

Manual Ventilation During Resuscitation: Does Device Matter?

Delivering effective positive pressure breaths to newborns during the first few breaths of life is an ongoing challenge. Because we have learned a great deal about physiologic effects of acute lung injury and lifelong consequences resulting from its outcomes, perspectives on delivering resuscitation breaths have changed. Device evaluations and independent studies have been conducted to identify the effects of tidal volume, pressure, frequency, and duration of inspiration during manual ventilation: the parameters that have the greatest impact on lung injury.¹ Others have explored device accessibility, ease of use, and infection prevention at delivery.² Despite the device or technique chosen, the emphasis on training and mastering skills is as important as the selection of the device itself. Attempts to demystify specific techniques, to compare delivery devices, and to identify safe practices have evolved over the last 10 or more years.³

Today's newborn resuscitation and manual ventilation recommendations are defined in the American Academy of Pediatrics in the 6th edition of the *Textbook of Neonatal Resuscitation*.⁴ Because institutions have access to different delivery devices, many options remain on the table. An increased emphasis on the need to understand these techniques has prompted research that has shown that no single practice or device has been identified as being superior to another. Institutions around the globe are challenged by varying physical and economic resources and limitations that frequently drive their practices. It is prudent to investigate all devices and techniques and implement strategies that best fit the situation with the tools we have on hand.

Attempts to define optimum methods for breath delivery during resuscitation have been explored. Devices including the T-piece resuscitator, self and flow inflating bag for manual ventilation, or mechanical ventilators have been shown to have both positive and negative attributes. The T-piece resuscitator has been the most sought after device in recent years. It has earned interest as most widely investigated for routine neonatal ventilation as well. Because of recent newer device availability, and evidence demonstrating reduced pressure variability among caregivers, it is most popular for use in some neonatal intensive care units and delivery rooms. The questions regarding tidal volume delivery related to pressure and effects of inspiratory time generated by the caregiver still remain.

Flow inflating bags are used to provide manual ventilation with the ease and ability to adjust PEEP and peak inspiratory pressure with breath-by-breath pressure monitoring. However the "educated hand" theory that was associated with this device, indicating that the caregiver could feel the compliance of the patient's lungs on the other end of the resuscitator, has been handed down from generation to generation without sufficient validation. The tendency to "overPEEP" the patient or use higher pressures has been shown to create iatrogenic lung injury, defined by Salyer and colleagues.⁵ This device, like others, requires practice and skill to accomplish the task at hand. There is potential to achieve suitable parameters through education, training, and much practice.

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Self inflating manual resuscitators are used in routine practice in the delivery room and at the bedside of every patient in a hospital (for emergency use). The distinct drawbacks to self inflating manual resuscitators include the inability to provide a sustained inflation if desired and failure to maintain PEEP without additional attachment.³ In this issue of *RESPIRATORY CARE*, Bassani and colleagues investigated caregiver performance and practice using a specific procedure with a self inflating device.⁶ Since self inflating resuscitation bag resuscitators are the most commonly used device in many United States hospitals and globally,⁷ this important study described the impact of performance variations, and differences in pressures, volumes, and frequencies, using a unique approach with this simple device. They measured the effects of applying 2–5 fingers (at each level) when squeezing the bag and delivering the breaths. Variations among caregivers from different disciplines were quantified based on their performance, evaluated when using this device under controlled conditions. This study answered some questions surrounding self inflating bag resuscitation methods that had not been previously addressed. This device has substantial value in clinical practice, is convenient, and may be less risky from a pressure-swing standpoint than its flow-inflater counterpart.

While most of the emphasis on breath delivery has been on device and method, we must not forget all of the other obstacles that plague our inability to achieve goals and

prevent us from accomplishing proper manual ventilation. Type of mask, presence of leaks, airway obstruction (from inappropriate positioning or from secretions during bag and mask ventilation), and a rapidly changing lung compliance may result in insufficient or over-ventilation.⁸ The effects of positive pressure manual ventilation during the first few breaths may be detrimental and cause histologic injury within the first minute of life in a premature infant.⁷ Therefore, it is imperative that we examine whether or not current methods and monitoring give us enough information and direction to prevent long-term lung injury.

Selecting a device for manual resuscitation of infants is important. Despite the type chosen, the accuracy and consistency with which the caregiver uses the device and method are most important. What does matter is knowing the device, its attributes and limitations, and how to apply it during these most critical times. Successful manual ventilation can be accomplished when there is familiarity, training, and competency in its practice; strategy for ap-

propriate application; and use of a method and device that assure best outcomes.

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