QUARTER TURN FROM PRONE POSITION INCREASES OXYGEN SATURATION IN PREMATURE BABIES WITH RESPIRATORY DISTRESS SYNDROME

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ABSTRACT

The rate of death and illnesses on premature babies is mostly respiratory distress syndrome (RDS). Desaturated-period frequently occurs on premature babies with RDS. One intervention to prevent it is a quarter turn from prone position. The research design was pre-experimental study with one group pre- and post-test design. This study involved 20 respondents that were selected with consecutive sampling technique. The setting of the research was in Perinatology ward at Prof. Dr. Margono Soekarjo. The oxygen saturation was examined before and after 2 hours of intervention. Data was then analyzed with *Wilcoxon test.* The results showed that median value of SpO2 before quarter turn from prone position was 94%, and its value after two hours of intervention was 96.5%. It was found that there was a significant effect in giving quarter turn from prone position to oxygen saturation on premature babies with RDS. Quarter turn from prone position was able to increase oxygen saturation on premature babies with RDS and is possible to be implemented in perinatology room.

Keywords: premature babies, RDS, oxygen saturation, quarter turn from prone position

ABSTRAK

Penyebab terbesar kematian neonatus adalah kelahiran prematur yaitu mencapai angka 35,2%. Angka kematian dan kesakitan pada bayi prematur paling banyak disebabkan oleh respiratory distress syndrome (RDS). Periode desaturasi sering terjadi pada bayi prematur dengan RDS, salah satu penatalaksanaannya yaitu pemberian posisi quarter turn from prone. Desain penelitian menggunakan pra eksperimen, one group pre and post test design. Penelitian ini melibatkan 20 responden yang diambil menggunakan teknik consecutive sampling. Lokasi penelitian di ruang Melati RS Prof. Dr. Margono Soekarjo. Data diuji dengan menggunakan Wilcoxon Test. Hasil analisis menunjukkan nilai median SpO2 sebelum pemberian posisi quarter turn from prone sebesar 94%, setelah 2 jam pemberian posisi quarter turn from prone terjadi peningkatan saturasi oksigen dengan nilai median sebesar 96,5%. Hasil signifikansi sebesar 0,000 (p value < 0,05) yang berarti terdapat pengaruh yang signifikan pemberian posisi quarter turn from prone terhadap saturasi oksigen pada bayi prematur dengan RDS. Posisi quarter turn from prone dapat meningkatkan saturasi oksigen pada bayi prematur dengan RDS dan dapat diaplikasikan di ruang perawatan bayi resiko tinggi.

Kata kunci: bayi prematur, RDS, saturasi oksigen, posisi quarter turn from prone

BACKGROUND

Premature baby is a newborn with less than 37 gestation weeks and mostly below 2500 gram birth weight (Nugroho, 2010). According to World Health Organization (WHO), in 2012 the mortality rate of newborn babies up to 28 days of life was 44% world wide. In Prof. Dr. Margono Soekarjo Hospital, Purwokerto, the number of premature babies in 2016 was doubled the rate of it in 2015 (from 164 to 317). It was also identified that in 2015 as many as 232 premature babies suffered from Respiratory Distressed Syndrome (RDS). There was a decrease number of this case which fell to 137 in 2016. Even though the number decreased almost a half, this case is a major concern for its risk of early death.

Lissauer and Fanaroff (2009) described the intervention for premature babies with RDS including oxygen therapy, antenatal corticosteroid, surfactant therapy, lung colaps prevention with CPAP *(Continuous Positive Airway Pressure),* and lung expansion with peak inspiration pressure using mechanic ventilator. Abdeyazdan et al (2010) asserted a certain position that can be used as a non invasive intervention for premature babies with RDS.

Few research suggested that prone position may improve oxygenation and reduce stress among premature babies, hence it enhances recovery. Prone is a position with knee flexed under abdomen and the body faced down (Wong, 2009). A study by Abdeyazdan et al in 2010 which compared prone and supine for premature babies with mechanic ventilation, showed a higher oxygen saturation in prone position. Other study which measured breath pattern and lung function in supine, left lateral and prone positions in babies with CPAP demonstrated an equal improvement of oxygen saturation both in left lateral and prone positions (Gouna, et al, 2013). A later research done by Montgomery et al (2014) indicated that quarter turn from prone position has a similar effectiveness with prone in improving respiration and oxygenation. However quarter turn from prone position is more comfortable for babies as pillow is placed to support the body.

A preliminary study regarding RDS was taken in Prof. Dr. Margono Soekarjo Hospital. It was found that nasal CPAP was the most frequent intervention for RDS, whereas mechanic ventilator was strictly used in condition when patients did not show improvement with nasal CPAP. At the moment, RDS intervention was not supported with the position which improves oxygenation. The common used position was supine with a light head extension while nesting on a soft pad. Desaturation period also appeared frequently along with chest wall retraction. Based on this preliminary study, it was necessary to investigate the effectiveness of quarter turn from prone position in improving oxygen saturation among premature babies with RDS.

This study was aimed to identify the effectiveness of quarter turn from prone position in improving oxygen saturation among premature babies with respiratory distress syndrome.

METHOD

This study used pre experiment with one group pre and posttest design. Samples were chosen with consecutive sampling. Inclusion criteria are including premature babies with 28-36 gestation weeks, 800-2400 grams birth weight, suffered from mild and moderate RDS, being placed in incubator with body

Table 1. Oxygen saturation before and after intervention (n=20)

Variabel	Mean	Median	Modus	SD	Min-max	95% CI
Oxygen saturation (before intervention)	93,25	94	95	2,17	89-96	92,23-94,27
Oxygen saturation (after intervention)	96,55	96,5	95	1,32	95-99	95,93-97,17

Table 2. Wilcoxon test results before and after intervention (n=20)

Variabel	Median (minimum-maximum)	Mean ± SD	P *value*
Oxygen saturation (before intervention)	94 (89-96)	93,25±2,17	0.000
Oxygen saturation (after intervention)	96,5 (95-99)	96,55±1,32	

temperature of 36.5 – 37.5 ^{o}C, and received oxygen therapy using nasal CPAP with 25-40% fiO2. Whereas exclusion criteria are premature babies with cardiorespiration disorder, fluctuative haemodynamic, and anaemia.

Initially, an informed consent was given to parents. With parents' approval, babies were then screened to determine their capability to be included in this study such as body temperature, fiO2, and the absence of disorders as mentioned in exclusion criteria. As many as 20 respondents were selected. Oxygen saturation was measured prior to the intervention of quarter turn from prone position. A soft pillow was placed under stomach to keep the body remain in this position. The babies were maintained in this position for 2 hours before oxygen saturation was measured once again. All these before and after measurements were well recorded. This research was approved by Margono Soekarjo Hospital ethical clearance team (Numb 420/29772/XII/2016).

RESULTS

The demographic data showed as many as 65% respondents are male, and 80% of all respondents suffered from moderate RDS. Mean gestation week was 33.1 with standart deviation (SD) was 2.125. The birth weight mean was 1836 grams (SD = 368.45). The body temperature ranged from 36.5^{o}C to 36.9^{o}C, with median was 36.6^{o}C. FiO2 CPAP varied between 30-40% with median was 40%. The percentage changes of oxygen saturation on before and after intervention presented in table 1.

Table 2 shows statistical results of oxygen saturation before and after intervention with median score after intervention was 2.5 higher. P value was less than 0.05 which means there was a significant difference of oxygen saturation measured before and after intervention of a 2 hours quarter turn from prone position.

DISCUSSION

The results showed a higher number of male among respondents, and this corresponds with the research done by Suardana (2013) which revealed that male newborn were more likely to suffer from RDS. The difference of phospholipid in amnion indicated that lungs biochemistry maturity in female started one week earlier than that in male.

In this research, most respondents (80%) suffered from moderate RDS. Those in severe RDS were excluded as

patients in this level were frequently experiencing unstable haemodynamic, more often having apnea periodic, and having a higher risk of intraventicular bleeding (Ramanathan 2009).

Mean of gestation week was 33.1. Gestation week related to the maturity of body organs especially lungs. Surfactant plays important roles in assisting lungs to inflate and deflate, maintaining alveoli size, preventing lungs from injury and infection (Halliday, 2008). Surfactant deficiency results in the occurrence of RDS. Consequently, a severe RDS may cause a worse respiration and a lower oxygen saturation.

Birth weight's mean was 1836.25 gram. Their weight was in category of very low brith weight (1000-1500 gram) and low birth weight (1500-2500 gram). A small baby has a very thin subcutaneous fat therefore they are prone to experience hypothermia and have a higher need of oxygen as metabolism is increased to produce heat (Wong 2009). Hypothermia will then increase risk of respiratory distress which affects the baby's oxygenation.

In this research, respondents' body temperature ranged from 36.5 ^{o}C to 36.9 ^{o}C. The tempereature which tend to be hypothermia is caused by a less heat production and a high heat loss. A less heat production also may caused by imperfect circulation, weak respiration, and lower nutrition intake. Heat loss is a result of a higher body surface and less subcutaneous fat. With hypothermia, babies may also develop acidosis, hypoglycemia, and respiratory distress (Lissauer & Fanaroff 2009). On the contrary, hyperthermia results in an increasing body metabolism which enhances oxygen needs thus hemoglobin releases more oxygen into tissue (Guyton & Hall 2006).

FiO2 CPAP in this research ranged from 30% to 40%, with median was 40%. FiO2 is the amount of oxygen transferred by CPAP to patients, which concentration varies between 21%-100%. Oxygen therapy in neonates should be observed thoroughly and carefully since toxic effects may occur. These effects are including retina disturbance or *retinopathy of prematurity* (ROP), Chronic Lung Disease (CLD) when FiO2 reaches 60%, and periventricular leukomalacia when PaCO2 is low (Lissauer & Fanaroff, 2009). The amount of FiO2 which enter the lungs indirectly increase lung diffusion capacity and oxygen partial pressure (PO2). Consequently, more oxygen are binded with hemoglobin to be transported all over the tissue and this increases oxygen saturation (Hudak & Gallo 2010). In Perinatology ward Prof. Dr. Margono Soekarjo Hospital, FiO2 are maintained in the maximum of 50%. This maximum percentage was sustained below 60% since CPAP is considered as fail when FiO2 is equal to or more than 60% (Lisssauer & Fanaroff, 2009).

Oxygen saturation percentage in premature babies with RDS before the intervention of *quarter turn from prone* was 89-96% with median was 94%. There were 2 respondents with 89% oxygen saturation. The first respondent was born in 35 gestation week with birth weight was 1900 gram, and had moderate RDS. Another respondent was born in 36 gestation week with birth weight was 1600 gram, and had moderate RDS. One of these two was in criteria of small for gestation week as his birth weight fell in percentile 10 (Lubchenco scale) which is small compare to the gestation week. This indicated a disturbance in fetus growth.

According to Lissauaer & Fanaroff (2009) and Suardana (2013), conditions such as longterm maternal stress, hypertension, and disturbance fetus growth enhance lungs maturity through mechanism which involves glucocorticoid and cathecolamin. Glucocorticoid prohibits alveolarisation during gestation week 32-36 which then reduces mesenchyme and makes lungs look more mature. However, when it reaches aterm week, lungs have a lower gas volume which causes respiratory problems after birth and affects its oxygenation.

The oxygen saturation after the intervention of quarter turn from prone was ranged from 95% to 99%, with median was 96.5%. Based on data analysis, it was found that p value was 0.000 which means that a two hours quarter turn from prone position significantly improves oxygen saturation. Quarter turn from prone position physiologically decreases respiratory problems in premature babies such as unequal pleura pressure, alveolar inflation, and unsynchronized thoracoabdominal movement. Therefore it increases lungs volume and contrarily inhibits atelectasis. Another study proved that this position enhances airway clearance (Montgomery *et al*, 2014). According to Baron *et al* in Kusumaningrum (2009) quarter turn from prone position gives more space for dorsal, which is a non dependent area, thus increases ventilation and lungs compliance. At the same time more blood flow through hydrostatic pressure to ventral which improves oxygenation to this area. Pelosi *et al* (2002) suggested that in supine position, heart is anatomically pressed lungs fraction. While in quarter turn from prone only a little was affected. This significant effect was similar with a study conducted by Abdeyazdan *et al*, (2010) which found that oxygen saturation in premature babies who received prone position for two hours demonstrated a 98.3% oxygen saturation in average.

Theoretically, quarter turn from prone and prone position have similar physiologic process. A study regarding prone benefits was also conducted by Kassim *et al*, (2007) which involved premature babies of 32-34 gestation weeks. The results showed a mean difference of 1.02% which demonstrated a higher oxygen saturation in prone than that in supine. This position improved a synchronic movement of chest cavity and abdomen which increase functional residual capacity (FRC) that prevents alveolar collapse. Similar results were shown in Saiki et al (2009) research which looked at premature babies with bronchopulmonary dysplasia (BPD), with gestation week varied between 25 and 32. In their research, oxygen saturation and FRC were higher in prone group with mean difference was 2.1%. Another study by Eghbalian (2014) proved that oxygen saturation was higher in prone compare to that in supine with mean difference was 1.3%.

Limitations of this study includes the lack of control group as a comparison and vital signs that were not measured as supporting data. Therefore, recommendation for further study would be an involvement of control group and vital signs data which obtained from routine measurement.

CONCLUSION

RDS has become one of main causes of death among premature babies in perinatology ward. In order to prevent its severity, intervention of a 2 hours quarter turn from prone was investigated in

babies with mild and moderate RDS. The results showed a significant difference of oxygen saturation before and after the intervention with p value was less than 0.05. An increase in lungs expansion and the improvement of lungs function were assumed to be the cause of a higher oxygen saturation.

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