International Journal of Nursing Research (IJNR)

International Peer Reviewed Journal

Research article

Effect of balloon therapy v/s spirometry in promotion of respiratory function in children with respiratory infection

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Abstract

Respiratory diseases are very common in children, especially the respiratory infection. It's one of the leading causes of morbidity and mortality in young children. In India acute respiratory infection is one of the major causes of childhood death. This study is to assess effect of balloon therapy v/s incentive spirometry in promotion of respiratory function among children with Acute Respiratory Infections (ARI) in NMMC Hospital Vashi. The aim of the study is to explore the effect of balloon therapy and incentive spirometry in promotion of pulmonary function in children with acute respiratory infections and also compare the effect of both interventions. The objectives were to assess the respiratory function, to find out the effect of balloon therapy and incentive spirometry, to find out association between selected demographic variables with balloon therapy and spirometry and to compare the effect of balloon therapy and incentive spirometry among children with ARI. Quasi experimental two group pre-test and post-test design was used. 40 children from the age group of 2- 6 years with ARI were the samples in this study. In both interventions the pulmonary function got improved along with routine treatment. The researchers found balloon therapy seems more effective in reducing respiratory symptoms in children with respiratory problems in comparison with spirometry. As the data supports balloon therapy is more effective than spirometry. During the data collection process the researcher experienced that balloon therapy was more acceptable among children as it is a part of their normal routine play activity and excitement to explore blowing balloons and few children expressed anxiety and fear towards spirometry. So the researcher strongly suggests approaching the hospitalized sick children with acceptable form of innovative therapeutic regimen for their complete participation in their health care.

Keywords: Balloon therapy, Spirometry, Physiological parameters. Respiratory tract infection

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1. Introduction

A child is unique individual; he or she is not a miniature adult, not a little man or women. The childhood period is vital because of socialization process by the transmission of attitude, customs and behaviour through the influence of the family and community. Family's cultural and religious belief, educational level and way of living influence the promotion and maintenance of child health. Children are major consumers of health care. In India about 35 per cent of total population is children below 15 years of age. Good health of these precious members of the society should be ensured as prime importance in all countries. As said by Karl Meninger "What is done to children they will do the society "Children are the wealth of tomorrow. About 13% of inpatient death in paediartic ward is due to acute respiratory infection. Most children have 3 to 5 attacks of acute respiratory infection in each year [4].

Acute respiratory infections (ARIs) are classified as upper respiratory tract infections (URIs) or lower respiratory tract infections (LRIs). The upper respiratory tract consists of the airways from the nostrils to the vocal cords in the larynx, including the paranasal sinuses and the middle ear. The lower respiratory tract covers the continuation of the airways from the trachea and bronchi to the bronchioles and the alveoli. ARIs are not confined to the respiratory tract and have systemic effects because of possible extension of infection or microbial toxins, inflammation, and reduced lung function1.Infection and inflammation of the lungs is particularly troublesome and is seen in many different forms in children. Other illnesses that occur in the lower respiratory tract, such as wheezing associated lower respiratory infections, asthma and pneumonia2.The more oxygen supplied to the body during exercise, the longer a trainer is able to exercise without becoming breathless and fatigued. Oxygen restores energy to cells and muscles by removing carbon dioxide. When plenty of oxygen is able to be processed by lungs, muscles equip themselves with energy reserves that permit trainers to continue a workout session [4].

Blowing balloons exercises the respiratory muscles, a group of muscles interacting to adapt thoracic dimensions to certain breathing stages. Basic respiratory muscles are the diaphragm, the internal intercostal and the external intercostal. Steadily blowing up several balloons, one after another, effectively exercises these muscles, building lung capacity and stamina [7].

A spirometry is a device used for the evaluation of lung function with a spirometer. It is one of the simplest most common pulmonary function test and may be necessary for all following reason including determination how well the lung receive, hold and utilize air, monitor lung diseases, monitor the effectiveness of treatment, determine the severity of lung disease and determine whether the lung disease is restrictive or obstructive [5].

Statement

A study to assess effect of balloon therapy v/s incentive spirometry in promotion of respiratory function among children with Acute Respiratory Infections (ARI) in NMMC Hospital Vashi.

Need of the study

Acute respiratory infections (ARIs) are the leading cause of death among children less than 5 years in India3. The prevalence of Bronchial Asthma has increased continuously since the 1970s, and now affects an estimated 4 to 7% of the people worldwide. Childhood Bronchial Asthma varies widely from country to country. At the age of six to seven years, the prevalence ranges from 4 to 32%. The same range holds good for ages 13 and 14. UK has the highest prevalence of severe Bronchial Asthma in the world. It has also increased the number of preventable hospital emergency visits and admissions. Apart from being the leading cause of hospitalization for children, it is one of the most important chronic conditions causing elementary school absenteeism [10].

Pediatric nursing is the branch of nursing concerned with care of infants and children. It focuses on providing holistic care to infants, children and adolescents. The goal of pediatric nursing is to foster growth and development of the child and promote optimum state of physical, mental and social wellness. The focus of paediartic nursing is shifting to child centered care, special care, health education, comprehensive care, holistic care, health promotion, quality care in terms of play, recreation nutrition etc., warmth, love, and evidence based practice [8].

Data source: medical records department NMMC Hospital, Vashi.

Table 1.1 Censes of NMMC Hospital Vashi Navi Mumbai 2014

SN	Month	No. of admission	Death
1.	January	15	1
2.	February	134	1
3.	March	21	1
4.	April	10	1
5.	May	22	2
6.	June	30	Nil
7.	July	17	1
8.	August	28	2

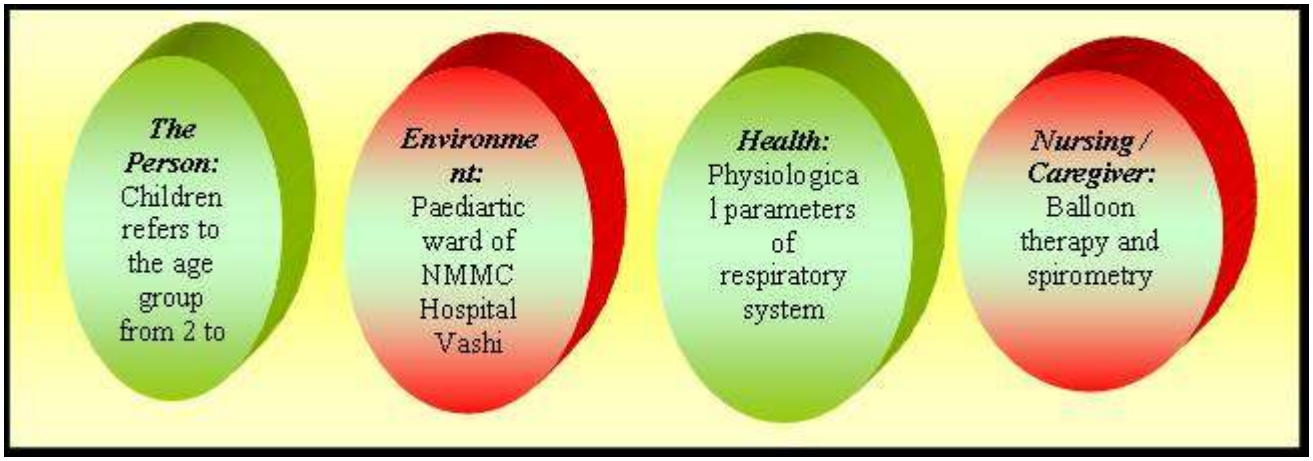
Conceptual / theoretical framework

Callista Roy's Adaptation Model has evoked much interest and respect since its inception in 1964 by Roy. The theory consists of four essential elements. The person who is the recipient of nursing care, the concept of the environment, the concept of health and nursing [9].

Limitations

- This study is limited to NMMC Hospital, Vashi.
- Sample size is only 40.
- Study is limited to children between 2–6 years.

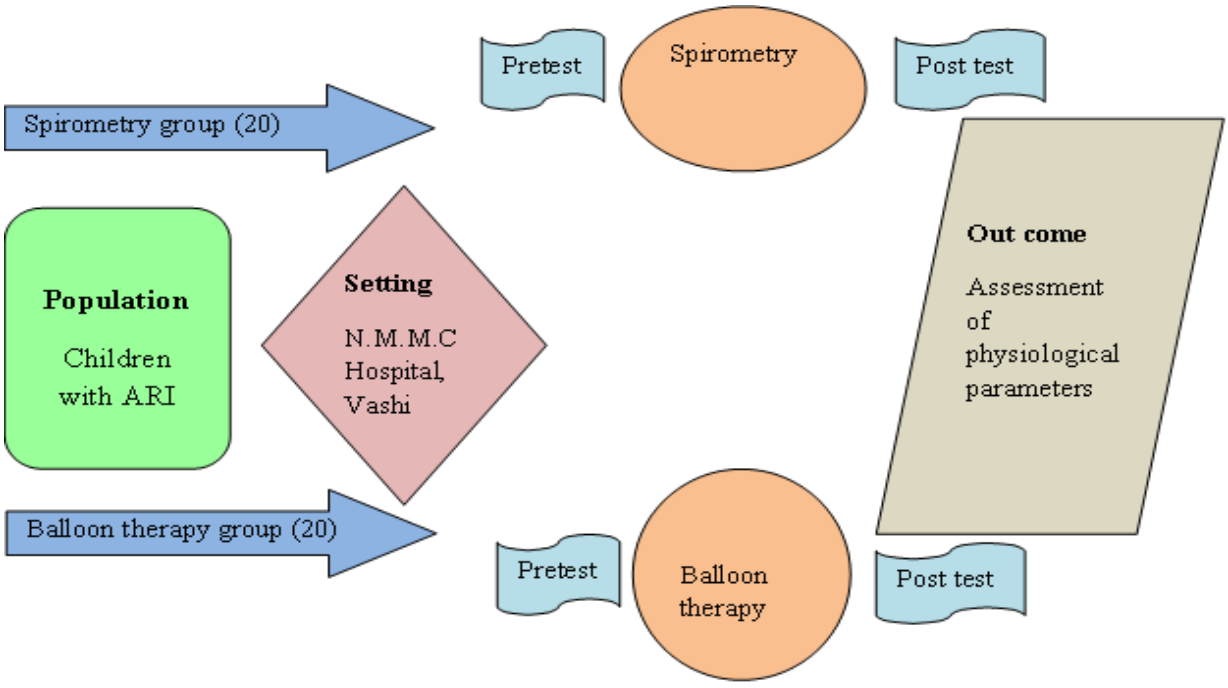
Figure 1.1: Conceptual framework



2. Methodology

The study and research tool is validated by experts from the field of medicine, nursing and others including statistician. The researcher got institutional ethical committee clearance. The research was conducted after obtaining permission from the authority from NMMC Hospital, Vashi. The researchers even obtained consent from the parents of children for the participation in the study. The research design selected for the present study is quasi experimental two group pre-test and post-test design. Spirometry and balloon therapy are independent variables and physiological parameters is dependent variable. Study was conducted at NMMC Hospital Vashi. The population in the present study is the children who are admitted with acute respiratory tract infection at NMMC hospital, Vashi. Samples are the children's from the age group of 2- 6 years with ARI. The sample size of the study consist of 40 (male or female) children from selected setting in which, 20 for balloon therapy and 20 for spirometry of those who are among the age group of 2-6 years. The investigator establishes certain criteria thought to be representative of the target population and deliberately selects subjects according to these criteria. Non-probability purposive sampling technique.

Figure 1.2 Schematic representation of the study



Sampling criteria

The study includes children:

Both male and female children between the age group of 2 to 6 years, who are admitted with acute respiratory tract infection in NMMC Hospital, Vashi, whose parents are permitting to participate their children in the study and children who can able to understand and speak Hindi and Marathi.

The study excludes the children:
Who are critically ill, with any oral surgery, on oxygen inhalation, diagnosed as tuberculosis, malnourished with weight for age and mentally retarded children?

Data collection tools and technique
The tools were prepared on the basis of objectives of the study. The tool consists of the following sections. Section A: It contains demographic profile of children such as age, sex, religion, education, monthly income, residence, weight of the child, birth order of the child, caretaker of the child and type of family. Section B:It contains duration of present hospital stay, times of hospitalized previously, previous history of admission, previous episode of respiratory tract infection and previous use of spirometry balloon therapy. Section C: It consists of selected physiological parameters which include respiratory rate, breath sounds, oxygen saturation, cough, sputum, breathing, nasal congestion**,** air entry, rales**,** rhonchi**,** wheeze and accessory muscle use. Respiratory rate will be measured by observation, breath sounds will be auscultator and oxygen saturation will be measured by pulse oxymeter.

Data analysis

Renuka et al conducted a study to find out effectiveness of balloon therapy on respiratory status of patients with lower respiratory tract disorders. The main aim of the study was to assess the effectiveness of balloon therapy on respiratory status of patients with lower respiratory tract disorders. Pre-experimental design was used for this study. Total 20samples were selected using purposive random sampling technique and balloon therapy was given for two weeks. The data pertaining to respiratory status was collected using structured self-administered questionnaire and respiratory assessment for respiratory rate, dyspnea, and lung capacity were done using incentive spirometry. Among 20 patients, 15(75%) of patients had poor respiratory rate, 5(25%) patients have poor lung capacity, 15(75%) patients had poor dyspnea score before the implementation of balloon therapy whereas after the implementation of balloon therapy, 18(90%) of patients had normal respiratory rate, 12(60%) of patients had normal score in dyspnea scale and all of them (100%) attained normal lung capacity. The result of this study proved that regular practice of balloon therapy can improve the respiratory status to a greater extent among patients with lower respiratory disorders [6].

Distribution of samples according to frequency and percentage of demographic variables

1. Age indicates that 42.5% children belongs to age group 2-4 years, 50.0% belongs to age group 4-6 years and 7.5% belongs to more than 6 years in the experimental groups respectively. The data presented in table 1 indicates that maximum (50.0%) of children in age group 4-6 years are affected with ARI.
2. Sex presents male children about 55.0% and female children 45.0% from both experimental groups respectively.
3. Religion represents 82.5% belongs to Hindu community and 17.5%of Muslim community from the both experimental group respectively and no any samples from Christian and any other community.
4. Residence reveals that 85.0%(urban) and 15.0%(rural) children from both experimental groups respectively.
5. Weight represents that 7.5% up to 10 kg,62.5% from 10-15 kg,25% from 15-20 kg,5% from 20 kg and above children's from both experimental group respectively.
6. Education present that 12.5% are from play group , 22.5% from kindergarten , 52.5% from preprimary , 12.5% from secondary children's from both experimental group respectively.

7. Birth order include that 57.5% children born as first child , 32.5% as second child, and 10% had a birth order more than 2 from both experimental group respectively.
8. Education of parents include that 22.5% parents are uneducated,37.5% are primary educated,40% are secodary educated from both experimental group respectively.
9. Income shows that 2.5% have a family income of RS below 5000, 40% have an income of RS 5001-10000,47.5% have an income of RS 10001-15000,10%have an income of RS 15001 and above from both experimental group respectively.
10. Primary care taker of child shows that 90% children are taking care by their mothers,2.5% children are taking care by their father and 7.5%by their grandparents from both experimental group respectively.
11. Type of family indicates that 82.5%belongs to nuclear family, 17.5% joint family from both experimental groups respectively.
12. Present hospital stay reveals that children's present hospital stay is from 35% less than 2 days, 55% 2-4days, 7.5% 1 week, and 2.5% more than 1 weeks from both experimental group respectively.
13. Previous hospitalization of child represents 42.5% are not admitted in hospital,47.5%are admitted one time, 10% two times from both experimental group respectively.

Association between the selected demographic variables

Demographic Variables		N	Balloon Therapy	N	Spirometry	p-value
Age	< 2yrs	0	0	0	0	0.006
	2-4yrs	13	65.00	0	0	
	4-6yrs	5	25.00	15	75.00	
	>6yrs	2	10.00	1	5.00	
Sex of Child	Male	11	55.00	11	55.00	0.624
	Female	9	45.00	9	45.00	
Religion	Hindu	16	80.00	17	85.00	0.500
	Muslim	4	20.00	3	15.00	
	Christian	0	0	0	0	
	Others	0	0	0	0	
Residence	Urban	16	80.00	18	90.00	0.661
	Rural	4	20.00	2	10.00	
Weight of Child	Up to 10 kg	3	15.00	0	3.00	0.124
	10-15 kg	11	55.00	14	25.00	
	15-20 kg	4	20.00	6	10.00	
	20 kg & above	2	10.00	0	2.00	
Education of Child	Play group	5	25.00	0	0.00	0.000
	Kindergarten	8	40.00	1	5.00	
	Pre primary	2	10.00	19	95.00	
	Primary	5	25.00	0	0.00	
	Secondary	0	0	0	0	
Birth order	One	10	55.00	13	65.00	0.107
	Two	6	30.00	7	35.00	
	More than two	4	20.00	0	0.00	
Mother's education	Uneducated	7	35.00	2	10.00	0.005
	Primary	10	50.00	5	25.00	
	Secondary	3	15.00	13	65.00	
	Graduate	0	0	0	0	

	Post graduate	0	0	0	0	
Father's Education	Uneducated	4	20.00	0	0.00	0.001
	Primary	9	45.00	4	20.00	
	Secondary	4	20.00	16	80.00	
	Graduate	3	15.00	0	0.00	
	Post-Graduate	0	0	0	0.00	
Income of Family	Below 5000	1	5.00	0	0.00	0.000
	5001-10000	14	70.00	2	10.00	
	10001-15000	5	25.00	14	70.00	
	15001 & above	0	0.00	4	20.00	
Primary Caretaker	Mother	18	90.00	18	90.00	0.513
	Father	0	0.00	1	5.00	
	Grandparents	2	10.00	1	25.00	
Type of Family	Nuclear	15	75.00	18	90.00	0.204
	Joint	5	25.00	2	10.00	
	Extended nuclear family	0	0	0	0	
	Broken Family	0	0	0	0	
	Single parent	0	0	0	0	
Duration of Present Hospital Stay	< 2 days	2	10.00	12	60.00	0.003
	2-4 days	15	75.00	7	35.00	
	1 Week	3	15.00	0	0.00	
	More than 1 Week	0	0.00	1	5.00	
Total		20	100.00	20	100.00	

Table: 1. 2 Association between the selected demographic variables

Since p value is less than 0.05 there is association between age,education of child, education of mother, education of father, income of family and duration of present hospital stay between selected parameters of respiratory function.

Effectiveness of balloon therapy and spirometry

Treatment	Pre & post test	N	Mean	Std. Deviation
Spirometry	Heart rate pretest	20	108.36	6.7007
	Heart rate post test	20	107.92	6.8372
Balloon therapy	Heart rate pretest	20	114.97	8.9985
	Heart rate post test	20	113.70	9.0685
Spirometry	Respiratory rate pretest	20	25.300	1.2371
	Respiratory rate post test	20	25.240	1.2167
Balloon therapy	Respiratory rate pretest	20	23.980	1.4006
	Respiratory rate post test	20	23.060	1.6835
Spirometry	Oxygen saturation pretest	20	98.00	.000
	Oxygen saturation post test	20	98.00	.000
Balloon therapy	Oxygen saturation pretest	20	97.38	3.384
	Oxygen saturation post test	20	98.31	3.983

Table: 1.3 showing effectiveness of balloon therapy and spirometry

In both spirometry and balloon therapy, it is found that the difference is statistically significant (P<0.05) between pre and post. But there is not much difference between pre-mean and post-mean of spirometry and balloon therapy. This may be due to the small sample size (n<30).There

is no statistically significant difference between pre and post respiratory rates in spirometry whereas in balloon therapy, the difference between pre and post respiratory rates is statistically significant. Similarly, in oxygen saturation, the difference between pre & post in spirometry is not statistically significant, whereas in balloon therapy, the difference is statistically significant ($p<0.05$).

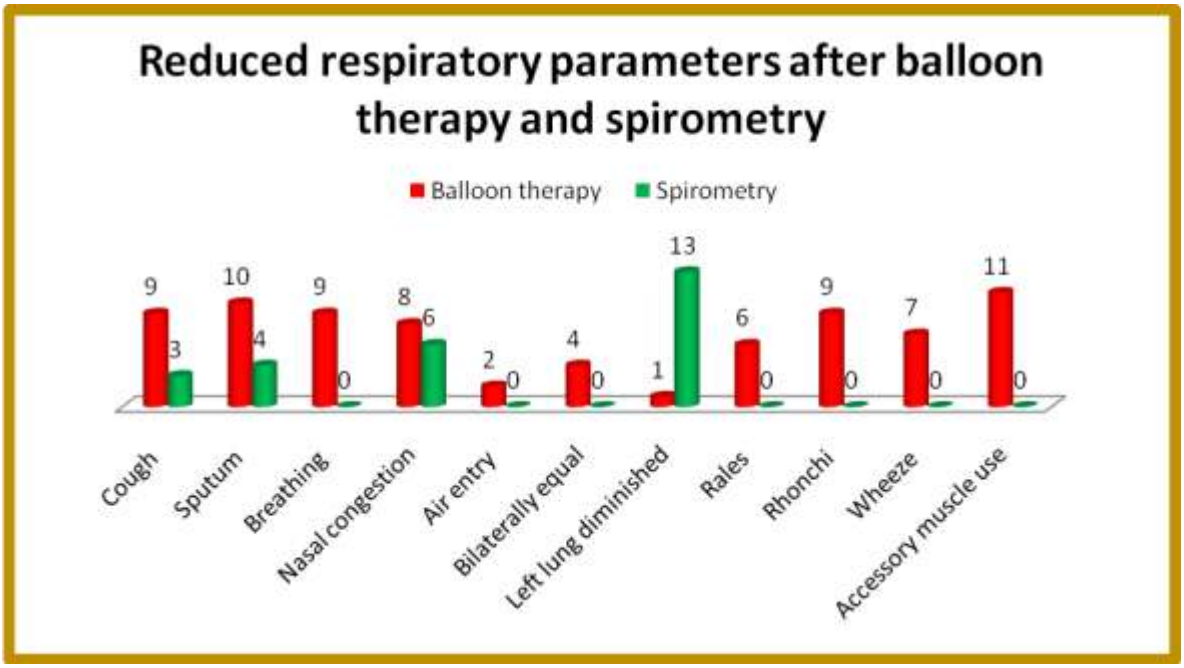
Comparison of respiratory parameters between pre and posttest in balloon therapy and spirometry

Reduced parameters after balloon therapy and spirometry	Balloon therapy	Spirometry
Cough	9	3
Sputum	10	4
Breathing	9	0
Nasal congestion	8	6
Air entry	2	0
Bilaterally equal	4	0
Left lung diminished	1	13
Rales	6	0
Rhonchi	9	0
Wheeze	7	0
Accessory muscle use	11	0

Table 1. 4 Comparison of respiratory parameters between pre and posttest in balloon therapy and spirometry

From the table it's clearly evident that except left lung air entry diminished parameter, in all other parameters the reduction in respiratory symptoms number (sample) is more in balloon therapy in comparison with spirometry. So balloon therapy seems more effective in reducing respiratory symptoms in children with respiratory problems in comparison with spirometry.

Figure 1. 3 showing reduced respiratory parameters after balloon therapy and spirometry



In both spirometry and balloon therapy, it is found that the difference is statistically significant ($P<0.05$) between pre and post. But there is not much difference between pre-mean and post-mean of spirometry and balloon therapy. This may be due to the small sample size ($n<30$). There is no statistically significant difference between pre and post respiratory rates in spirometry whereas in

balloon therapy, the difference between pre and post respiratory rates is statistically significant. Similarly, in oxygen saturation, the difference between pre & post in spirometry is not statistically significant, whereas in balloon therapy, the difference is statistically significant ($p<0.05$).

Cough

After giving balloon therapy 9 children's (45.0%) cough is being reduced and 11(55%) remain same, after giving spirometry 3(23.1%) cough is reduced and 10(76.9%) remain same among 20 children of each therapy.

Sputum

After giving balloon therapy 10 children's (50%) sputum is being reduced and 10(50%) remain same, after giving spirometry 4(30.8%) sputum is reduced and 9(69.2%) remain same among 20 children of each therapy.

Breathing

After giving balloon therapy 9 children's (45.0%) breath sound is being reduced and 11(55%) remain same, after giving spirometry o(0.0%)breath sound is reduced and 13(100%)remain same among 20 children of each therapy.

Nasal congestion

After giving balloon therapy 8 children's (42.1%) nasal congestion is being reduced and 10(52.6%) remain same, and 1(5.3%) is increased after giving spirometry 6(30.0%) nasal congestion is reduced and 14(70%)remain same and 0(0%) is increased among 20 children of each therapy.

Hoarseness of voice

After giving balloon therapy 7 children's (53.8%) hoarseness is being reduced and 5(38.5%) remain same, and 1(7.7%) is increased.

Thoracic in drawing

After giving balloon therapy 8 children's (61.5%) thoracic in drawing is being reduced and 5(38.5%) remain same.

Air entry

After giving balloon therapy 2 children's (10.0%) air entry is being reduced and 17(85.0%) remain same, and 1(5.0%) is increased after giving spirometry 0(0.0%) air entry is reduced and 19(100%) remain same and 0(0%) is increased among 20 children of each therapy.

Bilaterally equal

After giving balloon therapy 4 children's (20.0%) air bilaterally equal is being reduced and 15(75.0%) remain same, and 1(5.0%) is increased after giving spirometry 0(0.0%) bilaterally equal is reduced and 19(100%) remain same and 0(0%) is increased among 20 children of each therapy.

Right lung diminished

After giving balloon therapy 1 children's (100.0%) right lung diminished is being reduced.

Left lung diminished

After giving balloon therapy 1 children's (100.0%) left lung diminished is being reduced.

Adventitious lung sound

After giving balloon therapy 7 children's (53.8%) adventitious lung sound is being reduced.646.2%) remains the same.

Rales

After giving balloon therapy 6 children's (30.0%) rales is being reduced and 14(70.0%) remain same, after giving spirometry 0(0.0%) rales is reduced and 19(100%) remain same. among 20 children of each therapy.

Rhonchi

After giving balloon therapy 9 children's (45.0%) rhonchi is being reduced and 11(55.0%) remain same after giving spirometry 0(0.0%) rhonchi is reduced and 19(100%) remain same. among 20 children of each therapy.

Wheeze

After giving balloon therapy 7 children's (35.0%) wheeze is being reduced and 12(60.0%) remain same, and 1(5.0%) is increased. after giving spirometry 0(0.0%) wheezing is reduced and 19(100%) remain same and 0(0%) is increased among 20 children of each therapy.

Accessory muscle use

After giving balloon therapy 11 children's (57.9%) accessory muscle use is being reduced and 7(36.8 %) remain same, and 1(5.3%) is increased. after giving spirometry 0(0.0%) accessory muscle use is reduced and 19(100%) remain same and 0(0%) is increased among 20 children of each therapy.

Breathlessness

After giving balloon therapy 7 children's (58.3%) breathlessness is being reduced and 4(33.3 %) remain same, and 1(8.3%) is increased. among 20 children of each therapy

Air hunger

After giving balloon therapy 9 children's (75.0%) air hunger is being reduced and 2(16.7%) remain same, and 1(8.3%) is increased. among 20 children of each therapy.

It's clearly evident that except left lung air entry diminished parameter, in all other parameters the reduction in respiratory symptoms number (sample) is more in balloon therapy in comparison with spirometry. So balloon therapy seems more effective in reducing respiratory symptoms in children with respiratory problems in comparison with spirometry.From the findings the researchers found out both balloon therapy and spirometry are effective in reducing the respiratory symptoms in children diagnosed with respiratory problems. As the data supports balloon therapy is more effective than spirometry.

Implications

Nursing practice

As nurses is an integral part of health care services they can play an important role in health educational programs in helping the children by teaching them regarding balloon therapy and incentive spirometry on prevention of respiratory problem, improvement of lung function, reduction of length of hospitalization and repeated hospitalization.

Nursing education

The positive study results can be inculcated in syllabus and curriculum.

Nursing administration

The nurses in collaboration with the physiotherapy and pediatric department of NMMC Hospital can implement this balloon therapy and incentive spirometry to provide medical care for respiratory problems for children who are hospitalized.

Nursing research

Professional organization in nursing are convinced of one important of nursing research as a major contribution to meeting the health and welfare needs of the patient. Aim of nursing research is to expand and broaden the scope of nursing. Nurses play a good role in implementing evidence based practice. This study can be a basic study add more interventions and implement in large sample.

Recommendations

Keeping in view the finding of the study, the following recommendations are made.

- A similar study may be replicated on a large sample; there by findings can be generalized for a large population.
- Experimental studies can be carried out among children.
- A study can be carried out on parents of children to assess knowledge of care towards their children on respiratory problems.
- A study can be conducted to assess the effectiveness of other therapies.
- A similar study can be replicated in a different setting.
- Studies can be conducted to identify the important risk factor of ARI.

Conclusion

During the data collection process the researcher experienced that balloon therapy was more acceptable among children as it is a part of their normal routine play activity and excitement to explore blowing balloons and few children expressed anxiety and fear towards spirometry. So the researcher strongly suggest to approach the hospitalized sick children with acceptable form of innovative therapeutic regimen for their complete participation in their health care.

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