Effectiveness of Balloon Therapy on Respiratory Status of 6-12 Years Children with Lower Respiratory Tract Infection at a Tertiary Care Hospital in Bhubaneswar, Odisha

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Abstract

An experimental study was undertaken to assess and compare the respiratory status of children with lower respiratory tract infections in control and experimental group before and after balloon therapy and to determine the factors responsible for the respiratory status in both control and experimental group. Randomised controlled trial design was adopted, 25 patients each in experimental and control group were taken as per inclusion criteria. Then random allocation of sample was done (computer generating random number 0 and 1). Standardised treatment along with balloon therapy was given to the experimental group and only standardised treatment was given to control group. Results showed that in post-test control group average respiration rate was 31.2 (SD= 2) and in experimental group average respiration rate was 29.84 (SD= 2.19) and calculated p value was 0.03 (<0.05). In post-test control group average tidal volume was 198.6 (SD= 46.47) in experimental group average tidal volume was 225 (SD= 44.28) and calculated p value was 0.04 (<0.05). In post-test control group average dyspnea level was 1.36 (SD= 0.49) and experimental group dyspnea level was 1 (SD=0.0) and calculated p value was 0.00 (<0.05). The study concluded effectiveness of balloon therapy on respiratory status of children aged 6-12 years with lower respiratory tract infection.

Respiratory disease is a significant chronic health problem in our society. Chronic respiratory disease is found to be one of the most distressful conditions, badly affecting human life. Children under the age of five face multiple obstacles including birth injuries, infectious diseases, malnutrition, home environments that lack intellectual stimulation, and environments with polluted water and air. In developing countries, for every 7 seconds a child dies of an acute respiratory infection (ARI), usually pneumonia. Lower respiratory tract infection is responsible for the death of four and a half million children each year, accounting for 30 percent of all deaths in childhood. Hence the researcher gave balloon blowing exercise, which is one of the non-pharmacological methods and easy to perform; children are willing, and enjoy blowing the balloon. It is a simple exercise that creates lung capacity by blowing up a certain amount of balloons each day. Blowing balloons works out the intercostal muscles responsible for spreading and evaluating your diaphragm and ribcage. This allows lungs to absorb oxygen, alter its chemical composition while still in the lungs, and expel carbon dioxide as exhaling is commenced. While effectively exercising the lung's ability to expand and take in air, balloon blowing does not affect the size or number of alveoli contained in the lungs. Alveoli are air sacs that disperse carbon dioxide during exhalation and oxygen into the blood during inhalation. Daily routine of blowing up 10 to 15 balloons steadily increases lung capacity and also amplifies its ability to maintain a sufficient supply of oxygen. After thorough review of literature the investigator conducted a research on balloon therapy among the children with lower respiratory tract infection.

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Objectives

The study sought:

1. To assess and compare the respiratory status of children with lower respiratory tract infections in control and experimental group before and after balloon therapy; and
2. To determine the factors responsible for the respiratory status in both control and experimental group.

Hypothesis

H1: There is a significant difference in post-test score in respiratory status of children in control and experimental groups after balloon therapy.

Conceptual framework

The conceptual framework selected for this study

was based on modified Pender's Health promotion model.

Review of Literature

A study was conducted on effectiveness of balloon blowing on respiratory parameters among children with lower respiratory tract infection in a selected hospital of Kanyakumari district (TN) Quasi-experimental pre-post-test study was conducted among 60 children, 30 in each group experimental and control group between the age group of 3 and 8 years by convenience sampling technique (Fig 1). The estimated paired t value of respiratory distress among children (10.5), which is significant at $p<0.005$, shows balloon blowing exercise was effective in reducing respiratory distress and it was helpful to improve lung function (Sreedevi, 2015).

Methodology

Ours was a randomised controlled trial conducted in Pediatric medicine ward Pradyumna Bala Memorial Hospital, Bhubaneswar to evaluate effectiveness of balloon therapy on respiratory status of 6-12 years of children with lower respiratory tract infection from September 2017 to May 2018. Samples of 50 admitted children, aged 6-12 years were selected as per inclusion criteria. Subjects were allocated into 25 samples in experimental and 25 in control group by computer generating random numbers 0 and 1 based on pre-randomised list prepared with the help of statistician. Ethical approval was obtained from the institutional review board KIMS Ethics committee. Informed consent from parents were obtained after explanation of objectives of present study. Data were collected by using interview for demographic Performa and self structured checklist for assessing the respiratory status with lower respiratory tract infective child the checklist was used to assess the respiratory status by four domains: respiratory rate, saturation rate, tidal volume, dyspnea level. The tidal volume of the child was assessed and compared with normal tidal volume according to age. The tidal volume <200 was considered as inadequate tidal volume. In oxygen saturation level was <95 and respiratory rate was ≤ breaths/ minutes and dyspnea level was >1 considered inadequate respectively. Balloon therapy refers to blowing the balloon by the children for 10 times in an interval of 3 hours (3 times) in a day upto four days in experimental group and control group received as usual routine care. The score of checklist before providing balloon therapy considered as pre-test score. After providing balloon therapy on 5th day in the experimental group post-test score assessed.

Results

The data obtained was analysed by using software STATA 1.5 at 5 percent level of significance. Effectiveness of balloon therapy was assessed by independent variable paired 't' test .

Demographic Characteristics

Table 1 shows that with regard to location, 17 (68%) children in control group were rural, whereas 15 (60%) children in experimental group in rural. Majority 16 (64%) in control group and 15 (60%) in experimental group were male; 22 (88%) in each control and experimental group were Hindu; 16 (64%) in control group and 15 (60%) in experimental group had no case of comorbid illness; 20 (80%) in control group and 18 (72%) in experimental group had history of parental smoking. Majority of children (n=13, 52%) in control group were overcrowding and 17 (68%) in experimental group. Regarding mother's education, majority (n=12, 48%) in control group were primary education and 15 (60%) in experimental group. As for father's education, 13 (52%) were primary education in control group and 10 (40%) in experimental group. Majority (n=16, 68%) children were hospitalised one time in control group and 15 (60%) in experimental group.

Comparison of Respiratory Status between Pre-test and Post-test in Experimental and Control Group (Tables 2-9).

Table 2 shows that in pre-test control group

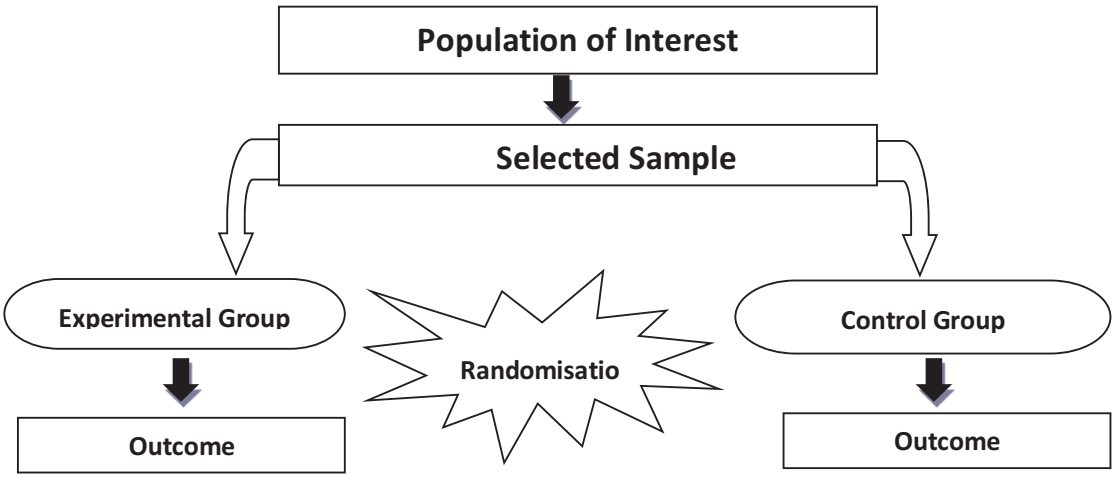

Fig 1: Research design of study.

Table 1: Frequency and percentage distribution of demographic variables of the lower respiratory tract infective child (N= 50, n1= 25, n2=25)

Sl. No.	Characteristic	Control group (n_1)		Experimental group (n_2)	
		Frequency (f)	%	Frequency (f)	%
1	**Location**				
	Rural	17	68	15	60
	Urban	8	32	10	40
2	**Gender**				
	Female	9	36	10	40
	Male	16	64	15	60
3	**Religion**				
	Hindu	22	88	22	88
	Muslim	3	12	3	12
4	**Comorbid illness**				
	Anaemia	6	24	8	32
	Congenital heart disease	1	04	1	04
	Thyroid disease	1	04	0	0
	Seizure disorder	1	04	1	04
	None	16	64	15	60
5	**Parental smoking**				
	Yes	20	80	18	72
	No	5	20	7	28
6	**Over-crowding**				
	Yes	13	52	8	32
	No	12	48	17	68
7	**Mother's education**				
	Illiterate	5	20	0	0
	Primary	12	48	15	60
	Secondary	4	16	6	24
	Higher secondary	3	12	3	12
	Graduate and above	1	04	1	04
8	**Father's education**				
	Primary	13	52	10	40
	Secondary	4	16	5	20
	Higher secondary	1	04	2	08
	Graduate and above	7	28	8	32
9	No. of hospitalisation in last one year	8	32	8	32
	2 times or more	1	04	2	08
	One	16	64	15	60

average respiration rate was 36 (SD=1.15) and experimental group average respiration rate was 36.4 (SD=1.41). The calculated p value was 0.28, which was greater than 0.05; in post-test control group average respiration rate was 31.2 (SD=2) and experimental group average respiration rate was 29.84 (SD = 2.19) and calculated p value was 0.03. The calculated p value was less than tabulated p value. It can be interpreted that there were statistically significant changes in respiration rate due to balloon blowing therapy.

In pre-test control group average saturation was 94.88 (SD=1.45) experimental group average saturation was 94.84 (SD=1.52) and calculated p value 0.93 which was greater than 0.05 (Table 3). In post-test control group average saturation was 98.36 (SD-0.95) and experimental group saturation was 98.72 (SD=0.61) and calculated p value was 0.12, which was greater than 0.05. It can be interpreted that calculated p value was decreasing in post-test than pre-test it was clinically significant but in post-test calculated p value was greater than tabulated p value so it is not statistically significant.

Table 4 shows that in pre-test control group average tidal volume was 180.8 (SD=9.2) and experimental group average tidal volume was 199.8 (SD=8.8) and calculated p value was 0.14, which was greater than tabulated p value. In post-test control group average tidal volume was 198.6 (SD=46.47), experimental group average tidal volume was 225 ± 44.28 (SD=44.28) and calculated p value was 0.04, which was less than 0.05. In post-test calculated p value was less than tabulated p value, so there was statistically significant improvement in tidal volume. It can be concluded that there were significant changes in tidal volume in experimental group due to balloon blowing therapy.

In pre-test control group average dyspnea level was 1.52 (SD=0.50), experimental group average dyspnea level was 1.36 (SD=0.48) and calculated p value was 0.26, which was greater than 0.05; in pre-test control group average dyspnea level was 1.36 (SD=0.49) and experimental group dyspnea level was 1 (SD=0.0) and calculated p value was <0.001, which was less than 0.05 (Table 5). In post-test calculated p value is less than tabulated p value, so there were statistically significant changes in dyspnea level in experimental group. It can be concluded that there were significant changes in level of dyspnea in experimental group due to balloon blowing therapy. Table 6 shows that the mean difference in control group was 4.8 and in experimental group 6.36. The calculated p was 0.005, which was less than tabulated value (p value 0.05). It can be interpreted that there were significant changes in respiration rate due to balloon blowing therapy.

Table 2: Difference between pre-test and post-test respiratory rate in control and experimental group [N=50 (n1- 25, n2- 25)]

Parameter	Control group (n_1)	Experimental group (n_2)	Independent 't' test 'p' value
Pre-test R. R.	36 ±1.15	36.4 ± 1.41	0.28
Post-test R. R.	31.2 ± 2	29.84 ± 2.19	0.03

'p' = 0.05

Table 3: Difference between pre-test and post-test saturation in control and experimental group [N=50 (n1- 25, n2- 25)]

Parameter	Control group (n_1)	Experimental group (n_2)	Independent 't' test 'p' value
Pre-test Sat.	94.88 ± 1.45	94.84 ± 1.57	0.93
Post- Sat.	98.36± 0.95	98.72 ± 0 .61	0.12

'p' = 0.05

Table 4: Difference between pre-test and post-test tidal volume in control and experimental group [N=50 (n_1- 25, n_2- 25)]

Parameter	Control group (n_1)	Experimental group (n_2)	Independent 't' test 'p' value
Pre-test tidal volume	180.8± 9.2	199.8 ± 8.8	0.14
Post-test tidal volume	198.6 ± 46. 47	225 ± 44.28	0.04

'p' = 0.05

Table 7 shows that in control group mean difference was 3.48 and in experimental group mean difference of saturation was 3.88 and calculated p value was 0.4 which was greater than tabulated p value 0.05. So, it can be interpreted that there was no statistically significant changes in saturation due to balloon therapy. Mean difference in control group was 17.8 and in experimental group it was 25.2 and calculated p was <0.001 and 0.05, which was less than 0.05 (Table 8). It can be concluded that there were statistically significant changes in tidal volume in experimental group due to balloon blowing therapy.

Table 9 shows that mean difference of dyspnea level in control group was 0.16 and in experimental group it was 0.36 and calculated p value is 0.002, which was less than 0.05. Hence it can be concluded that there was statistically significant change in level of dyspnea in experimental group due to balloon blowing therapy.

Factors responsible for the respiratory status in both control and experimental group

In comorbid illness the calculated 'p' value was 0.03 which was less than<0.05. So, it can be interpreted that there was significant association with comorbid illness with respiratory rate. In comorbid illness calculated 'p' value was 0.01 which was <0.05. It can be interpreted that there was significant association with comorbid illness with saturation rate. In comorbid illness calculated 'p' value was 0.003, in parental smoking calculated 'p' value was 0.001, and in overcrowding calculated 'p' value was 0.009 which was <0.05. Hence it can be concluded that there was significant association of comorbid illness overcrowding and number of hospitalisation with tidal volume. In comorbid illness calculated 'p' value was 0.01 which was < 0.05. It can be interpreted that it had significant association with location, comorbid illness with dyspnea level.

Discussion

There was statistically significant difference in post-test score in respiratory status of control and experimental groups after balloon therapy. This is supported by a study conducted by Dr Danasu R, Sathiyakala K and Revathi D. They also found that there was improvement in respiratory status of patients with lower respiratory tract disorders after balloon therapy.

Implications

Nursing practice: Nurses as a change agent can introduce various types of forced expiratory techniques to reduce respiratory signs and improve lung function among children with lower respiratory tract infections.

Nursing education: It can be used as informational aid to acquire knowledge regarding effectiveness and technique of balloon therapy of lower respective tract infective child. Nursing students must be encouraged to utilise knowledge of balloon therapy

Table 5: Difference between pre-test and post-test dyspnea level in control and experimental group [N=50 (n_1-25, n_2-25)]

Parameter	Control group (n_1)	Experimental group (n_2)	Independent 't' test 'p' value
Pre-test dyspnea Level	1.52± 0.50	1.36± 0.48	0.26
Post-dyspnea Level	1.36 ± 0.49	1± 0.0	<0.001

'p' = 0.05

Table 6: Mean difference of respiratory rate in control and experimental group [N=50 (n_1-25, n_2-25)]

Parameter	Control group (n_1)	Experimental group (n_2)	Independent 't' test 'p' value
Mean difference of RR.	4.8 ±0.46	6.36 ± 0.59	0.005

Table 7: Mean difference of saturation in control and experimental group [N=50 (n_1-25, n_2-25)]

Parameter	Control group (n_1)	Experimental group (n_2)	Independent 't' test 'p' value
Post sat.	3.48 ± 0.33	3.88 ± 0 .33	0.4

'p' = 0.05

Table 8: Mean difference of tidal volume in control and experimental group [N=50 (n_1-25, n_2-25)]

Parameter	Control group (n_1)	Experimental group (n_2)	Independent 't' test 'p' value
Post-test tidal volume	17.8 ± 1.15	25.2 ± 1.61	<0.001

'p' = 0.05

Table 9: Mean difference of dyspnea level in control and experimental group [N=50 (n_1-25, n_2-25)]

Parameter	Control group (n_1)	Experimental group (n_2)	Independent 't' test 'p' value
Post-dyspnea level	0.16 ± 0.07	0.36 ± 0.09	0.002

'p ' = 0.05

to improve respiratory status to give health education and demonstration in hospital and community.

Nursing administration: Administrators should take initiative action to update the knowledge of nursing personnel regarding forced breathing exercises in improvement of lung function and reducing the signs of respiratory illness by in-service education, workshop and seminars in hospitals

Nursing research: This study can enhance the body of knowledge of profession and also improves quality of care and can be effectively utilised by the emerging researchers for their reference purpose.

Recommendation

The study can be replicated on large sample in different setting to have wider generalisations of the findings. A similar study can be conducted using other strategies like bottle blowing, inventive spirometer.

Conclusion

On the basis of the findings of the study, it is concluded that balloon therapy is a cost-effective method to improve the respiratory status of children 6-12 years of age with lower respiratory tract infection.

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