Blow pinwheels improve oxygen saturation of preschool children with post pneumonia in outpatient pediatric departement

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Abstract

This study aimed to recognize the Pursed Lips Breathing (PLB) modification effect by blowing pinwheel to the oxygen saturation of preschool children with post pneumonia. Also, to analyze the oxygen saturation value of the preschool children with pneumonia on the intervention group and the control group and to recognize the differences. This study design was quasi experimental pre-posttest with control group design. The participants were 30 preschool children with post pneumonia (15 children were in the intervention group, 15 were in the control group) and were chosen by consecutive sampling. This study showed significant differences on oxygen saturation between the intervention group and control group ($p=0.018<0.05$). Blowing pinwheel affected the oxygen saturation of the preschool age with pneumonia on the intervention group but none on the control group. The results of this study can be used as the basis and reference for the hospital in making policies, as founded that blowing pinwheel affected the oxygen saturation escalation of the preschool children with pneumonia after several exercises. This activity was recommended to be implemented at the hospital as the treatment for the outpatient children with pneumonia and to be carried on at home for the preschool children who were able to perform independently. The recommendation for the further study was to use a true experiment with a larger sample and was not limited to PLB but also to measure the ability to blow.

Introduction

According to the World Health Organization, pneumonia contributed 15% of infant mortality in world wide. The WHO stated that in global estimation there were 10 million children's deaths every year in the world and about 99% deaths were in the develop countries.[1] In 2017, from the WHO, there were 808,694 children's deaths because of pneumonia.

Ibraheem *et al.* (2015) declared that India, Nigeria, Indonesia, Pakistan and China contributed to more than 54% of the global pneumonia cases with 32% of it was from India.[2] Many parties had done a lot of efforts to decrease world's infant mortality. The WHO and The Nation Children's Fund (UNICEF) had tried the prevention through vaccines, antibiotics and oxygenation treatments, also had ensured the children with pneumonia to have an access to a proper treatment both from the society based health worker and the health facility for the severe case. This effort was to handle the pneumonia which was also one of the Millenium Development Goals (MDGs)'s target to decrease the world's infant mortality rate to two third from 1990 to 2015. The global infant mortality decreased about 56% from 93 deaths per 1000

live birth in 1990 to 39 deaths per 1000 live birth in 2017. Even though there was a derivation, it had not reached the target yet. So the efforts were continued to decrease the infant mortality and the numbers of pneumonia case on children.[2]

Children with pneumonia had an edema in their lung alveolar which created or gave space to pneumonia causative organism to reproduce. The following process was the pulmonary inflammation which involved lung tissue and pleura so that the lung capacity's drop, the bronchial muscle narrowed and increased the mucus production.[3]

This condition escalated the breathing path resistance and decreased the volume of children's breathing expiration. If it took long, it might raise hypoxemia one of the complications of pneumonia on children that cause death. Hypoxemia could be prevented by monitoring and evaluation children's saturation oxygen. But to maximize the saturation rate, the children could be given a breathing exercise modified through PLB. The breathing exercise was intended to train children's lung to do a diaphragmatic breathing. By doing the exercise, it was expected to increase the lung residue capacity while expiration after maximum inspiration.[4]

There was several Pursed Lips Breathing (PLB) modification study held in hospital on children with pneumonia. Lestari, Wanda, and Nurhaeni's (2019) study about PB modification explained the PLB or PLB modification, was the technique to pursed lips then inhale through the nose and exhale the air through modified mouth using the media or straw and bottle also party whistle.[5]

The research explained there was a lot of PLB modification to support the breathing exercise for children. There were such as blowing balloons, blowing bubbles, blowing party trumpet or tongue trumpet and blowing pinwheel or paper mill, all of them were using the PLB technique. The PLB technique was used to activate the lung, to increase the alveolar pressure on each lung lobos so it might rise the air circulation during expiration which might support the gas exchange improvement on tissue. But the PLB modification was adjusted to the children's capacity.[6]

This study was held at the pediatric department on outpatient with pneumonia because of the COVID-19 pandemic. Most of the parents did not want their children to hospitalize at this time. The outpatient children who came to do their control for the pneumonia need to perform breathing exercise though the PLB modification to maintain their oxygenation status. It was important to observe the oxygen saturation of the children with post pneumonia to prevent a relapse and to help the recovery or to maintain the optimum respiratory status.

Materials and Methods

This study used quasi experiment design with pre and post and control group design approach.[7] The subject on this study was 2 groups, 1st group was the PLB blowing pinwheel, 2nd group was the control group (gaining routine intervention at the department of pediatric). The sample in this study was the preschool children with pneumonia who came to the Department of Pediatric of RSUD Kota Bekasi to do their check up. The inclusion criteria were: i) Children who came to do the check up or the outpatient with pneumonia at preschool age 3-6 years old to pediatric department, ii) Children with no fever above 37,5^{0}C, iii) Children who agreed and with their parental consent to participate as a participant. The exclusion criteria in this study were i) Children with pneumonia with others illness complication such as muscle weakness abnormality, bone fracture, blood disorder and other comorbid infection, ii) Children with harelip, iii) Uncooperative children. This study has received approval from the FIK UI ethics commission and The Ethic Committee of the district hospital review board, RSUD Kota Bekasi.

The consecutive sampling technique chose the study's subject who had inclusive criteria until the sample required was satisfied. There were 30 participants, consist of 15 participants of the intervention group and 15 participants of the control group. The study was held from March to September 2020 during the COVID-19 pandemic. The minimum participants in this study was based on the previous study by using the unpaired numeric comparative analytic formula with numeric variables which observed the formula of combined variant score and estimated about 20% the potential transition level so that the minimum sample for each group was 15 people.

The data collection tools were oximetry digital to measure oxygen saturation. The terra process ensured the tool's latest time use. The measurement was done twice both on the intervention group and the control group. It was before and after the intervention also before and after the intervention period on the control group.

Blowing pinwheel was performed by the control group with the pursed lips breathing technique 10 times in less than 2 minutes for a cycle and each child will perform 3 cycles in less than 5 minutes. The oxygen saturation measurement was executed before blowing pinwheel and soon after the three blowing cycles done. The blowing strength was not evaluated. But while blowing, the 1:2 ratio between the inspiration and the expiration was observed.[4] It was expected that the children blew the pinwheel properly according to the pursed lips breathing technique that was taught in advance.

Statistical analysis was performed using IBM SPSS IBM statistic for Windows Version 22.0 (IBM, Inc., USA). The descriptive statistic was used to calculate the maximum, minimum, percentage, mean and deviation standard. Inferential statistics, including independent and dependent sample t tests, chi-square test, variant analysis and Pearson correlation coefficients, were used for statistical analysis.[8]

Results

The age and gender were done Chi-square test. From the homogeneity test was obtained P value=0.364> (0.05), it might explained that the samples of two groups was from the same population. The homogeneity test was held on dependent variables with T Independent test and was obtained P value >0.05. It means the data were homogeny (Table 1).

The characteristic of the participant's mean age in this study was 4 years old. There were more female participants than males with the mean value age of the preschool children with pneumonia was 4.82 years old with deviation standard 0.98. On the control group the mean age was 4.99 years old with the deviation standard 0.85, while the intervention group was 4.65 years old with the deviation standard 1.11 (Table 2).

The mean value of oxygen saturation before the therapeutic intervention, the PLB modification blowing pinwheel, was 92.93 and deviation standard was 3.55. The lowest oxygen saturation was 86 and the highest was 99. After the intervention, the oxygen saturation mean was 96.27 and deviation standard was 2.71. The lowest oxygen saturation was 91 and the highest was 99. On the control group, the oxygen saturation mean before the intervention was 93.93 and the deviation standard was 1.34. The lowest oxygen saturation was 92 and the highest was 96. The oxygen saturation mean after the intervention was 94.40 and the deviation standard was 0.99. The lowest oxygen saturation was 92 and the highest was 96 (Table 3).

Independent t-test result explained that on the pretest, the oxygen saturation between the intervention and control groups was P=0.512>0.05 and T count 1.020>T table (2.048). So it could be interpreted that on the pretest there was not any oxygen saturation differences between the intervention and control groups (Table 4).

Independent t-test result explained that on the posttest, the oxygen saturation between the intervention and control groups was P=0.018<0.05and T count 2.506>T table (2.048). So it could be interpreted that on a posttest there was an oxygen saturation difference between the intervention and control groups (Table 5).

There was an escalation about 3.333 of the oxygen saturation before and after intervention. The further analysis result with T Dependent test was P =0.002< 0.05 and T count 3.876>T table (2.145), which explained that there was a significant difference of the saturation oxygen on the pretest and posttest of the intervention group. This was indicated that the PLB modification blowing pinwheel had some effects to the oxygen saturation value of the preschool children with pneumonia.

On the control group, there was an oxygen saturation escalation about 0.467 before and after the measurement. The further analysis result with T Dependent test was P=0.068>0.05 and T count 1.974<T table (2.145), which explained that there was not any difference between the pretest and the posttest of the control group (Table 6).

Discussions

This study was performed previously but with a different Pursed Lips Breathing (PLB) and media. This study was held in the pediatric department, which normally held in the pediatric ward. The age analysis result with oxygen saturation showed P value 0.346>0.05, which explained that there wasn't any significant relation between age and posttest oxygen saturation.

According to the analysis result, most of the gender was female which was 10 (66.7%), where the males and the females proportion on the control and the intervention groups was equal, 50%. From the homogeneity test gained P value=0.289 > (0.05) so it was explained that there was not any characteristic difference based on gender.

The study showed that there was about 3.333 oxygen saturation increase. The further analysis result was P value =0.002<0.05, it explained that there was a significant different between the pretest and the posttest on the intervention group. This showed the effect of the PLB modification blowing pinwheel to oxygen saturation value of the preschool children with pneumonia.

The inpatient children with pneumonia tend to have a respiratory disorder during their treatment. Besides the medical drugs, it was necessary to support the children to do breathing exercises to maximize their lung's capacity to inspire and expire as the oxygen need. If it lasted long, it might become hypoxemia which was one

Table 1. Equality analysis of confounding variables Juni-Agustus 2020 (n=30).

Characteristics	Group		P Value
	Control (%)	Intervention (%)	
Age (Year)	4.99 ± 0.85	4.65 ± 1.11	0.364
Sex			
Male	5 (33.3)	5 (33.3)	1.000
Female	10 (66.7)	10 (66.7)	
Oxygen saturation (Pre)	93.93 ± 1.34	92.93 ± 3.55	0.512

Table 2. The characteristic of preschool children with pneumonia, Juni-Agustus 2020 (n=30).

Characterictic	Groups				
	Control		Intervention		
	n	%	N	%	n
Gender					
Male	5	33.3	5	33.3	10
Female	10	66.67	10	66.67	20
Total (%)	15	100	15	100	30
	Mean± SD Dev		Mean± SD Dev		Mean± SD Dev
Age (Year)	4.99 ± 0.85		4.65 ± 1.11		4.82 ± 0.98

Table 3. The pretest and posttest description of the oxygen saturation on preschool children with pneumonia on the intervention and the control group (n=30).

Groups	Mean	Deviation Standard	Minimum-Maximum
Intervention			
Pretest	92.93	3.55	86-99
Posttest	96.27	2.71	91-99
Control			
Pretest	93.93	1.34	92-96
Posttest	94.40	0.99	92-96

of the pneumonia complications on children that caused death. Hypoxemia can be prevented by monitoring and evaluating children's oxygen saturation. But to maximize the saturation value, the children might be given the modified breathing exercise through the therapeutic games. The given breathing exercise was to train the children's lung to do the diaphragmatic breathing, it was expected that the exercise could increase the lung capacity residue while doing expiration after a maximum inspiration.[9]

In Swanson's caring theory, the nurse role in the implementation of the PLB blowing pinwheel was described in enabling dimension (giving alternatives). The nurse facilitated the child patient with pneumonia by empowering the preschool age capacity, joining the child's need to play and observing his oxygenation. The alternative game made by the nurse was realized in the PLB technique blowing pinwheel. The nurse capacity to think and to analyze through the problems of the preschool children with pneumonia that was the need to play and to optimize the oxygenation with its saturation value had result a problem solving alternative with the PLB blowing pinwheel.[10] This was show in this study where there was an effect of the PLB blowing pinwheel to the oxygen saturation value of the preschool children with pneumonia.

The treatment focus of the hospitalized children was usually directed only to the escalation of the illness clinical symptoms and neglected the children psychological condition by not paying attention to the children's other need which was to play. Without any therapeutic intervention to the hospitalized preschool children, it will raise the fear of the medical examination, the uncertainty, and the pain from the medical intervention. This condition intimidated the children and triggered a psychological burden then affected an exaggerated negative emotional respond which was the anxiety. This condition created self-confidence issues and children mental health that contributed to their physiology and affected their illness condition.[11] This study presented the focus of the PLB blowing pinwheel to the oxygen saturation of the preschool children with pneumonia. But what was recent in this study beside the simple and cheap handmade toys, was the room setting where the study held.

If all the previous study was held in the pediatric ward and was done for several days, this study was held in outpatient departement or pediatric departemen in one day or one time implementation. The result of this study was also possible to implemente in the outpatient departement as a rehabilitation focus for children with post pneumonia who came to do the control. The children will be happy and enjoy to find a pinwheel then they will become cooperative and it will also help to train children's breathing through the PLB technique in order to increase the children's oxygen saturation. Next, it could be done at home independently with the parents.

Conclusions

The PLB modification blowing pinwheel toy is effective to increase the oxygen saturation value of preschool children with post pneumonia. The result of this research can be input for the hospital to make a policy as nursing Standard Operational Procedure (SOP) for children with pneumonia patient to increase the oxygen saturation especially in pediatric department. The PLB modification blowing pinwheel toy is possible to implemente in the outpatient departement as a rehabilitation focus for children with post pneumonia who came to do the review control or chekup.

Table 4. The oxygen saturation difference on the pretest of preschool children with pneumonia between the intervention and the control groups (n=30).

Measurement	Groups		*T Independent*	
	Control	Intervention	T Count	*P value*
Oxygen Saturation Pretest	93.93	92.93	1.020	0.512

Table 5. The oxygen saturation difference on the posttest of preschool children with pneumonia between intervention and control groups (n=30).

Measurement	Groups		*T Independent*	
	Control	Intervention	T Count	*P value*
Oxygen Saturation Posttest	94.40	96.27	2.506	0.018

Table 6. The oxygen saturation difference on the pretest and posttest of preschool children with pneumonia between the intervention and control groups (n=30).

Oxygen Saturation	Mean	Deviation Standard	Escalation Mean	T Count	P value
Intervention					
Pretest	92.93	3.55	3.333	3.876	0.002
Posttest	96.27	2.71			
Control					
Pretest	93.93	1.34	0.467	1.974	0.068
Posttest	94.40	0.99			

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