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Original Article

Effect of Prone Position on Oxygen Saturation in Neonates having Respiratory Distress

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ABSTRACT

Objective: To determine the mean change in oxygen saturation of neonates having respiratory distress after prone positioning for six hours.

Study Design: Quasi experimental Study.

Place and Duration of Study: Neonatology Unit, Allied Hospital, Faisalabad Pakistan, from Jun to Nov 2015.

Methodology: Total 60 neonates <28 days of age and >32 weeks of gestation having respiratory distress of both genders were included. All neonates were stabilized after resuscitation (if required) and oxygen saturation was documented with pulse oximeter initially in supine position and then after prone positioning for 6 hours. Statistical analysis of data was done by using SPSS version 20.

Results: Out of 60 neonates 38(63.3%) were males and 22(36.7%) were females. Male to female ratio was 1.7:1. Their mean age was 1.75±0.68 days. Oxygen saturation in supine position was 76.97±10.12 and after 6 hours in prone position was 85.78±7.40 with *p*-value of 0.0001 which is statistically significant.

Conclusion: Prone position results in improvement of oxygen saturation in newborns having respiratory distress.

Keywords: Neonates, Oxygen saturation, Respiratory distress.

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INTRODUCTION

Neonatal mortality in Pakistan is the highest among the other countries in the world. Each year out of the 5.3million live births 0.27million neonates die in Pakistan due to the different causes.[1] Variuos pulmonary conditions can threaten the life of neonates, frequent etiologies leading to the neonatal morbidity and mortality are birth asphyxia, idiopathic respiratory distress syndrome, meconium aspiration syndrome and neonatal sepsis. All of these conditions are associated with the respiratory distress and require the interventions in the form of oxygenation, ventilation and surfactant administration. As a result of these interventions the neonates are prone to the air leaks in the form of pneumothorax, pneumomediastinum, pneumopericardium and pneumoperitoneum, and most of the neonates die due to these complications.[2] Respiratory distress is one of a common clinical feature of all these etiologies. Respiratory distress by definition is the respiratory rate >60/min with significant chest retractions (subcostal, intercostal, suprasternal), nasal flaring and grunting.[3]

Respiratory distress in the infants is most commonly treated by supplemental oxygen and mechanical ventilation, both of which are expensive, invasive at times and may cause injury to lungs in the form of pneumothorax and prolong the hospital stay.[4] Prone positioning is a simple, non-invasive, cost free method of improving oxygenation but still it is used less frequently or not at all.[5] We may get the better results in terms of the early recovery by the prone positioning of infants having respiratory distress.

Most of the studies done in developed countries about prone positioning were on the mechanical ventilation.[5-7]

A study done by Das *et al.* at Liaqat University Hospital Hyderabad observed that saturation in supine position (84.84±4.20) improved to 92.63±3.02 after 6 hours in prone position. According to another study done by Hough *et al.* in New Zealand there was not any significant change in regional lung ventilation distribution in preterm neonates in prone and supine position.[8] The risk factors for respiratory distress in newborns are prematurity, male sex, cesarean delivery without labor, prenatal asphyxia, multiple gestation, maternal diabetes etc. Respiratory support given to the newborns is in the form of mechanical ventilation (which includes various modes like intermittent positive pressure ventilation, synchronized intermittent mandatory ventilation and high frequency oscillatory ventilation), continuous positive airway

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pressure, and humidified high flow nasal cannula oxygen system.[9,10]

Previously there are not many studies indicating the effects of prone position on tissue oxygenation and results are controversial. Body positioning can be used as a tool for improving the oxygenation in severely ill patients. It is actually the non invasive and simple method of improving ventilation. It can easily be implemented as a part of routine nursing care. This study is planned to determine whether it will be helpful to nurse a neonate having respiratory distress in the prone positioning in reducing the need of the oxygen therapy and respiratory distress when resources are limited for the intensive care units like trained nursing staff, availability of the mechanical ventilators and the economical cost of management.

METHODOLOGY

The Quasi experimental study was done in the department of Neonatology, Allied Hospital, Faisalabad Pakistan from June to November 2015. Sample size was calculated by using WHO sample size calculator keeping absolute precision required 6%, confidence level 95%. SpO^2 in prone position= 92.63± 3.021 in supine position= 84.84±4.201. Sample size was 60 patients.

Inclusion Criteria: Neonates of either gender admitted in the Neonatology Unit of Allied Hospital, Faisalabad were inlcuded.

Exclusion Criteria: Newborns of the gestational age <32 weeks and birth weight <1.5kg, babies having the congenital malformations, babies needing the mechanical ventilation, babies showing sudden drop in the oxygen saturation on change in position were excluded.

After getting permission from the Hospital Ethical Review Committee, 60 neonates admitted in the neonatology unit of Allied Hospital, Faisalabad were selected by non-probability consecutive sampling after explaining the purpose, procedure, risks and benefits , addressing the ethical issues and taking informed consent from the parents. Neonate was the new-born less than 28 days of age. Respiratory distress was defined as respiratory rate greater than 60/minute with or without chest retractions (any of the following subcostal, intercostal, sternal, suprasternal recessions), nasal flaring and grunting. Oxygen saturation will be documented by a pulse oximeter after keeping the neonates in a prone position for six hours. Pulse oximeter measures peripheral capillary oxygen saturation (SpO^2) according to the following formula. $SpO^2= HbO^2/HbO^2+Hb$.

All neonates were stabilized after required resuscitation and their oxygen saturation was documented by the pulse oximeter first at the supine position then after kept in the prone position for 6 hours. During this period continuous monitoring of the vitals and oxygen saturation was done. Performa containing biodata, examination and findings was filled and statistically analyzed by using SPSS version 20. Descriptive statistics were calculated for all variables. Mean and standard deviation were calculated for all the numeric variables like age and oxygen saturation. Frequency and percentages were calculated for categorical variables like gender. Paired sample t-test was applied to compare the oxygen saturation before and after keeping neonates in the prone position. *p*-value <0.05 taken statistically significant.

RESULTS

In our study 60 neonates were evaluated, out of which 38(63.3%) were males and 22(36.7%) were females. Male to female ratio was 1.7:1. Their mean age was 1.75±0.68 days. Out of them 23(38.3%) were <1 day old, 29(48.3%) were between 2-10 days and 8(13.3%) were between 11-28 days. The oxygen saturation in supine position was 76.97±10.12 and after 6 hours in prone position was 85.78±7.40 with *p*-value of <0.001 which is statistically significant as shown in the Table-I.

Table-I: Oxygen saturation in supine and prone position (n=60)

Variable	Supine	After 6 hours in Prone Position	*p*-value
Oxygen saturation	76.97±10.12	85.78±7.40	<0.001

The results remained similar regardless of the gender and age as shown in Tables-II & III.

Table-II: Oxygen saturation in prone and supine position in age distribution.(n=60)

Age	Oxygen Saturation in		*p*-value
	Supine Position	Prone Position	
<1 day	76.43±8.85	84.65±7.8	<0.001
2-10 days	76.93±11.78	86.28±7.37	<0.001
11-28 days	78.63±7.56	87.25±6.54	<0.001

Table-III: Oxygen saturation in prone and supine position in gender distribution. (n=60)

Gender	Oxygen saturation in		*p*-value
	Supine position	Prone position	
Male	75.95±10.38	85.74±6.93	<0.001
Female	78.73±9.62	85.86±8.31	<0.001

DISCUSSION

Respiratory distress is much more frequent among the etiologies leading to the hospitalization in

the neonates.[4] The common causes of respiratory distress are respiratory distress syndrome, meconium aspiration syndrome, transient tachypnea of newborn.[10]

Regardless of modes of ventilation and duration of treatment prone results in increased ratio of partial pressure of oxygen and FiO_2. Prone position improves lung oxygenation and decrease inflammation whereas supine position does not result in better exchange of gases and also results in more lung inflammation. Due to these benefits prone position is effective, economical and safe management step for patients with respiratory distress syndrome.[12] In hypoxic patients with acute lung injury prone positioning is beneficial as early rescue method to improve oxygenation and hence condition of the patient. Other than improving lung oxygenation prone positioning also provide some additional benefits like prevention of bed sores and the patient comfort.[13]The severity of distress should be estimated with an initial assessment. Mild distress may warrant observ-ation and pulse oximetry. Severe distress, especially with a complicated birth history, requires immediate resuscitation, chest radiography, and laboratory tests. Newborns commonly demonstrate signs of respiratory compromise much earlier than cardiovascular collapse. The common treatment modalities of these diseases like mechanical ventilators and cardio respiratory monitors are expensive and often not available in every hospital. Despite of various recent advancement in neonatal intensive care, ventilator-induced lung injuries are still significant unresolved problem leading to neonatal morbidity and mortality. Therefore, we need to find the new strategies which can minimize the duration of hospitalization and oxygen requirement.[14,15] Hence as a conclusion of this, researchers have suggested less invasive ventilation strategies, which includes the use of nasal continuous positive pressure ventilation and nasal cannula oxygen for neonates. Nasal continuous positive pressure ventilation has proven beneficial effects by keeping the alveoli open and stabilizing the functional residual capacity in the treatment of respiratory distress syndrome within limited period of time. Hence it is strongly recom-mended to apply continuous positive airway pressure within the first few minutes of life in order to prevent respiratory distress syndrome and worsening of alre-ady developed respiratory distress syndrome and it is also beneficial for post-ventilator removal neonates after extubation as it results in significant reduction of the need for reintubation.[14] Positioning of the newborns is an essential part of the neonatal care. Particular positions can help the neonates breath more comfortably and have better outcomes in terms of early recovery and less requirement of the oxygen.[16]

We conducted this study to find out whether nursing the neonates in prone position improves the oxygen saturation as it may be helpful in reducing the morbidity and mortality and reduce the hospital stay. Our study showed that placing the neonates with respiratory distress improves the oxygen saturation, these findings are similar to study conducted by Das *et al.* at Liaqat University Hyderabad.[1] Gillies *et al.* in a Cochrane study also compared the effects of different body postures in the infants and children hospitalized due to the respiratory distress and found prone positioning significantly much better than the supine position.[4]

Abdeyazdan *et al.* conducted the study on the premature infants undergoing mechanical ventilation and found prone position to be an inexpensive and a simple method of improving the lung oxygenation.[5] Nyren *et al.* studied the lung perfusion and ventilation in prone and supine position with reference to the anesthetized and mechanically ventilated adult and found that the prone posture is more favorable in evenly distributing the oxygen between different lung regions.

In another study done by Hough *et al.* in New Zealand they did not find any significant difference in the regional lung ventilation and perfusion in preterm neonates in prone and supine position.[8] There are no guidelines regarding the length of time for which patients should remain in prone position. Relvas *et al.* found that keeping patients in prone position for prolonged periods rather than shorter periods results in greater improvement in oxygenation,[11] while in our study we found significant improvement even in short period of time hence helping in reducing the duration of requirement of supplemental oxygen, ventilator support. In this way duration of hospitalization can also be reduced.

Most of the studies done on the effect of prone positioning on the tissue oxygenation have been on the ventilated patients,[17,18] and few in the spontaneously breathing patients. Our study contributed in this aspect by showing that prone position decreases oxygen requirement by improving oxygen saturation and in this way it helps in reduction of need of supplemental oxygen and ventilator support. It is also very simple and easily applicable during routine nursing

care. So it is proved to be the economical and effective step in management of patients with respiratory distress.

CONCLUSION

Prone position improves the oxygen saturation in the majority of neonates having respiratory distress. It also helps in reducing the duration of need of supplemental oxygen and ventilator support. It is an easy and inexpensive part of the management which does not require any training or resources which is especially beneficial in the resource limited public sector hospitals. However, more studies are needed to show the effect of prone on oxygenation on larger scales also studying the overall effect on morbidity, mortality and duration of hospital stay. This can help us to review our NICU guidelines.

Conflict of Interest: None.

Author's Contribution:

Following authors have made substantial contributions to the manuscript as under:.

AT & ITC: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

IA & IA: Data acquisition, data analysis, approval of the final version to be published.

MA & MAB: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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