Benefits of the Neo-Tee versus the Self Inflating Resuscitation Bag in the Delivery Room and NICU

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The self inflating resuscitation bag is unable to provide the neonate continuous positive airway pressure (CPAP). In addition, the self inflating resuscitation bag is unable to maintain end expiratory alveolar volume, which may lead to alveolar collapse and loss of alveolar recruitment. This may be overcome if a PEEP valve is incorporated into the self inflating resuscitation bag. However the self inflating resuscitation bag is often used without this PEEP valve.

The Neo-Tee is able to provide the neonate with CPAP. As simple as this sounds, Neo-Tee's ability to provide CPAP is the tremendous benefit of the Neo-Tee over the self inflating resuscitation bag.

The only strategy that has proven to promote alveolar stability and enhance alveolar recruitment in the delivery room and the NICU is CPAP in one form or another. CPAP also prevents the loss of end expiratory alveolar volume thus maintaining alveolar stability and alveolar recruitment.

During a positive pressure breath the variation of lung volume depends on the compliance of the alveolar structures and the amount of pressure used to produce that change. The normal lung at birth does not present pure elastic behavior across the vital capacity range. Even in the normal lung at birth there are regional and postural variations in how fast or slow lung units will fill or empty along the vital capacity range.

When the lung is subjected to a pressure change, time is needed until a volume change will occur. The time necessary to inflate an alveolar structure to 63% of its volume is called a "time constant." This concept is extremely important when trying to understand the challenges of the neonate's pulmonary mechanics during the transition to breathing air. Time constants refer to the speed at which the alveoli will fill or empty. In the normal or near normal lung the alveolar time constants will vary based on the resistance and compliance of the lung structures. Some alveoli will fill or empty faster while others are slower to fill or empty. During transition many factors may unfavorably alter the regional time constants immediately after birth. Understanding these challenges and regional differences in time constants is essential in the delivery room and the NICU.

The successful transition from fetal circulation to pulmonary circulation depends on the neonate's ability to achieve a stable functional residual capacity (FRC) immediately following birth. The challenge in these neonates is to achieve and maintain an adequate FRC allowing alveolar stability and optimizing alveolar recruitment. Achieving alveolar stability means that the spontaneous breath must be able to open or recruit as much of the available alveoli as possible. Maintaining alveolar stability also means that there is adequate end expiratory alveolar volume to prevent alveolar collapse and loss of alveolar recruitment.

As stated earlier, the only strategy that has proven to promote alveolar stability and enhance alveolar recruitment in the delivery room and the NICU is CPAP in one form or another. CPAP also prevents the loss of end expiratory alveolar volume, thus maintaining alveolar stability and alveolar recruitment. The Neo-Tee provides CPAP and will assist the transition process from fetal to pulmonary circulation by providing a dynamic FRC immediately following birth. The self inflating resuscitation bag does not provide a dynamic FRC.

Maintaining end-expiratory alveolar stability and alveolar volume is the function of the amount of the positive-end expiratory pressure (PEEP) or continuous positive airway pressure (CPAP) that is applied. Adding PEEP to a self inflating resuscitation bag requires the addition of a special PEEP valve to the self inflating resuscitation bag. Without this PEEP valve the end expiratory airway pressure will be allowed to return to zero after each positive pressure breath. This may cause a decrease in the FRC and loss of alveolar stability resulting in alveolar collapse and a loss of alveolar recruitment. Maintaining alveolar stability using a self inflating resuscitation bag without a PEEP valve may be impractical or impossible.

CPAP is able to achieve and maintain alveolar stability because the airway pressure never falls below the lower inflection point, preventing alveolar collapse. Keeping these alveoli inflated (dynamic FRC) and continuously participating in gas exchange is the unique secret of CPAP.

Therefore the benefit of the Neo-Tee is the ability to provide CPAP, providing a dynamic FRC and alveolar stability and optimizing alveolar recruitment which will enhance the transition from fetal to pulmonary circulation in the newborn.

This review was written by Chandler, who is solely responsible for its content. This review would not have been possible without the suggestions and the unwavering support of Ed Golden RRT, Director of Pulmonary Services, Manatee Memorial Hospital. Chandler is a staff Respiratory Therapist who is currently employed at Manatee Memorial Hospital. He has been involved in respiratory care for the past 44 years.