

# Technology & Clinical REPORT

Winter 2008

Vol. XIII, No. 1

Advances in  
pulmonary management of  
the critically ill infant

 **bunnell**  
INSPIRED INFANT CARE

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## A Life Saving Combination

Imagine an uneventful pregnancy and delivery, birth-weight 3.2 kg, and Apgars of 9 and 9. Then your beautiful baby girl turns purple and joy quickly turns to panic. The medical staff springs into action, but manual ventilation and oxygen therapy aren't working. All you can think about is "What's happening to my baby." In the blink of an eye she is rushed off to the Newborn Intensive Care Unit. This is how Kelligar Neal came into the world on August 2, 1999.

Surfactant provided only a transient benefit, so the medical team decides Kelli needs to be transferred to Phoenix Children's Hospital. When she arrives, a variety of conventional ventilation and HFOV strategies as well as pharmacological therapies (steroids, diuretics, bronchodilators, antibiotics) are tried to no avail. HFJV is the final option and fortunately it works to stabilize her condition and maintain acceptable gas exchange.

Kelli's settings on the Life Pulse remained fairly consistent with the Rate 360 bpm, PIP/PEEP 28/10 cm H<sub>2</sub>O, T<sub>I</sub> 0.02 sec., F<sub>I</sub>O<sub>2</sub> 0.6-0.9, and a CV Rate of 6 bpm. For ten weeks numerous tests were run to identify the cause of Kelli's



respiratory distress, including a study looking for Surfactant Protein B deficiency, which was negative. An open-lung biopsy revealed that her lungs were seriously malformed: pneumocyte hyperplasia, reduced number of distal alveoli, widening and fibrosis of interstitium, but no specific histologic diagnosis. Kelli's lungs would not be able to sustain her life for long, even with the Life Pulse.

Everyone who cared for her was transfixed by Kelli and her big blue eyes. Kelli's parents were given two options: enjoy Kelli for the short time she would be with them or put her on the waiting list for a double lung transplant. Not surprisingly her parents chose to put her on the transplant waiting list. There was only one small problem; the transplant program was in St. Louis, Missouri, and they were in Phoenix, Arizona.

The first thing the staff at Phoenix Children's had to determine was if Kelli could be transported to St. Louis Children's on the Life Pulse. After consulting with Bunnell, they decided it was possible via fixed wing air ambulance. In mid-October, the St. Louis Children's transport team flew to Phoenix. They spent four days with Tom Harris, MD, learning to use the Life Pulse and getting familiar with Kelli and her medical condition.

The staff at St. Louis Children's did not use the Life Pulse at the time, so Bunnell flew Kay Hendrix, RRT, a clinical specialist from Birmingham, Alabama

to St. Louis Children's the day before Kelli arrived. Kay stayed for four days to provide in-service training and support for the staff at St. Louis Children's. She wanted to make sure Kelli's transition was smooth and that the staff felt comfortable with the Life Pulse.

After only 19 days on the national transplant waiting list, Kelli received her double lung transplant. The surgery went well and gave her a new lease on life. Remarkably, she was extubated four days after her surgery and was on room air a month later. Kelli was discharged just six weeks after the double lung transplant!

Kelli is now nine years old. She shares her home with two brothers, Tristan (12), Aidan (5) and her mom and dad, Ursula and Kevin. She loves to sing and dance, play the piano, and she's a great swimmer. Mostly, Kelli loves to ride her bike and scooter.

Thanks to Ursula and Kevin and the staff at Phoenix Children's for sharing Kelli's

story. It's stories like this that inspire and reassure us that we do make a difference in the lives of our patients and their communities. To learn more about this amazing little girl and to see more photos of Kelli, you're invited to visit her website at [www.kelligar.com](http://www.kelligar.com).

## Customer Support # 1

A new Life Pulse In-Service DVD is now available. The In-Service DVD contains a thorough in-service training video by Evan Richards, along with four other key educational lectures related to the Life Pulse. Bert Bunnell reviews the key issues for effective patient management in Seven Steps for Success. Dave Platt outlines simple strategies for troubleshooting alarms. Kari Woodruff explains servo pressure and how it can be used to better manage your patients. And last but not least, Keith Kohutek discusses myths about the Life Pulse.

In addition to the new In-Service DVD, Bunnell is

also releasing an Alarms and Advanced Troubleshooting Guide. This new guide combines technical information on the Life Pulse's alarms with years of troubleshooting experience. The guide is easy to use with tabs for each alarm. Troubleshooting recommendations are listed in order from most to least common. We are certain that this new guide will make your bedside troubleshooting more effective.

One copy of the In-Service DVD and the Alarms and Advanced Troubleshooting Guide have been sent to the Director of Respiratory Care for all active customers. We encourage you to review these new materials and send comments or suggestions along with order requests to Evan Richards at [evanr@bunl.com](mailto:evanr@bunl.com).

Finally, we want to remind everyone about our What, Why, and How booklets. These booklets are the culmination of more than 24 years of experience. The What, Why, and How pocket reference set provides comprehensive yet concise information on the Life Pulse and how to maximize its clinical benefits. To date we have distributed more than 9,000 copies. To obtain additional copies of one or all of these booklets contact Dave Platt at [plattdr@bunl.com](mailto:plattdr@bunl.com).

## Meet Our Newest Clinical Specialists

Bunnell is proud to introduce two new clinical specialists who have joined the Bunnell family: Dawn Rost and Greg Shelton. Dawn and Greg were hired to meet the increasing training and support demands brought on by new Life Pulse sales and increased usage, which have more than doubled over the last five years. Bunnell is



committed to customer satisfaction and providing the highest level of service.

Dawn Rost, BS, RRT-NPS joined Bunnell in May of 2008. Dawn spent the last fourteen years as a staff therapist, as a Clinical Instructor for the North Dakota State University/MeritCare School of Respiratory Therapy, and most recently as the Children's Hospital Coordinator at MeritCare Health System in Fargo, North Dakota. Dawn was involved in the transport of neonate and pediatric patients, the education of both students and staff, as well as teaching other disciplines about respiratory care. Dawn is actively involved with her state respiratory care society and is currently serving as the Secretary for the AARC House of Delegates. Dawn lives in Illinois with her husband Kevin and two daughters, Madison and Alexis.



Dawn provides training and sales support in Minnesota, Iowa, Wisconsin, Michigan, Illinois, Indiana, Ohio, Kentucky, and Missouri. Please contact Dawn at 815-302-0977, or via email at dawn.rost@bunl.com for sales, training, and support needs.



Greg Shelton, BS, RRT-NPS joined Bunnell in May, 2008. Greg comes to Bunnell with extensive experience as a respiratory therapist in the area of Neonatal/Pediatric Intensive Care. He has been the Neonatal Clinical Coordinator at The Johns Hopkins Hospital and most recently served as the Neonatal/Pediatric Supervisor at Johns Hopkins Bayview Medical Center. He has provided training to all members of the health care team. Greg lives in Maryland with his wife Cheryl, son Kyle, and daughter Madelyn.

Greg provides clinical training and sales support in Virginia, Maryland, West Virginia, Delaware, New Jersey, Pennsylvania, New York, Connecticut, Rhode Island, Massachusetts, Maine, Vermont, and New Hampshire. Please contact Greg at 443-370-9211, or via email at greg.shelton@bunl.com for sales, training, and support needs.

### **iNO for PPHN – HFJV vs. HFOV**

“Neonatal pulmonary hypertension treated with inhaled nitric oxide and high frequency ventilation” was published in the October 2008 issue of the Journal of Perinatology.

Eric Coates, MD conducted this retrospective study at Wake Forest University Baptist Medical Center in 2005. His conclusion was, “term and near term neonates with pulmonary hypertension who require nitric oxide have similar short-term outcomes regardless of whether nitric oxide is delivered by HFJV or HFOV.”

The study had two significant findings. The HFOV group was more likely to require ECMO [19/43 (44%) vs. 2/22 (9%):  $p=0.004$ ] and the lower risk of ECMO persisted when logistic regression was used to adjust for the baseline difference in a/A oxygen ratio prior to the initiation of HFV/iNO combination.

Sixty-five patients between April 1, 2000 and August 31, 2005 met the inclusion criteria: > 35 weeks gestation, respiratory failure with clinical evidence of pulmonary hypertension, no congenital malformations, treatment with iNO in the first week of life in conjunction with HFJV or HFOV. Forty-three patients were treated with iNO and HFOV and 22 with iNO and HFJV. There were no demographic differences between the two groups.

This study is historic for two reasons. It is the first study ever to compare HFJV and HFOV in the same patient population. In addition, it is the first study to report on the clinical effectiveness of iNO delivery with HFJV compared to another mode of iNO delivery.

Copies of the paper are available upon request by contacting Dave Platt at [plattdr@bunl.com](mailto:plattdr@bunl.com) or 800.800.4358 ext. 15.

## "WhisperJet" Patient Box Troubleshooting

The WhisperJet Patient Box (Cat# 312) has been a great success. With the original patient box now obsolete we want to remind all our customers about special troubleshooting considerations using the WhisperJet.

The pinch valve in the WhisperJet is a precision valve. Alignment and maintenance of the valve is more important than with the original patient box. Valve alignment can be affected by dropping the patient box, so it is important to handle the WhisperJet carefully at all times. Annual maintenance is also critical to ensure proper performance.

All WhisperJet patient boxes should be inspected for visible damage caused by dropping prior to every use. Signs of damage may include cracks at the corners where the case halves meet, damage to the handle, barbed connectors, or patient box cable. If there are any signs of damage, the patient box should not be used. Arrangements should be made to get a return authorization number (RA#) and return the WhisperJet to Bunnell for service.

If the WhisperJet ever stops cycling while running on a patient and the ventilator is not in the Standby mode, **press the Standby button** before doing any troubleshooting. Going to the Standby mode releases the pressure in the Life Pulse circuit, so high pressure and large tidal volumes can't be delivered to the patient.

Disconnect the Life Pulse circuit from the patient's ET tube, connect a test lung, and perform an operational

test to determine if the system is running properly. Call the Bunnell hotline to get assistance in evaluating the patient box if you have any question about its performance.

If you have questions about the WhisperJet, contact our customer service department at 800.800.4358, ext. 6. One of our clinical specialists is always available to answer your questions.

## Proper Control of Humidification

Humidification of the Life Pulse circuit may need to be adjusted for different environmental conditions. Where is the patient's bed relative to air conditioning or heating vents, doorways, or traffic patterns? Is the patient in an open intensive care bed or a closed bed? The humidifier is programmed to set the **circuit** (air) temperature at 40 degrees C and the **cartridge** (water) temperature is set at 38 degrees C. In most situations these settings work fine, but that doesn't mean they are always appropriate.

The circuit temperature should always remain at 40 degrees C because the gas temperature cools as it accelerates through the patient box and the LifePort adapter. We know from our testing that the delivered temperature at the ET tube is 37 degree C or less.

To control humidity (minimize rain-out) you have to adjust the cartridge temperature. To control rainout lower the cartridge temperature one degree, clear the excess water from the Life Pulse circuit, and wait 20-30 minutes to see if the rainout has decreased. If it has not, drop the cartridge temperature 0.5 degrees and repeat the process.

Your goal is to have the clear portion of the circuit between the humidifier and the patient box mostly dry (small patches of mist or fog are O.K. but no droplets) and the green portion of the circuit between the patient box and the patient coated with mist, so that if you tapped this green tube, droplets would immediately form.

If the patient on the Life Pulse is in one of the new style closed ICU beds (giraffe style), the easiest way to control over-humidification (rain-out) is to put as much of the Life Pulse circuit inside the closed hood, as possible. Minimizing the portion of the circuit that is outside the hood, decreases the amount of cooling that can take place and lessens the potential for rainout to occur.

## INOMax DS & the Life Pulse

The Life Pulse is now validated as a compatible ventilator for the delivery of iNO using the INOMax DS. Set-up diagrams and all the necessary connectors will be provided by Ikaria with the INOMax DS. Bunnell will still provide technical support, but now support will also be available through Ikaria as well.

Please inform all the clinical and risk management personnel at your hospital so this life saving therapy can be implemented when appropriate.



## Research Papers & Case Studies

Do you have a study in mind but need help developing the protocol? Maybe you have a protocol, but you need some support to get the project started. Whatever support you need, Bunnell can help.

Bunnell is always interested in case studies and research papers. If you have a study or paper you would like to share with other clinicians, we would like to help.

We can help in the editing or proofing process. We can distribute copies of papers to other clinicians for feedback. We can publish articles and abstracts in our newsletter. And, we can post information on our website.

The Snowbird Conference on High Frequency Ventilation of Infants, Children & Adults,

If you need some assistance or if you want to discuss ideas for a research project, contact Dave Platt at [plattdr@bunl.com](mailto:plattdr@bunl.com) or 800.800.4358 ext. 15

## Closed Suction System Options

Some of you may know that closed suction systems can be used with the Life Pulse ventilator. What you may not know is that there are several options available. In addition to the Kimberly-Clark/Ballard Neonatal Elbow system, there are two other options.

CorPak which is a subsidiary of Cardinal Health makes a product call NEO-Link which can be used with or without sheathed catheters. One unique feature of the Neo-Link is a guide post inside the 15 mm connector that directs the suction catheter into the

product called the Bodai NEO<sub>2</sub> – Safe. This product replaces the conventional circuit “Y” connector and has a duckbill valve built into it, so you can suction without losing pressure in the circuit.

All three of these systems work with the LifePort ET tube adapter and allow you to better maintain pressure (PEEP/CPAP) in the airway while suctioning. For contact information and catalog numbers on these systems contact Dave Platt at [plattdr@bunl.com](mailto:plattdr@bunl.com) or 800.800.4358 ext. 15

## Service Seminar 2009

The Bunnell Service Seminar is a technical service training program geared toward clinical engineers and biomedical technicians. The two-day seminar is held in Salt Lake City, Utah, in September each year. The program covers the theory of operation, clinical troubleshooting, bench top evaluation, and preventive maintenance procedures.

The registration fee of \$1,200 includes ground transportation from the hotel, continental breakfast, and lunch, as well as a service manual and test equipment unique to the Life Pulse ventilator.

Class size is limited to eight participants and is reserved on a first-come first-served basis, so register early. The class agenda and registration form are available on the Bunnell website at [www.bunl.com](http://www.bunl.com) under the Technical menu. For additional information on registration or hotel accommodations contact Dave Platt at 800-800-4358 ext.15 or [plattdr@bunl.com](mailto:plattdr@bunl.com).



March 31-Apr. 4, 2009 is also a great place to share your Jet experiences with others. Papers can be submitted to Don Null, MD at Primary Children's Medical Center, Salt Lake City, UT, through the first part of January 2009.

ET tube lumen. This feature addresses a concern that some clinicians have had with the Ballard product where the catheter can turn as it is being advanced and catch inside the LifePort adapter.

B&B Medical Technologies from Loomis, CA makes a