



# High-Frequency Oscillatory Ventilation

High-Frequency Oscillatory Ventilation (HFOV) is a mode of ventilation which has been in clinical use for over thirty years. In many hospitals around the world, HFOV is not only a common rescue strategy but is increasingly an established as first-intention ventilation approach for respiratory disease. HFOV is used to treat diseases such as respiratory distress syndrome, pneumonia, meconium aspiration syndrome, persistent pulmonary hypertension of the newborn and lung hypoplasia more successfully and more gently than conventional ventilation<sup>1</sup>.

<sup>1</sup> Pillow J. High-Frequency Oscillatory Ventilation: Theory and Practical Applications. Drägerwerk AG & Co. KGaA. 2016: 9102693.

# Improve pulmonary gas exchange & respiratory outcome

Many infants continue to require invasive ventilation, despite major advances in perinatal care including widespread use of antenatal steroid therapy, exogenous surfactant therapy and non-invasive respiratory support. Ventilation induced lung injury (VILI) is a complication of invasive ventilator support that prolongs duration of

supportive care. VILI in the developing lung has lifelong implications for respiratory well-being due to failure of alveolarisation and abnormal airspace development. The proportion of infants requiring mechanical ventilation increases at lower gestations: extremely preterm infants are additionally extremely vulnerable to injury<sup>1</sup>:

## Respiratory failure due to lung immaturity is a major cause of mortality in preterm infants<sup>2</sup>

## In extremely premature infants weighing 500–750g, IVH occurs in about 45% of neonates<sup>3</sup>

Consequently, ventilation research and device development has focused intensely on new therapies that facilitate life support with minimal risk of injury. Ventilation strategies such as HFOV offer opportunities for lung protective ventilation whilst minimising

trauma resulting from either excessive cyclic volume oscillations or repeated re-inflation of atelectatic air space<sup>1</sup>. In combination with Volume Guarantee, it can be also seen as brain protective ventilation approach.

### STABILISE THE VENTILATED INFANT

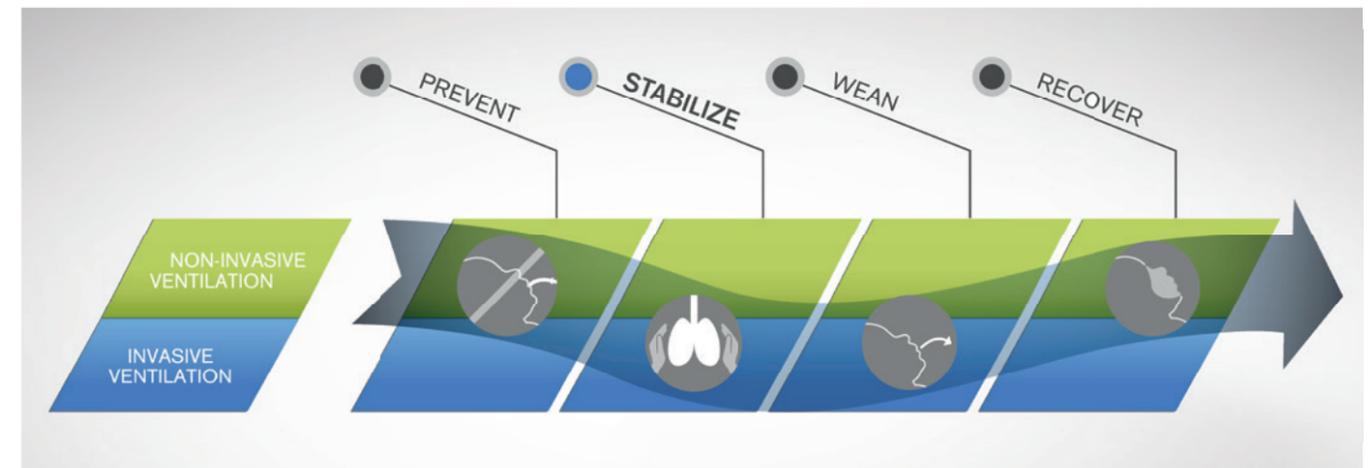
The aim of any ventilation strategy is to support the premature infant's respiratory system without inducing damage to the lung or the brain. HFOV is a comprehensive ventilation strategy that

on the one hand would avoid volutrauma by applying large tidal volumes and on the other hand atelectrauma by repetitive shear stress of the expansion and collapse with each CMV inflation.

### High Frequency Oscillation addresses perfectly the primary goals of ventilation therapy:

- Stabilize and recruit alveoli
- Reduce strain and stress on alveolar level
- Achieve stable blood gases

With our Dräger Babylog ventilators, we can help you to manage the whole respiratory pathway, including ventilatory support, prevention of intubation and weaning modes after extubation:



### RESPIRATORY PATHWAY IN NEONATAL VENTILATION

Ventilation strategies – from preventing intubation to recover the infant to secure weaning and the developmental process – can be viewed as a continuum of dependencies that accompany the infant and the care giver from the beginning to the end of respiratory challenges as pictured in our respiratory pathway.

<sup>1</sup> Pillow J. High-Frequency Oscillatory Ventilation: Theory and Practical Applications. Drägerwerk AG & Co. KGaA. 2016: 9102693.

<sup>2</sup> Cools F, Offringa M, Askie LM. Elective high frequency oscillatory ventilation versus conventional ventilation for acute pulmonary dysfunction in preterm infants. Cochrane Database of Systematic Reviews 2015: 19;(3):CD000104.

<sup>3</sup> Wilson-Costello D, Friedman H, Minich N, Fanaroff AA, Hack M. Improved survival rates with increased neurodevelopmental disability for extremely low birth weight infants in the 1990s. Pediatrics. 2005 Apr; 115(4):997-1003.

# High-Frequency oscillatory ventilation

## HIGH-FREQUENCY VENTILATION WITH THE BABYLOG

Babylog provides powerful and consistent High-Frequency Oscillation delivery as well as other useful tools, such as combining High-Frequency Oscillation with Volume Guarantee (HFO-VG) and High-Frequency Oscillation integrating Sigh functionality (HFO-Sigh). The oscillation generated in Babylog is sinusoidal: expiration is supported by active expiration to prevent air trapping. The result is smooth, precise and gentle oscillation.

## DEFINING HIGH-FREQUENCY OSCILLATORY VENTILATION

HFOV enables gas to be exchanged in the lungs despite very small tidal volumes. While pressure amplitudes may be considerable in the breathing circuit, only small fluctuations occur around the mean pressure in the lungs. The efficacy of HFOV is primarily due to improvement in pulmonary gas exchange. Yet it can also have favorable influence on respiratory mechanics and hemodynamics<sup>1</sup>. Thus, HFOV can be considered as a lung protective ventilator approach by reducing strain and stress on alveolar level.

## HIGH-FREQUENCY OSCILLATION WITH VOLUME GUARANTEE (HFO-VG)

As in conventional ventilation, the tidal volume is primary determinant of CO<sub>2</sub>-removal in HFOV. By continuously regulating the oscillation amplitude, HFO-VG compensates for dynamic changes in both the lung and the breathing circuit. Thereby, the weaning process of the oscillatory amplitude  $\Delta P_{Phf}$  is automatized. Blood gases and ultimately the cerebral blood flow become less susceptible to potentially hazardous risking complications such as periventricular leukomalacia or intraventricular haemorrhage<sup>1</sup>. HFO-VG can be seen as lung and brain protective ventilation strategy as it facilitates automatic weaning of  $\Delta P_{Phf}$ , protects the lung from excessive tidal volume and protects the brain from rapid flux in PaCO<sub>2</sub><sup>7</sup>.

## HIGH-FREQUENCY OSCILLATION INTEGRATING SIGH FUNCTIONALITY (HFO-SIGH)

A sigh breath is a conventional time-cycled pressure inflation. HFO-Sigh helps avoiding atelectasis and might be a useful recruitment procedure<sup>8</sup>. It can be triggered at pre-set intervals or performed manually.

## SUMMARIZED: IMPROVED OUTCOMES WITH HIGH-FREQUENCY OSCILLATORY VENTILATION

- HFO as a low volume strategy is highly effective in eliminating carbon dioxide using low peak airway pressures<sup>5</sup>.
- HFO with Volume Guarantee provides better control of ventilation and the risk of severe brain injury [...] could be in some way reduced<sup>6</sup>.
- Animal studies suggest that HFV works at lower proximal pressures than CMV, reduces ventilator induced lung injury and lung inflammatory markers, is synergistic with surfactant, improves gas exchange in face of air leaks, and decreases oxygen exposure<sup>9</sup>.
- An "optimal lung volume" strategy with HFOV [...] and extubation to CPAP rather than CV were associated with a reduction in Chronic Lung Disease in the HFO group<sup>8</sup>.

4 Kolton M, Cattran CB, Kent G, Volgyesi G, Froese AB, Bryan AC. Oxygenation during high-frequency ventilation compared with conventional mechanical ventilation in two models of lung injury. *Anesth Analg*. 1982 Apr; 61(4): 323-332.

5 Rimensberger PC. ICU Cornerstone: High frequency ventilation is here to stay. *Crit Care* (2003) 7: 342.

6 González-Pacheco N, Sánchez-Luna M, Ramos-Navarro C, Navarro-Patiño N, de la Blanca ARS. Using very high frequencies with very low lung volumes during high-frequency oscillatory ventilation to protect the immature lung. A pilot study. *J Perinatol*. 2016 Apr; 36(4): 306-310.

7 Iscan B, Duman N, Tuzun F, et al. Impact of Volume Guarantee on High-Frequency Oscillatory Ventilation in Preterm Infants: A Randomized Crossover Clinical Trial. *Neonatology* 2015; 108(4):277-82.

## CUSTOMER VOICES

### What experts say about High-Frequency Oscillatory Ventilation

“High-frequency ventilation offers opportunities for lung protective ventilation whilst minimising rheotrauma resulting from either excessive cyclic volume oscillations or repeated re-inflation of atelectatic air spaces.<sup>1</sup>”

“High-frequency oscillatory ventilation offers unique and highly efficient gas mixing, contributing to its success in both a priori and rescue treatment of patients with severe respiratory disease and impaired gas exchange.<sup>1</sup>”

Jane Pillow, Co-Director of the Centre of Neonatal Research and Education at the University of Western Australia

1 Pillow J. High-Frequency Oscillatory Ventilation: Theory and Practical Applications. Drägerwerk AG & Co. KGaA. 2016: 9102693.

## High-Frequency Oscillatory Ventilation is available for the following Dräger ventilators



Babylog VN800

D-5755-2018



Babylog VN600

D-5755-2018

Not all products or features are for sale in all countries or are only available as an option.

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Learn more about High-Frequency Oscillation under [www.draeger.com/neonatal-ventilation](http://www.draeger.com/neonatal-ventilation)

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