% in volume controlled ventilation. With the Leak Compensation system turned off, the ventilator auto-triggered to a rate of 24 – 26 breaths per minute.

What's next?

Newport tells us that their cart for the e500 is being redesigned with the intent of reducing the size of the e500's footprint. An ultrasonic nebulizer is also on the horizon.

Conclusions

Based on our test conditions in the laboratory, the e500 performed as stipulated in the operator's manual and has several useful features that most practitioners will find advantageous in numerous clinical settings. Newport itself is a very reputable company with a good track record and excellent support. We recommend your checking into the e500 when your need for new ventilators arises. The company's toll-free number is 800-451-3111. Their website address is www.ventilators.com

For more information on Newport's e500 Ventilator call 800-451-3111 and/or visit www.ventilators.com