The Effect of Prone Position on Fio2 Level in Premature Baby Who Received Ventilator

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ABSTRACT

Introduction	Literature study about the position of infant who has respiratory problem indicates that Prone Position (PP) is more beneficial compared to Supine Position (SP). One of monitoring action done by nurse while baby is receiving mechanical ventilator is baby's need monitoring of concentration of inspired oxygen (FiO2). The purpose of this study is to identify the effect of Prone Position to oxygenation status (FiO2) of baby who received mechanical ventilation at NICU RSUPN dr. Cipto Mangunkusumo.
Methodology	The research design is pre experimental one group pretest-posttest. Sample of this research is 18 babies. FiO2 level in this research was measured before PP, 30 minutes after PP, 1 hour after PP, and 2 hours after PP.
Results	Sample of this research is 18 babies by characteristics; age of 44,78±25,06 days; boys 61%; girls 39%; birth weight: 2008,33±977,84; mode of ventilator: pressure support; used synchronized intermittent mandatory ventilation and assist control; and length of use ventilator: 36,67±19,57 days. Babies' birth weight who received mechanical ventilation and PP is 2008,33 grams on average and the standard deviation is 977,84 grams.
Conclusions and recomendation	There are no significance difference between birth weight and FiO2. The result shows that there are no significance differences of Fi02 in babies who received mechanical ventilation before and after receiving prone position. There is a significant difference in measurement before and 2 hours after PP. Moreover, there is a tendency that the more of baby's weight, the lower of the FiO2. From that research, the recommendation of nursing implication is to improving PP intervention to babies who are in stable condition and weaning process. It is needed to conduct an advanced research with a big amount of sample, conducted by quasi experiment or true experiment method with custody variable controlling. It is also needed more analyzes for the correct PP time.
Keywords	prone position – baby - FiO2 - ventilator

BACKGROUND

One of observation done by nurse in using of mechanical ventilation is the need of inspired oxygen..Fraction of Inspired oxygen (Fi02) is the total of oxygen given by ventilator to the patient (Taryono, 2009).The giving of oxygen concentration is adjusted to patients' needs by accurate and rigorous procedures. The longer of a high concentration will cause oxygen toxicity and the lack of concentration will not significantly fulfill the client's oxygenation.FiO2 levels can be lowered slowly or done weaning gradually bending on the level of pulse oxymetry and value of astrup if the patient has been stable.

Literatures show the benefit of Prone Position (PP) compared to the Supine Position (SP).Nurses in RSUPN (Rumah Sakit mum Pusat Nasional) dr Cipto Mangunkusumo (CM) have positioned babies and neonates in the NICU (Neonatal Intensive Care Unit) and SCN (Special Care Nursery) rooms by applying PP for increasing the oxygenation status; however the impact of this PP intervention has not been well documented even in nursing record or observation sheet.Moreover, the influence of PP on FiO2 level was not known yet.

Therefore, researcher was interested to know, "How is the influence of prone position to FiO2 level of babie's who received ventilator?"The aim of this study is to know the influence of aplying prone position to F1O2 level of babies who received mechanical ventilation in NICU RSUPN CM rooms.

MATERIALS AND METHOD

The research design used in this study is pre experimental one group pretest-postest. Samples were obtained from the population of babies treated mechanical ventilation in the NICU RSUPN Dr. Cipto Mangunkusumo. Inclusive characteristics of the samples in this study are:

(1) babies who were given mechanical ventilation by Pressure Support, SIMV, and Asist controlled mode.

(2) babies who had not PP contraindication determined by researcher and assistant researcher based on the guide.

And the exclusive criteria in this research are:

(1) babies who showed worsening of oxygenation status and health; and

(2) babies who were often given invasive/ non-invasive procedure.

This research had passed the ethicts test from Faculty of Nursing, University of Indonesia on April 17, 2009.

Data collection was done by using FiO2 level assessment instrument sheets. This assessment instrument sheets include characteristics of respondents' data and oxygenation status included FiO2. Bivariate analysis which was used is Friedman test.

RESULT

a. Respondents age, birth weight and length of ventilator

Table 1 Distribution of Respondents by Age, Birth Weight, and Length of Babies Using Ventilator

Variable	*Mean*	*SD*	Min – Max	95% CI
Age	44,78	25,06	4,00 – 79,00	32,32 – 57,24
Birth Weight	2008,33	977,84	750 - 4000	1522,07 – 2494,60
Length of Using Ventilator	36,67	19,57	4,00 – 64,00	27,94 – 47,40

Age

The amount of the respondents in this research is the same with the amount of respondents in Bozynski's research (1998, in Balaguer, Escribano, & Figuls, 2008). However, different with Bozynski's research, the babies' age in this research is more than 14 days (mean: 31 days).

Mendoza, (1991, in Balaguer, Escribano, & Figuls, 2008) conducted research on 26 babies from the initial number of 33 babies (7 babies were excluded from the analysis) in the age of 15-138 days (mean= 28).

Respondents in this research are different with research done by Chang (2002, in Balaguer, Escribano, & Figuls, 2008) who are 28 neonates in the age less than 7 days. Crane (1990, in Balaguer, Escribano, & Figuls, 2008) conducted a research to 14 babies in the age of 20 – 72 hours. Fox (1990, in Balaguer, Escribano, & Figuls, 2008) also conducted a research to 25 neonates in the age of 22 hours – 5 days (55,4 ±32,17). Zhao, et al. (2004) conducted a specific research to 30 neonates in the age of 15,3 ± 8,8 days.

From that research above, the age limited by the lifespan of neonates age (0-28 day) which is different to what the researcher did. This research is also different to studies to children in the age of 5 ±3,6 years (Kornecki, et al. 2001) and children in the age of 2 months – 17 years (Curley, Thompson, & Arnold, 2000).

These studies were conducted in the range of children age so that there are long distances and large standard deviation. That is different with the range of age as what the researcher has done;

neonates to baby (0 – 1 year). Those researches limited the age and a certain range in the studies. It was done because researchers assumed that the age may influences oxygenation status in baby. The aim of that age limiting is to decrease research bias caused by unequal respondents' characteristics.

Birth Weight

The average of birth weight of babies who received ventilator in RSUPN dr. Cipto Mangunkusumo is 2008,33 grams and the standard deviation is 977,84 grams. Data obtained by the researcher is smaller than Hutchison, Ross, and Russel (1979) research; 10 premature babies (birth weight 2217 ± 144 grams) and 13 non premature babies (birth weight 2455 ± 199 grams).

Zhao, et al. (2004) conducted a research to 30 neonates (birth weight 3242 ± 437 grams). Rehan, et al. (2000) obeserved 16 non premature babies (birth weight 3300 ±600 kgs). Antunes, Rugolo, and Crocci (2003) observed the impact of premature babies' positions on mechanical ventilation weaning process to 42 premature babies (21 PP and 21 SP), which the weight less than 2,000 grams. Other studies, as the researcher knows, did not see patients' characteristics based on birth weight and used birth weight criteria as inclusion criteria in that researches.

Table 2 Relation between Babies' Birth Weight to FiO2 of Babies who Received Mechanical Ventilation after PP

Variable	r	P *value*	n
FiO2	-0,216	0,389	18

By Spearman correlation analysis, it is known that the more of baby's weight, the lower of the FiO2 level (r = -0.216). FiO2 derivation indicates that the need of oxygen to be given as a respiratory support for babies reduces, and it is because the babies could spontaneously breathe and independently take the oxygen. This is appropriate to what is stated by Kattwinkel (2004, in the Chair, 2004) that baby with low birth weight will have a high risk of respiratory problem. It is because baby with low birth weight has also different anatomy structure and physiology i.e. thin skin, more permeable, and the ratio of skin surface wide to body mass is very far. Fat tissue under the thin skin will make baby loses heat easily so that the need of metabolism will be high. Metabolism must be supported by adequate oxygen supply whereas baby with low birth weight tends to have less surfactant in the lungs which causes a problem during ventilation giving.

Length of Using Ventilator

The average length of using ventilator for babies in RSUPN dr. Cipto Mangunkusumo is 36,67 days and standard deviation 19,57 days. It is possible because patients hospitalized in NICU have serious respiratory problems so that they use ventilator for long time and will do weaning process (included FiO2 derivation process) which are done gradually for long time.

b. Ventilator mode and Fraction of inspired Oxygen (FiO2)

Ventilator Mode

Restrictions in inclusive criteria related to ventilator mode differ in each research; depend on the aim of research which will be conducted. Researcher used ventilator mode as inclusive criteria because researcher would notice patients signs and clinical symptoms during the research and ensure that babies do not get oxygenation problem while the researcher is doing treatment and measuring FiO2.

FiO2 as a measured parameter closely related to ventilator mode. AC mode, SIMV with or without pressure support are determined because in these mode patients can do respiratory spontaneously besides respiratory given by ventilator so that signs of clinical symptoms like the increasing or decreasing of respiratory rate, sianosis, and apnea could be well monitored.

Table 3 Respondents Distribution based on Ventilator Mode

Ventilator Mode	Group (n=18)		Total	
	n	%	n	%
- *Pressure Support*	7,00	38,90		
- *SIMV*	5,00	27,80	18,00	100
- *Asist Control*	6,00	33.30		

Fraction of inspired Oxygen (FiO2)

The same research result is shown by Antunes, Rugolo, and Crocci (2003) in their research which FiO2 was measured in two groups which are PP and SP for 3 hours with every hour observation. The median of 1 hour after PP measurement is 31% (28 – 35%, 95% CI, P value = 0,159), 2 hours after PP is 31% (29 – 37%, 95% CI, P Value = 0,48), and after 3 hours is 31% (P Value = 0,54).

From literature studies done by the researcher, there are no different research results compared to this research. However, Relvas, et al. (2003) and Curley, Thompson, and Arnold (2000) found that P/F (PaO2/FiO2) ratio shows the significant difference between PP and SP.

P/F ratio shows the result which is directly proportional to the decrease of FiO2 as the indication of oxygenation status betterment. Therefore, the increasing of P/F ratio is the decreasing of FiO2. The increasing of P/F ratio PP (177 mm Hg) is higher than before PP (90 mmHg) in PP measurement for 8 ± 2 hours and increases again (200 mm Hg) after PP for 21 ± 4 hours (Relvas, et al. 2003).

Table 4 Fraction of inspired Oxygen (FiO2) level

Variable	*Mean*	SD	Min - Max	95% CI
FiO2				
- Before PP	32,67	11,48	21,00 – 60,00	26,96 – 38,37
- 30 minutes After PP	32,61	11,87	21,00 – 60,00	26,71 – 38,52
- 1 hour after PP	32,89	13,15	21,00 – 63,00	26,35 – 39,43
- 2 hours after PP	35,78	20,15	21,00–100,00	25,76 – 45,80

Table 5 The Differences of FiO2 level in Babies who received Mechanical Ventilation After PP

Variable	Measurements	Mean	SD	95% CI	P Value
FiO2	- Pre PP	32,67	11,48	26,96 – 38,37	0,674
	- 30 minutes PP	32,61	11,87	26,71 – 38,52	
	- 1 hour PP	32,89	13,15	26,35 – 39,43	
	- 2 hours PP	35,78	20,15	25,76 – 45,80	

From the table above it is known that there are no significance differences of FiO2 level before and after PP (P = 0,0674).

Other study shown there are significance differences in P/F ratio (P value = 0,006) in four times measurement which are before PP, 1 hour PP, 19 hours PP and back to SP in 21 hours. P/F ratio increases (P value – 0,04) in SP from 143 ± 10 mmHg to 173 ± 14 mm Hg after 1 hour PP, then increases again (P Value = 0,005) to 194 ± 15 mmHg after 19 hours measurement (Curley, Thompson, & Arnold, 2000).

Patients, who are hospitalized in NICU, on the average use ventilator and have to do weaning process from ventilator (included in decreasing FiO2) gradually for a long time.

This is appropriate with research result that on the average, length of ventilator using to babies in RSUPN dr. Cipto Mangunkusmo is 36, 67 days (median: 40,50 days, standard deviation 19,57 days).

CONCLUSION AND RECOMMENDATION

Conclusion

1. There are no significance differences of FiO2 in babies who received mechanical ventilation before and after aplying prone position for 30 minutes, 1 hour, and 2 hours measurement.
2. There is a significant difference in measurement before and 2 hours after PP.
3. Babies' birth weight who received mechanical ventilation and PP is 2008,33 grams on average and the standard deviation is 977,84 grams.
4. There are nosignificance difference between birth weight and FiO2.
5. The futhrer analyse shows that the more of baby's weight, the lower of the FiO2.

Recommendation

1. From that research, the recommendation of nursing implication is to improving PP intervention to babies who are in stable condition and weaning process.
2. The increasing of respiration frecuency in 30 minutes and first hour must be noticed because that increasing may happens.
3. It is needed more investigation about PP implementation for a long time in babies/neonates who received mechanical ventilation.

4. It is also needed to conduct an advanced research with a big amount of sample and compare it to control group and another variable controlling.

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