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Peak Inspiratory Pressure During Delivery Room Resuscitation for Infants Born at Less Than 500 Grams

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1. Abstract

Introduction: With the advent of technological advancement and better scientific understanding it is possible now to successfully resuscitate and save babies born at less than 500 grams. Stabilization of these infants in the delivery room (DR) is one of the goals of the golden hour management. While some factors, including temperature management and airway care have standards, there is paucity of data on the optimal peak inspiratory pressure (PIP). The Neonatal Resuscitation Program (NRP) recommends using the same inflation pressure of 20 cm to 25 cm H_2O for preterm infants as used for term infants. Preterm lungs are not the same as term infants. Due to the smaller lung volume, capacities and dynamic pulmonary mechanics, these preterm infants are prone to pulmonary complications including pneumothorax. Therefore, there is need to use PIP judiciously in the DR.

Methods and Results: In this brief report we present two cases of newborn infants that were born at less than 500 grams and were successfully resuscitated with a lower PIP. The success criteria in the DR were heart rate greater than 100 per minute and adequate oxygen saturations minute by minute per NRP guidelines with minimal use of supplemental oxygen.

Conclusion: While we need good prospectively designed studies to document the ideal PIP for these extreme preterm infants, we suggest a PIP lower than the currently recommended may be sufficient for some extremely preterm infants.

2. Keywords: Preterm; Infant; Resuscitation; Peak inspiratory pressure; Delivery room

3. Introduction

With the advent of technological advancement and better scientific understanding it is possible now to successfully resuscitate and save babies born at less than 500 grams. The neonatal viability and intervention are a matter of continuous debate. Should it be gestational age based or weight based? What is the cutoff? The American Academy of Pediatrics (AAP) recommends comfort care rather than active resuscitation for infants born at less than 22 weeks gestation. Therefore, neonatal intensive care units (NICU) with the capacity to resuscitate are required to provide support to all live birth irrespective of gestational age or birth weight. The other caveats with the decision to resuscitate these peri-viable cases are a) gestational age is not reliable if prenatal care is started late and b) infant could be growth restricted.

As mentioned above providing active resuscitation to infants born at less than 500 grams is no more a rarity.

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The Neonatal Resuscitation Program (NRP) has introduced a chapter in the textbook for the care for premature infants, however when it comes to the use of positive pressure ventilation it does not provide specific recommendations for this group of extreme premature infants. NRP recommends using the same inflation pressure of 20 to 25 cm H_2O for preterm infants as used for term infants. A peak inspiratory pressure (PIP) of 20 to 25 is high for an infant born at less than 500 grams. The main goal of providing an adequate PIP is to create an appropriate functional residual capacity (FRC) and tidal volume (VT). The normal neonatal FRC, which is the sum of expiratory reserve volume and residual volume and VT are 10 to 15 mL/kg and 5 to 8 mL/kg, respectively. Thus, a baby who weighs 500 grams at birth would need an FRC of 5.0 to 7.5 ml and VT of 2.5 to 4.0 ml, which could be achieved by using a lower PIP. As seen in the figure, an optimal FRC could be achieved by using a lower PIP if the lungs are treated with surfactant.

In this report we present two cases of newborn infants that were born at less than 500 grams and were successfully resuscitated with a lower PIP (18 cm H_2O). The success criteria in the delivery room (DR) were heart rate greater than 100 beats per minute and adequate oxygen saturations minute by minute per NRP guidelines with minimal use of supplemental oxygen. At the time of this report both infants are stable in the NICU (only the delivery room course is presented here, the details of the NICU course is not presented for the value of space and time).

4. Case Series

Case 1

Estimated fetal weight (EFW) of 320 grams (gestational age (GA) of 23 weeks by 7-week ultrasound, intrauterine growth restriction -IUGR). The mother was a 35-year-old gravida 3, para 0202 (term 0, preterm 2, abortion 0, live 2), presented with pre-eclampsia with severe features, absent Doppler flows and IUGR. She received betamethasone and magnesium sulphate. A female infant was delivered via low cesarean section. Apgar scores were 3 and 5. She was intubated and PPV was provided via T-piece resuscitator. The PIP was set as 18 cm H_2O with positive end expiratory pressure (PEEP) of 5 cm H_2O. After confirming the endotracheal tube placement by colorimetric CO_2 detector, pulse oximeter and bilateral breath sound, she was dosed with surfactant in DR and then was transferred to the NICU using the portable ventilator attached to the transport incubator.

Case 2

EFW of 475 grams (GA of 27 weeks by 9-week ultrasound, IUGR). Mom was a 25-year-old, gravida 3, para 2002 (term 2, preterm 0, abortion 0, live 2). The pregnancy was complicated by superimposed preeclampsia with severe features of IUGR (EFW <1%, reversal of flow on umbilical artery Doppler's. She received two doses of betamethasone and magnesium sulfate. A male infant was delivered by cesarean section. Apgar scores were 6 and 8. He was intubated for secondary apnea and PPV was provided via T-piece resuscitator. The PIP was set as 18 cm H_2O with positive end expiratory pressure (PEEP) of 5 cm H_2O. After confirming the endotracheal tube placement by colorimetric CO_2 detector, pulse oximeter and bilateral breath sound, he was dosed with surfactant in DR and then was transferred to the NICU using the portable ventilator attached to the transport incubator.

5. Discussion

Preterm lungs are not the same as term infants. Most infants with birth weight of less than 500 grams need respiratory assistance in the form of PPV. Due to the smaller lung volume, capacities and dynamic pulmonary mechanics, these preterm infants are prone to pulmonary complications including pneumothorax. Therefore, it is particularly important to use the PIP judiciously in the DR.

The pulmonary compliance, which is a measure of change in volume per change in pressure, is low in surfactant deficient lung. To achieve a specific volume higher pressure would be needed. However, if

the lungs are treated with surfactant the compliance increases thereby decreasing the need for higher pressure (Figure).

Figure

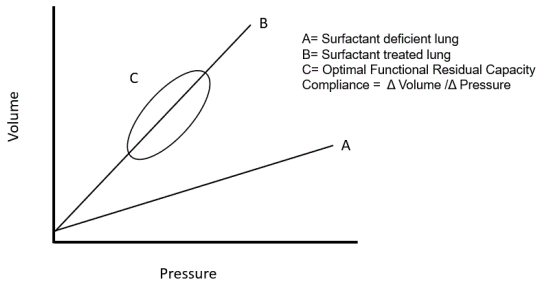

Figure 1: Graph Showing the Relationship between Pulmonary Volume and Pressure.

The use of surfactant in the DR increases the pulmonary compliance and time constant, hence higher PIP is not required. One could argue about the potential risk associated with giving surfactant in the DR without radiological confirmation of the endotracheal tube (ETT). With the use of colorimetric CO_2 detector, pulse oximeter and good clinical examination for bilateral breath sounds, the risk could be minimized. In future, the use of point of care ultrasound to see the exact ETT placement in trachea would eliminate the potential risk of instilling surfactant accidently into the right or left lung.

Unfortunately, knowing the optimal peak PIP during the PPV to produce an adequate FRC and VT is difficult in clinical settings. FRC and VT is dependent on spontaneous breathing activity of the infant, lung compliance and resistance, the amount of lung liquid and its absorption rate and the inflation-time [1]. Moreover, during bag-mask ventilation, mask leak can further compromise adequate FRC and VT delivery. However, by using the cardiac monitor and pulse oximeter during resuscitation in DR for these small premature infants, a reasonable clinical judgement could be made about the appropriate delivery of FRC and VT.

Researchers have tried using sustained lung inflation (SLI) pressure during resuscitation of premature infants with conflicting results [2,3]. In fact, a recent Cochrane review on SLI showed no evidence of support [4]. Recently Abd E-Fattah et al. [5] reported that using a pressure of ≥ 20 cm H_2O was not superior to lower pressures of 15 cm H_2O. Similarly, Hunt et al. [6] in comparing endotracheal and facemask ventilation, have used a lower range of mean inflation pressures of 17.2 versus 18.8 cm H_2O, respectively. The other option for providing lower inflation pressure is to use the T-piece rather than self-inflating bags, as described by Szyld et al. [7].

6. Conclusion

While we need some prospective studies to document the ideal PIP for these extreme preterm infants during DR resuscitation, a lower PIP may be sufficient for some extremely preterm infants.

References

1. Vali P, Mathew B, Lakshminrusimha S. Neonatal resuscitation: evolving strategies. Matern Health, Neonatol and Perinatol. 2015;1: 4.

2. Keszler M. Sustained inflation during neonatal resuscitation. Curr Opin Pediatr. 2015; 27: 145-451.

3. Kirpalani H, Ratcliffe SJ, Keszler M, Peter G Davis, Elizabeth E Foglia, Arjan Te Pas, et al. Effect of Sustained Inflations *vs.* Intermittent Positive Pressure Ventilation on Bronchopulmonary Dysplasia or Death Among Extremely Preterm Infants: The SAIL Randomized Clinical Trial. JAMA. 2019; 321: 1165-1175.

4. Bruschettini M, O'Donnell CPF, Davis PG, Morley CJ, Moja L, Simona Zappettini, et al. Sustained versus standard inflations during neonatal resuscitation to prevent mortality and improve respiratory outcomes. Cochrane Database of Systematic Reviews. 2020; 7: CD004953.

5. Abd E-Fattah N, Nasef N, Al-Harrass MF, Khashaba M. Sustained lung inflation at birth for preterm infants at risk of respiratory distress syndrome: The proper pressure and duration. J Neonatal Perinatal Med. 2017;10: 409-417.

6. Hunt KA, Murthy V, Bhat P, Grenville F Fox, Morag E Campbell, Anthony D Milner, et al. Tidal volume monitoring during initial resuscitation of extremely prematurely born infants. J Perinat Med. 2019; 47: 665-670.

7. Szyld E, Aguilar A, Musante GA, Nestor Vain, Luis Prudent, Jorge Fabres, et al. Comparison of devices for newborn ventilation in the delivery room. J Pediatr. 2014; 165: 234-239.

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