UB-designed ventilator can safely sedate ICU patients for less

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A new, recently licensed medical device developed by University at Buffalo researchers would introduce into intensive care settings the powerful and effective method of anesthetizing patients that works so well in the operating room.

The new UB ventilator has the potential to shorten the length of patient stays in the intensive care unit (ICU) because it will greatly reduce complications and habituation to sedatives used in the ICU. It also is expected to be more cost-effective than current methods of ventilating ICU patients.

The device also may have promising applications in treating large numbers of patients during pandemics or other events with mass casualties because it can safely enable multiple patients to share a single ventilator without the risk of cross-contamination.

The device is designed to cost effectively deliver to patients small amounts of powerful inhalation anesthetic agents as they breathe or are mechanically ventilated.

The portable patient ventilator was invented by Bradley Fuhrman, Ph.D., professor of pediatrics and anesthesiology and chief of critical care at Women & Children's Hospital of Buffalo, and Mark Dowhy, director of the Pediatric Critical Care Laboratory in the UB Department of Pediatrics; both are on staff in the UB School of Medicine and Biomedical Sciences.

The invention, which has been presented at numerous technology exhibitions, including the 2008 World's Best Technologies Showcase, was licensed from UB to Medical Conservation Devices (MCD) of Buffalo, located in UB's New York State Center of Excellence in Bioinformatics and Life Sciences.

Fuhrman and Dowhy are founding partners in MCD, and will receive the UB Entrepreneurial Spirit Award at the UB Inventors and Entrepreneurs Reception on March 5.

MCD is raising funds to further develop the prototype for FDA medical-device evaluation. Initial prototype devices have been validated in laboratory experiments. First Wave Technologies Inc. is a partial owner and manager of MCD. It is a technology-development company that partners with UB's Office of Science, Technology and Economic Outreach to expand the commercialization of early-stage university technologies utilizing private-sector resources.

A key advantage of inhaled anesthetics over intravenous sedation, which is the current approach in the ICU, is that inhaled anesthesia delivers and clears sedatives by way of the lungs, bypassing the metabolic and excretory systems. That's a critical factor, Fuhrman said, for patients who have sustained damage to their kidneys or livers, as a result of their illness.

When anesthesia is delivered through the lung, there is a much more rapid onset of effect and much quicker reversal once it is removed, an important consideration especially in patients who need to be frequently or abruptly awakened, such as children who have suffered trauma to the skull.

The invention addresses a problem common in ICU settings in which sedation must be deep enough that the patient is not aware of pain, but

not so deep that it will cause withdrawal issues once the patient is no longer sedated.

"We administer significant amounts of narcotics and other agents to keep patients comfortable," explained Fuhrman. "But if we sedate them too well, we often face problems with withdrawal."

In those cases, patients can exhibit shakiness, combativeness and anxiety, symptoms that are then treated with methadone, usually requiring the patient to remain in the ICU for several more days.

By contrast, Fuhrman explained, patients in operating rooms are sedated using intravenous sedatives combined with precisely controlled concentrations of inhalation agents delivered by an expensive, specially designed anesthesia ventilator. An anesthesiologist or nurse anesthetist then monitors and controls a patient's vital signs and depth of anesthesia on a moment-by-moment basis.

"It's that kind of control that we are seeking to duplicate at each ICU bedside," said Fuhrman.

"With our ventilator, the patient is continually rebreathing the same anesthetic and oxygen mixture, so the amount of anesthetic that is used can be reduced by about 80 percent," he said.

The ventilator was developed with initial assistance from the UB Product Development Fund and the UB Center for Biomedical and Bioengineering Technology (CAT).

Source: University at Buffalo