



Mandatory Minute Ventilation in Premature Infants

Mandatory Minute Ventilation (MMV) is a relatively simple closed-loop mode of ventilation, whereby the ventilator delivers pressure-limited, volume-targeted mandatory breaths when the minute volume generated by pressure supported spontaneous breaths falls below a target minimum Minute Volume (MV). It continuously adapts its mechanical support, whilst safeguarding on a minimum minute ventilation level. In addition, it can be considered a safe weaning strategy as it combines frequency adaptation and pressure adaptation in one mode and changes to the individual patient needs. Furthermore, it adapts safely for the leakage for trigger sensitivity and compensates for leakage in Volume Guarantee.

Wean the patient as fast as possible to reduce BPD/VILI

Bronchopulmonary dysplasia (BPD) is one of the most common comorbidities of prematurity. According to studies, delaying extubation beyond the first 3 and 7 days was associated with an increased risk of BPD and death: Infants of <1000g and <28 weeks have a sevenfold increase in BPD if ventilated for more than 7 days compared to early extubation¹. Ultimately, therapy should aim to reduce BPD by prevention of ventilator induced lung injury.

CLINICAL INTERVENTIONS OR STRATEGIES TO AVOID BPD

Beside consideration of less invasive surfactant administration and careful use of oxygen, a good ventilation strategy is key. The longer the patient is ventilated the higher the risk of developing BPD. But if one cannot prevent intubation, then the key is to prevent lung damage and revert MV patients to spontaneous breathing as soon as possible. Ventilator dependency can be decreased by:

- Reduce hyper- and hypoventilation
- Reduce ventilation time
- Prevent volutrauma and barotrauma
- Encourage spontaneous activity
- Reduce WOB by adequately supporting spontaneous breathing

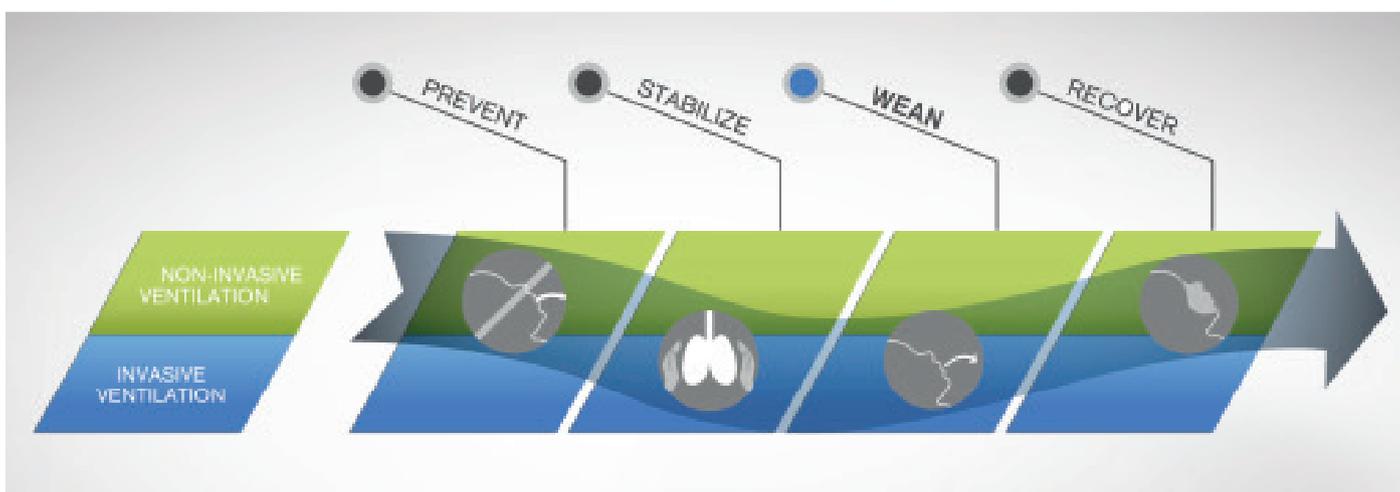
Wean the patient as fast as possible to reduce BPD/VILI.

WEAN THE PATIENT QUICK AND SAFE WITH MANDATORY MINUTE VENTILATION

The start of ventilation therapy is always the start of a weaning process. To prevent chronic lung disease such as BPD it is essential to directly help the infant to regain its own respiratory drive. Dedicated therapy approaches can facilitate and automatize weaning. MMV “closes the loop” in the weaning and transition

of the work of breathing from the ventilator to patient is a seamless process, operating continuously in real time.

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.

MANDATORY MINUTE VENTILATION

MMV promotes development of patient initiated breathing patterns, whilst guaranteeing a minimum level of minute ventilation. Pressure supported synchronized breaths initiated spontaneously by the patient are supplemented by pressure-limited, volume-guaranteed mandatory breaths when the minute volume generated by pressure supported breaths falls below the user set mandatory minute volume. Hence, MMV includes integrated apnoea ventilation.

SYNCHRONIZE VENTILATION AND AUTOMATE WEANING PROCESS

Synchronized ventilation improves patient comfort, decreases the risk of airleak, and reduces the risk and severity of diaphragmatic dysfunction². MMV is based on SIMV with Volume Guarantee. However, classic SIMV does not support spontaneous breaths above the mandatory respiratory rate (RR), imposing a high work of breathing on the infant breathing through the ET tube, as occurs during weaning. Moreover, close monitoring and manual interaction is required during weaning process. The development of SIMV with pressure support (PS) provided an intermediate ventilator option to balance the work of breathing between ventilator and patient, providing differential pressure support of mandatory and spontaneous breaths².

Volume targeting (Volume Guarantee) promotes more stable gas exchange, whilst reducing the risk of cyclic volutrauma and promoting more rapid reduction in ventilator pressures, compared to ventilation without volume-targeting. Although Volume Guarantee facilitates automated reduction of peak inspiratory pressure during weaning in SIMV, the **reduction of the respiratory rate, and transition of the work of breathing from ventilator to patient is highly dependent on active changes of ventilator settings** by the clinician².

Mandatory minute ventilation (MMV) builds on the advantages of these standard neonatal respiratory modes including synchronisation, Volume Guarantee and the differential pressure support of spontaneous and mandatory breaths offered in PC-SIMV/VG+PS. MMV offers the benefit of even more stable gas exchange, as the mandatory ventilator rate is continuously and automatically adjusted to “guarantee” a minimum level of minute ventilation (MV) – the key determinant of carbon dioxide removal from the lung. However, MMV also “closes the loop” in the weaning and transition of the work of breathing from the ventilator to patient is a seamless process, operating continuously in real time². The weaning thus takes places throughout the day and not just during rounds which might decrease the time on the ventilator.

SUMMARIZED: POTENTIAL BENEFITS OF MANDATORY MINUTE VENTILATION ^{2,3,4,5,6,7,8,9,10}

- 1) Wide range of ventilator support to support an infant throughout its requirement for mechanical ventilation;
- 2) More stable control of arterial blood gases resulting from more stable minute ventilation;
- 3) Automated weaning of mandatory respiratory frequency and peak inspiratory pressure;
- 4) Seamless apnoea ventilation within pre-set safety limits to avoid hypoventilation;
- 5) Intrinsic benefits arising from biologically variable respiratory rhythms associated with increased patient control over breathing patterns;

CUSTOMER VOICES

What experts say about Mandatory Minute Ventilation

“This seamless apnoea ventilation provides a safeguard for the patient; it reduces the frequency and severity of disturbance to oxygenation and cardiovascular stability, whilst providing the infant with opportunities to recommence breathing.”

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

- 1 Berger J, Mehta P, Bucholz E, Dziura J, Bhandari V. Impact of early extubation and reintubation on the incidence of bronchopulmonary dysplasia in neonates. *Am J Perinatol* 2014; 31(12):1063-72.
- 2 Pillow J. Mandatory Minute Ventilation: Background and Clinical Applications. Drägerwerk AG & Co. KGaA. 2019: 9106653.
- 3 Sassoon CS, Zhu E, Caiozzo VJ. Assist-control mechanical ventilation attenuates ventilator-induced diaphragmatic dysfunction. *Am J Respir Crit Med* 2004; 170(6): 626-32.
- 4 Futier E, Constantin JM, Combarret L, et al. Pressure support ventilation attenuates ventilator-induced protein modifications in the diaphragm. *Crit Care* 2008; 12(5): R116.
- 5 Claire N, Suguihara C, Peng J, Hehre D, D'Ugard C, Bancalari E. Targeted minute ventilation and tidal volume in an animal model of acute changes in lung mechanics and episodes of hypoxemia. *Neonatology* 2009; 95(2): 132-40.
- 6 Poets CF, Rau GA, Neuber K, Gappa M, Seidenberg J. Determinants of lung volume in spontaneously breathing preterm infants. *Am J Respir Crit Care Med* 1997; 155(2): 649-53.
- 7 Bartolak-Suki E, Noble PB, Bou Jawde S, Pillow JJ, Suki B. Optimization of Variable Ventilation for Physiology, Immune Response and Surfactant Enhancement in Preterm Lambs. *Front Physiol* 2017; 8: 425.
- 8 Davis S, Potgieter PD, Linton DM. Mandatory minute volume weaning in patients with pulmonary pathology. *Anaesth Intensive Care* 1989; 17(2): 170-4.
- 9 Berry CA, Suki B, Polglase GR, Pillow JJ. Variable ventilation enhances ventilation without exacerbating injury in preterm lambs with respiratory distress syndrome. *Pediatr Res* 2012; 72(4): 384-92.
- 10 Pillow JJ, Musk GC, McLean CM, et al. Variable ventilation improves ventilation and lung compliance in preterm lambs. *Intensive Care Med* 2011; 37(8): 1352-9.

Mandatory Minute Ventilation is available for the following Dräger ventilators



D-5755-2018

Babylog VN800



D-5755-2016

Babylog VN600



D-12081-2019

Evita V800



D-12080-2019

Evita V600

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Learn more about Mandatory Minute Ventilation under www.draeger.com/neonatal-ventilation

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