

Clinical Q & A

1. **How do I give an aerosol treatment while ventilating with the Life Pulse™ ("Jet")?**

The process for delivering medication via a nebulizer to a patient on the Jet is identical to using a nebulizer with a conventional ventilator.

The preferred method is to use MDIs (meter-dose inhalers). Attach the MDI as close to the ETT as possible. Put the Jet in standby, and coordinate aerosol delivery with conventional IMV breaths or hand bagging.

However, the nebulizer may also be placed inline between the conventional circuit and the ET tube adapter. Because there is very little entrainment of gas with the Jet pulses most of the medication is delivered during the conventional IMV breaths. As a result, you have two options to increase deposition.

One, you can put the Jet in Standby and increase the IMV rate during the nebulizer treatment, as if the Jet were not there or...

Two, you can increase the IMV rate while the Jet is running and adjust the PIP's and/or Jet rate to maintain a constant Mean Airway Pressure.

The patient's dependence on HFJV will dictate which method should be employed.

2. **What's the best way to give surfactant while ventilating with the Jet?**

The following procedure for surfactant replacement was developed at Strong Memorial Hospital in Rochester, NY: Surfactant delivery is a sterile procedure; therefore all supplies must be sterile. They include:

- 1 pair of sterile gloves
- 1 5-French feeding tube
- 1 pair of scissors
- 1 syringe

An ABG should be drawn before administration of the surfactant. **The Jet ventilator should be operating, with the READY light on.**

Transcutaneous monitoring and pulse oximetry are recommended during the procedure. To insure proper ET tube placement, a chest x-ray should be taken prior to surfactant administration.

A new ET tube of the same size is taped to the patient's bedside and used as a "ruler" to prepare the 5 French feeding tube.

The feeding tube is cut off at a length of 1 cm less than the length of the ET tube. An anesthesia bag is attached to the main patient adapter of the ET tube - in place of the conventional ventilator - for positive end expiratory pressure (PEEP).

The feeding tube is then connected to an appropriate size syringe and the surfactant is drawn up into the tube and syringe. The surfactant is delivered in two aliquots, down the main port of the ET tube. To administer the surfactant, disconnect the patient from the anesthesia bag, insert the feeding tube into the ET tube and give 1/2 the dose in the syringe. Reconnect the patient to the anesthesia bag and give 1-2 large sigh breaths to clear the surfactant from the ET tube. Then reconnect the conventional ventilator.

Between the 2 aliquots the infant is placed back onto HFJV and conventional ventilation for 3-5 minutes. After administration of the surfactant watch the patient's chest movement and observe non-invasive monitoring for 5 minutes to evaluate new pressure requirements. The second aliquot is then delivered using the same technique as the first aliquot. The patient is then returned to HFJV and conventional ventilation.

Adjust the FiO₂ at any time during the procedure to prevent hyperoxia. Follow-up ABG's should be obtained at 15-30 minutes. If Servo Pressure increases be prepared to wean HFJV PIP prior to obtaining the ABG.

3. **Can I deliver Nitric Oxide during high frequency jet ventilation?** see abstract

Yes. For specific information contact David Platt, 800.800.4358 ext. 15, plattdr@bunl.com

4. **How many IMV (sigh) breaths should I use with the Jet?**

We recommend as few IMV breaths as possible. But they are important for alveolar recruitment during HFJV.

The number of IMV breaths required is specific to the pathophysiology and the pathogenesis of the disease.

Airleak syndromes (e.g., PIE, Ptx) should be treated with as few IMV breaths as possible, perhaps even with CPAP if the airleaks are significant and symptomatic.

Five to ten IMV breaths may be required initially for patients with stiff, non-compliant lungs.

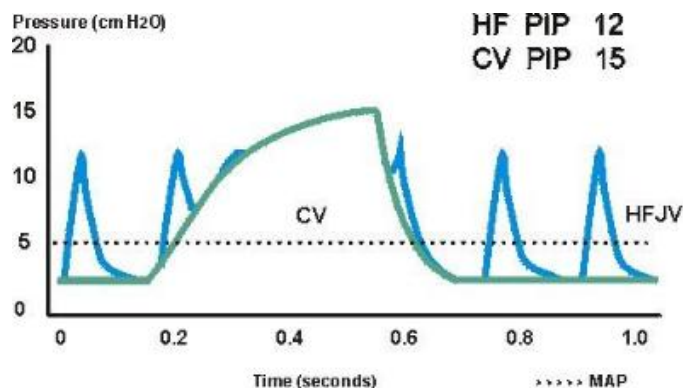
Once optimal PEEP has been reached, you may be able to lower the IMV rate to 1-3 bpm.

5. **Should the IMV (sigh) breaths interrupt the Jet?**

The Life Pulse breaths will be interrupted anytime the monitored CV PIP exceeds the set Jet PIP. If the CV PIP does **not** exceed the Jet PIP, the Jet breaths will not be interrupted.

Whether to interrupt or not depends on the pathophysiology of the patient and what you are trying to accomplish.

Interrupted Jet Breaths



When the CV PIP exceeds the Jet PIP, the Life Pulse pauses to avoid contributing to what it perceives as an excessive pressure. The Jet breaths will resume during the exhalation phase of the CV breath once the CV PIP falls below the set Jet PIP.

Mild CO₂ retention may occur when the Jet breaths are interrupted. The higher the CV rate, the greater the degree of CO₂ retention.

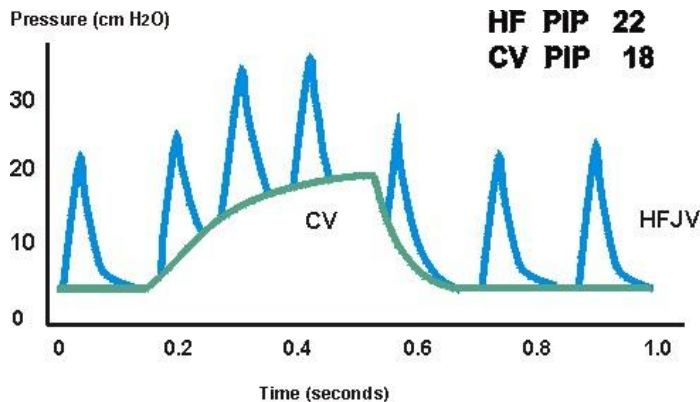
That is, the Jet breaths, which are primarily responsible for ventilation, will be interrupted more frequently with a subsequent rise in PaCO₂. This increase in PaCO₂ may be minimal because the Jet is very effective at eliminating CO₂.

Clinical Strategies: The Jet breaths can be interrupted if low PaO₂, severe atelectasis, or non-compliant lung disease are major concerns.

Interrupting the Jet breaths may be beneficial to increase CO₂ retention when lowering Jet PIP and elevating PEEP will not elevate an excessively low PaCO₂ into a desired range.

Jet breaths may also be interrupted during the latter stages of weaning a baby from HFJV.

Uninterrupted Jet Breaths



Jet breaths will not be interrupted if CV PIP is lower than set Jet PIP. Normally, this strategy is preferred to reduce PaCO₂ and provide the most effective ventilation.

The Jet PIP will "ride" on top of the volume delivered by the CV breath. This elevated PIP is not harmful to alveoli, airways, and hemodynamics because of the Jet's very short Inspiratory times (0.02 seconds) and unusually small tidal volumes (1-3 ml/kg). In fact, the "riding" Jet PIP may assist in lowering PaCO₂.

Clinical Strategies: The Jet breaths should not be interrupted if air leaks, elevated PaCO₂, V/Q mismatch, or cardiac output are major concerns.

6. What level of PEEP is safe with the Jet?

Higher PEEP levels may be applied during HFJV because of the small tidal volumes and pressures delivered by the Jet. Still, PEEP and MAP must be respected during HFV to avoid decreased venous return and cardiac output.

Generally, optimal PEEP may be anywhere between 5 to 13 cm H₂O depending upon the patient's pathophysiology.

Airleak syndromes require lower PEEPs (5-7 cm H₂O); non-compliant lung disease may require higher PEEPs (7-12 cm H₂O). [SEE OPTIMAL PEEP CHART.](#)

7. Which conventional ventilators can I use in tandem with the Jet?

All conventional ventilators work in tandem with the Jet. The CV should be operated in its simplest pressure control mode. Any mode that triggers on a patient's breathing effort may be fooled by the venturi created by Jet breaths. That is, the CV may interpret the Jet breaths as a patient effort and trigger an assisted CV breath.

8. **Is the performance with the LifePort™ adapter the same as with the Hi-Lo Triple Lumen Jet tube?**

No. Their performance is similar. The LifePort and the Hi-Lo tube monitor pressure at opposite ends of the ET tube. We tried to match their pressure signals so the Life Pulse would respond in a similar way to both. *The Jet PIP should always be adjusted to achieve the desired PaCO₂ for your patient, regardless of the PIP value.*

With the smaller sized LifePort adapters (2.5 - 3.5), it may be necessary to use slightly higher levels (10 - 15%) of PIP than with the Hi-Lo tube. The only time this is obvious is when switching from one to the other. However, the PIP the baby senses will be the same when PaCO₂ is the same.

When switching from the LifePort adapter to the Hi-Lo tube servo pressure should be held constant rather than PIP. This will provide approximately the same gas exchange during the transition. Once the transition has been made PIP should once again be titrated to achieve the appropriate PaCO₂.

9. **When would I change the rate on the Jet?**

Patients in the NICU generally respond to the default rate of 420 bpm. However, there are situations where you may get better results with different rates. Larger patients or babies with lungs that are prone to gas trapping and inadvertent PEEP may respond better to lower Jet rates (e.g. 240-360 bpm). Babies with smaller, non-compliant lungs may respond better to higher rates (e.g. 500-600 bpm).