ORIGINAL RESEARCH

Impact of regular chest percussion on outcome measures for infants with pneumonia

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Received: July 10, 2019 **Accepted:** November 14, 2019 **Online Published:** December 16, 2019
DOI: 10.5430/jnep.v10n4p11 **URL:** https://doi.org/10.5430/jnep.v10n4p11

ABSTRACT

Objective: To evaluate the impact of regular chest percussion on outcome measures for infants with pneumonia.
Methods: A two-group pre-post quasi-experimental design was conducted in the Pediatrics Medical Unit at Abu Elrish Children's Hospital, Cairo University. The experiment involved 100 infants fifty (control group) followed the hospital routine care and other fifty applied regular chest percussion (intervention group). Chest condition was assessed subjectively and objectively throughout five days before and after the regular chest percussion using Pediatrics Respiratory Severity Scales. Physiological measurements of infant's respiratory rate, heart rate, and temperature and oxygen saturation were assessed. All research ethics were applied.
Results: The mean of Pediatric Respiratory Severity Score (PRSS), temperature, respiration, heart rate and oxygen saturation among infants was statistically improved throughout the intervention days than the control group 1st, 2nd, 3rd and 4th days post the regular chest percussion at a significance level as $p < .05$.
Conclusions: The regular chest percussion had a significant improvement in the respiratory health conditions for infants with bacterial pneumonia. This study recommends regular chest percussion that should be applied in medicine and intensive care units. Further researches must be done to add more evidence -based practices regarding the effect of chest percussion for children with pneumonia.

Key Words: Chest percussion, Infants, Pneumonia

1. INTRODUCTION

Pneumonia is an inflammatory lung disease as a result of an infectious agents. In the World Health Organization, operational definition is commonly used based solely on clinical symptoms (cough or difficulties in breathing and tachypnea).[1]

According to UNICEF (2018),[2] pneumonia is the leading infectious disease that causes death in children less than five years old, killing around 2,400 children per day. Pneumonia accounted for approximately 16 percent of total 5.6 million deaths worldwide. The Mortality rate for Egyptian children less than five years old is 21 per 1,000 live births distress, while for infants it is 18 per 1,000 live births. In Egypt, 42,000 children were under five years old die yearly as a result of pneumonia.

Pneumonia can result from a variety of causes, including infection with bacteria, viruses, fungi, or parasites, and chemical or physical injury to the lungs. Pneumonia in children under five year is usually seen due to two main causes, bacterial or viral infection. Bacterial pneumonia is caused by

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different types of bacteria. The most common bacteria that cause bacterial pneumonia is Streptococcus pneumonia.[3]

In Bacterial-pneumonia, alveolar air sacs become filled with fluids and pus as a result of the infection. This leads to interruption of breathing patterns and pulmonary complications along with other manifestations as elevated body temperature, chest pain and cough.[4]

Coughing starts as a non-productive cough that ends up to productive cough expelling out thick yellowish or bloody mucus.[5] As airways are obstructed and coughing interferes with breathing; breathing gets hard, aching and shallow that some are breathless affecting their level of oxygenation.[6]

Bacterial-pneumonia treatment protocols involve the use of anti-bacterial drugs, expectorants, demulcents besides promoting proper oxygenation and the use of interventional techniques based on case severity.[7] Different interventional techniques have been established to promote loosening of accumulated thick mucus sticking to the respiratory tract as chest percussion and postural drainage.[8]

Wright et al. (2019)[9] Added that chest physiotherapy, as chest percussion play a great role in helping mucus drainage and normal chest expansion in infants with respiratory infections as asthma, bronchitis and pneumonia.

Chest percussion implicates manual tapping of the chest that transmits the jiggling effect. Jiggling effect assists mobilization of highly dense mucus sticking to alveolar sacs; thus mucus can be expelled through coughing. This external intervention allows clearing of airways and normal breathing patterns. It also helps children with excessive lung discharge as in pneumonia.[10]

Also chest Percussion causes the transmission of vibrations along the chest cavity which helps strongly sticking mucus to the airways to be expelled; thus evacuation of the airways and reduction of airways resistance. Evacuation of the airways occurs when infants get to cough out the sputum or swallow it.[11] Pediatric nurses are playing a role in the management of pneumonia with a variety of treatment modalities.

Conversely, a systematic review concluded that chest physiotherapy seems to have some positive effects in treating pneumonia, there is still a large gap in the literature and more studies need to be done on this disease Therefore, the disease is often treated with chest physiotherapy, although there is also limited supporting evidence regarding this approach.[12] Therefore, the current study should investigate the impact of the regular chest percussion on subjective and objective parameters for infants with pneumonia.

1.1 Aim of the study

The aim of the current study was to evaluate the impact of regular chest percussion on outcome measures for infants with pneumonia.

1.2 Research hypotheses

1)-Infants who apply regular chest percussion will have lowest pediatric respiratory severity score (PRSS) compared to infants in the control group.
2)-Infants who apply regular chest percussion will have better physiologic measures stability score compared to infants in the control group.

1.3 Operational definition

Outcome measures are subjective parameters that infants having as cough, fever, nutrition, and rhinorrhea and objective parameters as dyspnea, respiratory sound, adventitious sound and secretions were measured by PRSS scale.

Physiologic measures: Infant's respiration, heart rate, temperature and oxygen saturation were assessed by the researchers.

2. Subjects and methods

2.1 Research design

A quasi-experimental two-group design was conducted to achieve the aim of the study.

2.2 Subjects

Non-probability convenient sample of 100 infants was divided in two groups; fifty (control group) followed the hospital routine care and fifty (intervention group) applied regular chest percussion before suction session.

All infants had the following inclusion criteria: male and female, age from one to 12 months, having bacterial pneumonia, receiving nasopharyngeal suctioning as a chest care. Children's having any types of chest infection was excluded.

2.3 Setting

The study was implemented in the Pediatrics Medical Unit on the fifth floor at Abu Elrish Children's Hospital, Cairo University, Egypt.

2.4 Tools of data collection

It included the following:

1) A structured interview questionnaire was developed by researchers after studying the relevant literature. It consisted of 11 questions related to infant's characteristics as age, sex, hospital stay, oxygen source, oxygen methods, oxygen duration, infants' weight, and types of feeding, side effect during chest percussion and Parents opinion about the effectiveness of chest percussion.

2) PRSS scale was adapted by Alexandrino et al.[13] to monitor and evaluate the respiratory health status in children less than 36 months of age. It included eight parameters: cough, nutrition, fever, rhinorrhea, dyspnea, respiratory sound, adventitious sounds and secretions. The researchers must put score 1 (normal), 2 (mild) and 3 (severe) to each parameter, according to the severity of the health status of the infant. The final total score is calculated as the sum of all the 8 parameters, varying from 8 to 24. The child's health condition is considered to be normal if the total score is 8, moderate if the total score is between 9 and 16, and severe if the total score is between 17 and 24.
3) Physiological assessment: These measurements included respiratory rate, heart rate, and body temperature and oxygen saturation. Standardized evaluation methods were utilized.

2.5 Validity and reliability

The tools were revised by two experts in pediatric nursing and one in pediatric medicine to check face and content validity. As peer their opinions, no modifications were required. As regards the reliability of the (PRSS) tool, Cronbach's alpha was 0.94. The tool has been shown to have high validity and reliability.

2.6 Pilot study

A pilot study was applied on 10% of the total sample (10 infants) to test the clarity and applicability of the study tools. Infants who participated in the pilot study were included in the sample.

2.7 Data collection procedure

Official permission was obtained from managers of Abu Elrish Children's hospital and medicine unit. A clear explanation was given for infants mothers about the nature, importance and expected outcomes of the study. The filed work was carried out from the first of September 2018 up to end of February 2019 (6months). Formal consent obtained from mothers/caregivers of children.

Firstly, the study was implemented with the control group each infant was interviewed individually in his room at the pediatric medicine unit to fulfill the questionnaire sheet and using infants medical record by the researchers it took 10-15 minutes. PRSS was used five times: 0 day observation on admission day pre the routine hospital care, then 1st, 2nd, 3rd and 4th days each child was observed at the end of morning hospital shift to assess the chest health status post the routine hospital care it took 30-40 minutes. Also the researchers measured infant's weight, body temperature (BT), respiratory rate (RR), heart rate (HR) and oxygen saturation (O2sat) at admission day pre hospital routine care and1st, 2nd, 3rd and 4th days for each infant at the end morning hospital shift, it took 25-35 minutes. They neither were nor received the regular chest percussion sessions.

For the intervention group; each infant were interviewed individually, a structured interview sheet and PRSS tools were fulfilled on admission day pre the intervention. Also the researchers were measured infant weight, BT, RR, HR and O2sat on the same day pre the chest percussion .Infant mothers were informed about the importance of the regular chest percussion then, before infant feeding i used clapping technique which provided by cupped hand for 3 minutes in 5 positions of drainage (upper lobes-apical and posterior segment, apical and anterior segment, right upper lobe–posterior segment, left upper lobe-posterior segment, lower lobes–apical segment) with assisted suction three times/shift for four days, and then each infant was observed by using PRSS and infant weight. BT, RR, HR, O2sat were measured at the end of morning hospital shift for four days (1st, and 2nd, 3rd and 4th days) post regular chest percussion.

2.8 Ethical considerations

Written consent was obtained from infants mothers/caregivers. Researchers maintained anonymity and confidentiality of data; they have the right to withdraw from the study without giving any reason.

2.9 Statistical analysis

Data entry and statistical analysis were done using SPSS 20.0 statistical software package. Frequencies and percentages were used as descriptive statistics for qualitative variables, while means, medians and standard deviation for quantitative variables. Cronbach alpha coefficient was calculated to assess

the reliability of the scale through its internal consistency. Quantitative continuous data were compared using Student t-test in case of comparisons between two independent groups. In absence of normal data distribution, on-parametric Mann-Whitney test was used. Qualitative categorical variables were compared using chi-square test. Spearman rank correlation was used to assess the inter-relationships between quantitative variables and ranked ones. In order to identify the independent predictors of PRSS, multiple linear regression analysis was used along with analysis of variance for the full regression models. Statistical significance was at p-value $<$ .05.

3. RESULTS

Table 1 shows that infants mean age was near equal in intervention and control groups as 7.4 ± 3.7 & 7.5 ± 3.7 months with no statistically significant difference, with slightly more females (56%) in both groups. Also Table 1 reveals that the

m of infants (80%) in the intervention and control groups were from urban area. Their duration of hospital stay ranged between 4 to 10 days, with mean 5.8 ± 1.312.5 in the intervention group while ranged between 4 to 18 days, mean 14.1 ± 4.1 in the control group. As regard oxygen source the highest percent of both groups (84% & 94% respectively) connected with nasal oxygen and their duration ranged between 2 to 4 days, median 2.50in the intervention group, while the control group ranged between 3 to 7 days, median 6.0. There is a significant difference between both groups as $p < .05$. Concerning nutrition 32% of infants had intravenous therapy and NPO in the intervention group compared to 70% in the control group. There are highly statistically significant differences as $p < .05$.

Table 2 illustrates that the mean PRSS, BT, RR, HR and O2sat among infants was improved at third and fourth days post the regular chest percussion at a significance level as $p < .05$. While no significant difference was shown on admission day pre the regular chest percussion. Regarding infants weight there was no statistically significant difference between both groups at admission day pre and at 1st, 2nd, 3rd, and 4th days post the regular chest percussion.

Table 1. Demographic and medical status of infants among intervention and control groups (n = 100)

Items	Intervention		Control		χ^2 test	*p* value
	No	%	No	%		
Age/months						
< 6	20	40.0	19	38.0		
6+	30	60.0	31	62.0	0.04	.84
Mean ± SD	7.4 ± 3.7		7.5 ± 3.7		*t* = .16	.87
Median	7.00		7.00			
Gender						
Male	22	44.0	22	44.0		
Female	28	56.0	28	56.0	0.00	1.00
Residence						
Urban	40	80.0	40	80.0		
Rural	10	20.0	10	20.0	0.00	1.00
Hospital stay/day						
< 7	39	78.0	3	6.0		
7+	11	22.0	47	94.0	53.20	.001*
Range	4.0-10.0		4.0-18.0			
Mean ± SD	5.8 ± 1.3		14.1 ± 4.1		U = 57.37	.001*
Median	6.00		15.00			
Oxygen source						
No	8	16.0	3	6.0		
Yes	42	84.0	47	94.0	2.55	.11
Method: nasal	42	100.0	47	100.0	0.00	1.00
Duration (days)						
2-3	36	85.7	1	2.1		
4+	6	14.3	46	97.9	63.80	.001*
Range	2.0-4.0		3.0-7.0			
Mean ± SD	2.6 ± 0.7		5.7 ± 1.1		U = 63.71	.001*
Median	2.50		6.00			
Nutrition						
Oral	21	42.0	0	0.0		
Gavage	13	26.0	15	30.0	28.22	.001*
IV and NPO	16	32.0	35	70.0		

*$p < .05$

ISSN 1925-4040 E-ISSN 1925-4059

Table 2. Infants mean PRSS scores, vital signs, and oxygen saturation among intervention and control groups pre/post the study days (n = 100)

Days	Control	Intervention	Mann Whitney test	*p*-value
Day 0 pre intervention				
PRSS	19.5 ± 4.2	19.2 ± 3.8	7.48	.62
Weight (kg)	7.9 ± 3.2	8.0 ± 2.6	0.26	.61
BT	38.3 ± 0.8	38.5 ± 0.6	2.11	.15
RR	56.4 ± 6.8	55.7 ± 6.5	0.44	.51
O2sat	85.9 ± 4.2	86.0 ± 4.2	0.02	.89
HR	122.1 ± 25.1	123.3 ± 24.5	0.09	.77
Day1 post				
PRSS	14.2 ± 4.2	19.2 ± 3.4	32.96	.001*
Weight (kg)	7.8 ± 3.1	8.0 ± 2.6	0.31	.58
BT	37.6 ± 0.7	38.5 ± 0.5	32.79	.001*
RR	48.4 ± 10.2	53.3 ± 4.8	7.03	.008*
O2sat	93.6 ± 3.0	90.4 ± 3.0	24.58	.001*
HR	110.0 ± 18.1	152.7 ± 7.4	68.56	.001*
Day 2 post				
PRSS	12.8 ± 3.4	18.5 ± 3.2	47.75	.001*
Weight (kg)	7.7 ± 3.1	8.0 ± 2.6	0.62	.43
BT	37.3 ± 0.5	38.3 ± 0.6	50.59	.001*
RR	45.1 ± 9.2	52.8 ± 5.8	23.06	.001*
O2sat	95.6 ± 2.1	90.8 ± 2.4	62.69	.001*
HR	108.4 ± 15.3	154.6 ± 9.8	70.52	.001*
Day 3 post				
PRSS	12.1 ± 2.5	17.4 ± 3.1	50.81	.001*
Weight (kg)	7.9 ± 3.2	7.9 ± 2.7	0.00	1.00
BT	37.4 ± 0.6	38.2 ± 0.5	35.71	.001*
RR	46.2 ± 9.5	52.8 ± 5.2	15.06	.001*
O2sat	96.5 ± 2.5	91.1 ± 2.1	59.91	.001*
HR	110.6 ± 17.4	154.5 ± 8.2	71.32	.001*
Day 4 post				
PRSS	11.2 ± 2.2	16.1 ± 3.4	41.84	.001*
Weight (kg)	7.8 ± 3.1	7.8 ± 2.7	0.10	.75
BT	37.3 ± 0.5	38.0 ± 0.5	32.21	.001*
RR	44.5 ± 10.0	53.3 ± 8.2	21.56	.001*
O2sat	97.8 ± 2.0	91.4 ± 2.0	70.55	.001*
HR	109.5 ± 16.9	155.3 ± 9.4	71.06	.001*
Overall				
PRSS	13.6 ± 4.0	18.1 ± 3.6	160.11	.001*
PRSS change (post-pre)	-6.3 ± 4.0	-3.2 ± 5.0	10.06	.002*

* $p < .05$

As regard PRSS levels at the admission day pre regular chest percussion, Table 3 indicates that infants in intervention and control groups (52% & 58% respectively) had severe respiratory conditions while the minority of both groups (42% & 48% respectively) with mild respiratory condition with no statistically significant difference between the two groups. At the 1st day post the regular chest percussion, the majority of infants in the intervention group (78%) had mild respira-

tory condition compared to 40% of the control group. Only 22% of the intervention group had severe respiratory condition compared to 60% of the control group with statistically significant differences between both groups (χ^2 = 14.92, p = .001). Regarding the 2nd day, the most (78%) of the intervention group had mild respiratory condition compared to 58% of the control group had severe respiratory condition. As clarified in that Table, 3rd and 4th days. 90%, 88% & 50%, 54% respectively) had mild respiratory condition in the intervention and control groups, and minority of the intervention group (6% & 2% respectively) had severe respiratory condition compared to 48% and 36% respectively in control group. There was a highly statistically significant differences between both groups in the 1st, 2nd, 3rd & 4th days post the regular chest percussion as $p < .001$.

Table 4 shows highly statistically significance relation between PPRS score and infants' age , hospital stay, weight, body temperature, respiratory rate, heart rate and oxygen saturation as $p < .01$.

Table 3. Infants PRSS levels among intervention and control groups pre/post the study days (n = 100)

PRSS levels	Intervention		Control		χ^2 test	*p* value
	No	%	No	%		
Admission day pre						
Mild	29	58.0	26	52.0		.55
Severe	21	42.0	24	48.0	0.36	
Day 1 post						
Mild	39	78.0	20	40.0		.001*
Severe	11	22.0	30	60.0	14.92	
Day 2 post						
Normal	4	8.0	0	0.0		.001*
Mild	39	78.0	21	42.0	22.84	
Severe	7	14.0	29	58.0		
Day 3 post						
Normal	2	4.0	1	2.0		.001*
Mild	45	90.0	25	50.0	22.38	
Severe	3	6.0	24	48.0		
Day 4 post						
Normal	5	10.0	5	10.0		.001*
Mild	44	88.0	27	54.0	19.28	
Severe	1	2.0	18	36.0		

* $p < .05$

Table 4. Correlation between PRSS scores and hospital stay and infants' characteristics

	Spearman's rank correlation coefficient	
	PRSS score	Hospital stay
Hospital stay	.585**	
Age	-.094*	-.127**
Weight (kg)	-.102*	-.061
Body temperature	.765**	.455**
Respiratory rate	.516**	.331**
Oxygen saturation	-.612**	-.437**
Heart rate	.537**	.604**

* $p < .05$; ** $p < .01$

Regarding factors influencing PPRS scores among infants, Table 5 indicates that the control group was its main independent negative predictor with increased severity of respiratory condition. In addition the infants' female gender, the days the infants spend at hospital and times on the intravenous fluids were risk factors.

As shown in Table 6, half of infants (50%) had side effect during chest percussion, more than half of them (68%) had tachycardia and 32% had vomiting. As regards the effect of chest percussion, the highest percent (82%) of mothers their opinions that regular chest percussion had improved their infants' respiratory conditions.

It was clear from Figure 1 the total mean pediatric respiratory scores in the intervention increased 0 day (admission day) pre the regular chest percussion and decreased at 1st, 2nd, 3rd and 4th days post the intervention. On the other hand, PRSS increased day 0 (admission day) pre and post at 1st, 2nd, 3rd and 4th days.

ISSN 1925-4040 E-ISSN 1925-4059

Table 5. Best fitting multiple linear regression model for the PRSS score

	Unstandardized Coefficients		Standardized Coefficients	*t*-test	*p*-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
Constant	10.76	0.76		14.149	< .001	9.26	12.25
Time	-1.15	0.10	-0.37	11.326	<.001	-1.35	-0.95
Control group	1.60	0.50	0.18	3.219	.001	0.62	2.57
Female gender	1.10	0.30	0.12	3.719	< .001	0.52	1.68
Hospital stay	0.28	0.05	0.32	5.658	< .001	0.18	0.37
IV therapy	0.71	0.22	0.13	3.277	.001	0.29	1.14

Table 6. Chest percussion side effects reported by infants mothers and their opinions in the intervention group (n = 50)

Regular chest percussion	NO	%
Side effects		
No	25	50.0
Yes	25	50.0
Side effects		
Bradycardia	0	0.0
Tachycardia	17	68.0
Vomiting	8	32.0
Mothers opinions		
No effect	9	18.0
Improve respiratory conditions	41	82.0

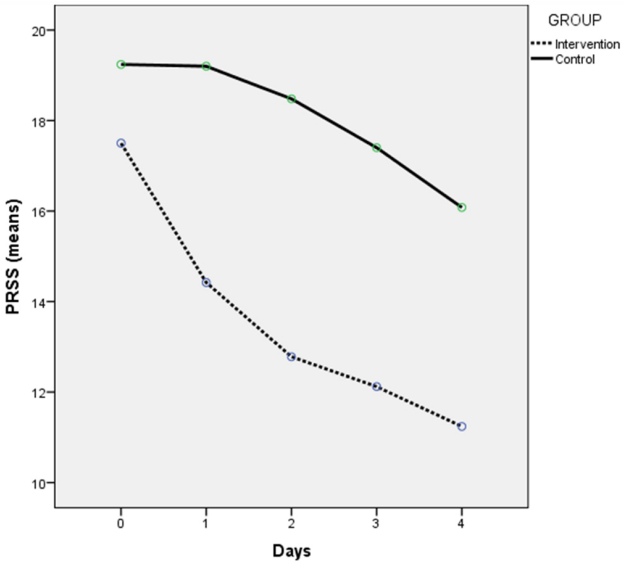

Figure 1. Changes in PRSS scores among infants in intervention and control groups throughout the study days

4. Discussion

Chest percussion has been widely applied on pediatric settings, based on the potential importance on removing airway secretions, improving gas exchange and decreasing the force of breathing.

It was obvious from the current study that infants mean age was nearly equal in both groups. This result was in agreement with Damiani and Adasme[14] who found that the majority of study participants were children less than one year and admitted with pneumonia. From the researchers point of view it may be related to decrease infant's immunity and improper health care implemented by their mothers. The current study revealed that more than half of the intervention and control groups were female's infants. This again was dis agreed with Gomes and Donadio[15] who mentioned that the majority of children in his study were male.

According to the present study results, the highest percent of infants in both groups came from urban areas. This is because hospital referral from all Egyptian government to Abu Elrish Children's hospital due to free charge and better services. This in agreement with Lisy[16] who found that most infants in both groups were from urban area.

The current study indicated that duration of hospital stay was decreased among infants in intervention and increased in control groups. From researchers point of view results of the study detected the effectiveness of regular chest percussion with improvement of infant's respiratory health condition which decreases their length of hospital stay. Findings of the current study are in agreement with Paludo et al.[17] as they stated that no differences in median of clinical resolution time and length of hospital stay. Also this finding matched with a study that had done by Hussein and Elsamman[18] as they reported that regarding the length of hospital stay, a significant diffidence was detected between intervention and control groups.

As regards oxygen source the results showed that the highest percent of infants among intervention group connected with nasal oxygen and their duration ranged between 2 to 4 days while control group ranged between 3 to 7 days with significant difference between both groups. Study results are on the same line with Hussein and Elsamman[18] who mentioned that concerning frequency of oxygen requirement /day with chest physiotherapy, there was a significant difference

between study and control groups.

Regarding IV fluids, the results of the present study revealed a significant deterrence between intervention and control groups. This result was in agreement with the results of study implemented by Dean and Florin[19] who found that infants in the control group need hydration greater than infants in the intervention group.

The findings indicated that the mean scores of PRSS among infants with pneumonia was not changed on admission day in two groups but decreased in the intervention group at 1st, 2nd, 3rd and 4th day post the regular chest percussion and was increased in the control group. This in congruence with Lukrafka et al.[20] as they stated that, at admission day no differences were detected between the two groups for severity of pneumonia while respiratory rate and severity scores decreased from admission to discharge day in both groups.

Also, the study results illustrated that mean scores of body temperature, respiratory rate, heart rate and oxygen saturation among infants with pneumonia was not changed on admission day in each group but improved in the intervention group at 1st, 2nd, 3rd and 4th days post the regular chest percussion while not improved in the control group. The present result goes on same line with Chaves et al.[21] who reported a positive improvement in respiratory rate and oxygen saturation after chest physiotherapy. A study done by Lestari et al.[22] showed a difference between the two groups in heart rate, respiratory rate, and oxygen saturation means score. Chaves et al.[23] found no difference in resolution of fever between children in the physiotherapy (conventional chest physiotherapy and assisted autogenic drainage) and control groups.

Result revealed that nearly half of infants among two groups presented severe impairment of the respiratory health conditions on admission day pre regular chest percussion. At the day1 and day 2 posts the regular chest percussion, the majority of infants in the intervention group had mild respiratory condition compared to one third of the control group. At 3rd and 4th day post the intervention the highest percent of infants in the intervention group had mild respiratory condition compared to the control group. The results of the current study goes in line with Alexandrino et al.[13] found that the highest percent of children presented a moderate respiratory impairment of the respiratory health condition mainly due to the presence of rhinorrhea and secretions. Other study conducted by Nayani et al.[24] stated that regarding Clinical Respiratory scores (CRS), about one third of children had mild respiratory condition, more than half in moderate and nine percent in sever category. Post the intervention, the total scores improved with obvious decrease in the percent of children having a moderate CRS.

It was observed from the current results a significant relation between PPRS score and hospital stay, infants' age, weight, temperature, respiration, heart rate and oxygen saturation. This result contradicted with the study done by Corten et al.[25] they reported that for study group, chest physiotherapy didn't effect on the length of hospital stay. In addition, Lukrafka et al.[20] detected a significant difference between the two groups with a longer length of hospital stay for intervention group. Another experiment conducted by Lestari et al.[22] added that despite the correlation between age and heart rate, other characteristics (nutritional status, exclusive breast-feeding, vaccination, the length of illness, and the content of nebulization medication) chest physiotherapy had no effect on pulse, respiration and oxygen saturation. the current results may be powered with significance difference between intervention and control group.

Moreover, regarding factors influencing PPRS scores among infants with pneumonia, this result indicated that the control group was its main independent negative predictor with increased severity of respiratory condition. In addition the infants' female gender, the days the infants spend at hospital and times on the intravenous fluids were risk factors. This result agrees with Dean and Florin[19] mentioned factors correlating with severe pneumonia such as age, gender, weight for age, length of hospital stay, in proper management and malnourished child.

As shown in our study fifty infants appeared with side effect during chest percussion, more than half of the infants had tachycardia and 32% had vomiting. From the researchers point of view these side effects were temporary and relieved as soon as the chest percussion stopped. Also this study findings in congruence with study developed by Gajdos et al.[26] who Observed tachycardia with desaturation and vomiting during the chest percussion and they noted that children bradycardia disappeared quickly.

In addition, most of the infants' mothers their opinions that regular chest percussion had improved their infants' respiratory conditions. Findings of other studies implemented by Melbye et al.[27] as they observed that improvement in chest sound was auscultated after the chest percussion therapy.

It was clear from the findings of the study, improvement in the respiratory condition for infants with pneumonia as the total mean (PRSS) respiratory severity scores in the intervention group increased on admission day pre the regular chest percussion and decreased at 1st, 2nd, 3rd and 4th days post the intervention. On the other hand, the total mean (PRSS) increased on admission day pre and post at 1st, 2nd, 3rd

and 4th day among the control group. This result in agreement with Alexandrino et al.[13] they found a significant improvement in the total mean PRSS after the management of chest physiotherapy. Generally, our results revealed a positive impact of regular chest percussion for infants suffered from pneumonia which confirmed the correction of the study hypothesis.

5. Conclusion and recommendations

The study results summarized that infants were applied regular chest percussion had a significant decrease in total PRSS scores than before, with better respiratory health condition. Nurses in medical ward can able to build evidence based practices in relation to chest percussion by implementing simple practical nursing care. Therefore, established regular chest percussion should be performed continuously in medicine and intensive care units. Moreover, the effectiveness of chest percussion on infants' respiratory health condition needs further researches to add more evidence based practices regarding chest physiotherapy for children with pneumonia.

Acknowledgements

A researcher thanks the manager of medicine unit and all health team members for their cooperation and preparation to achieve the aim of the study.

Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest.

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