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Effectiveness of breathing exercises as therapeutic play on respiratory status among children undergoing nebulization therapy with lower respiratory tract disorders

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Abstract
Background: Lower respiratory infections are leading factor for death in children in developing countries resulting in nearly about 1.9 million child deaths per year, out of which 20% are estimated to occur in India. So, Breathing exercises play a notable role in airway clearance and parenchyma expansion by enhancing the efficiency of respiratory muscles and reduce the respiratory efforts and improve the lung function.
Methods: A Quasi-Experimental (non-equivalent control group pre-test post-test) design was used to collect data from children with lower respiratory tract disorders. A total of 60 children (30 in experimental group and 30 in comparison group) were selected for the study by using purposive sampling techniques. The Modified Clinical Respiratory Score was used to assess the respiratory status among children. Reliability of Modified Clinical Respiratory Score i.e 0.86 was calculated by Inter-rater reliability to confirm the equivalence.
Results: The results showed that the mean respiratory status in experimental group improved significantly from pre-intervention (8.33 ±2.84) to post-intervention 3rd (3.30 ±1.26) as compared to comparison group in which mean respiratory status in pre-intervention (8.23±2.45) and post-intervention 3rd (5.46± 1.40). The computed 't' value in post-intervention 1st (t=1.17, p=0.24), in post-intervention 2nd (t=2.47, p= 0.01*) and in post-intervention 3rd (t=6.27, p= 0.001*), which was found to be significant in post-intervention 2nd and post-intervention 3rd at 0.05 level of significance.
Conclusion: Respiratory status of children improved significantly in experimental group where breathing exercises as therapeutic play was administered along with Nebulization therapy as compared to comparison group.

Keywords: Breathing exercises, therapeutic play, respiratory status, nebulization therapy, lower respiratory tract disorders

Introduction
Health is the valuable concern of all human beings as it is significant for every individual and community. The concept of health is comprehensive and positive. Webster put forward the concept of health "Health as the quality of life resulting from total functioning of the individual that empower him to achieve personally satisfying and socially useful life" [1]. According to WHO "Health is a complete state of physical, mental, social and spiritual well-being not merely the absence of any disease or illness". Healthy children are the future citizen of nation so protection and promotion of the child is of prime importance for building a healthy and sound nation. The National policy for children (1947) said that, children are the blessings for state; and to maintain their nature and care is our responsibility [2]. Children are more delicate to occurrence of various minor and major respiratory problems. The frequency rate of asthma and bronchiolitis in Karnataka, Gujarat, Haryana, Madhya Pradesh, Uttar Pradesh are more than 50% and shown a reduction from 24.7 to 19.2. The result shows that asthma and bronchiolitis was a leading cause of death in last 3 decade accounting above 9-11% [3]. According to the global epidemiological survey, it is shown that almost 6.6 million of deaths occur in 2012 among children of 5years of age. Despite these substantial successes, the annual rate of reduction in the global mortality rate of 3.9% remains below the SDG targeted rate i.e. 4.4%, necessary to achieve the goal of a 2/3 reduction in the 1990 rate by

2015 [4]. Asthma remains the leading cause of childhood killing, nearly about 1.2 million deaths each year 2015, most of which are preventable disease. Throughout the sphere, infants and young children are more prone to have respiratory diseases [5]. Acute Bronchiolitis is predominantly a viral disease; RSV is responsible for more than 50% of cases. Approximately 100,000-126,000 children are hospitalized annually in United States because of RSV infection [6]. The incidence of pneumonia is more than 10-fold higher, and the number of childhood-related deaths from pneumonia is 2,000 fold higher, in developing than in developed countries. Fifteen countries account for more than three-fourths of all pediatric death from pneumonia [7]. In India**,** as per Centre for Disease Control (CDC) 30-50% of people were visited for pursuing medical facility and 20-40% having hospital admissions. In India, more than 4 lakh deaths every year are due to pneumonia accounting for 13%-16% of all deaths in the pediatric hospital admissions. In 2001 to 2009 there is 50% increase in cases of acute respiratory infection and approximately 3,404 deaths occur in 2010. In urban areas, acute respiratory infection consist over two-thirds of child diseases [8].

Breathing techniques are helpful for reducing breathing difficulty. The ultimate goal is for children to be able to relax quickly when faced with stressful situations. Breathing exercise as an integral part plays a notable role in airway clearance and parenchyma expansion by enhance the efficiency of respiratory muscles. Modified breathing exercise is mandatory in children because they might not co-operate like adults. The principle is to mesmerize the children and not to create boredom. It can be accompanied by musical tone that would evince interest in a child. Various modified forms of breathing exercises like group exercises, running, balloon blowing, abduction, adduction and forward movement of upper limbs, blowing air into the water with a straw, blowing a trumpet, candle blowing, flute and mouth organ playing are found effective in children [9]. The aims of breathing training are to "prevailing" breathing patterns, usually by adopting a slower respiratory rate with longer expiration and reduction in overall ventilation. Use of abdominal rather than the upper-chest and accessory muscles of ventilation in resting breathing and nasal rather than mouth breathing are also frequently stressed. The rationale for this training is based on the assumption that people with lower respiratory tract disorders have unusual or debilitated breathing pattern [10]. The objectives of the study are:

1. To assess and compare the respiratory status among children undergoing Nebulization therapy in experimental and comparison group before and after administration of breathing exercises as therapeutic play.
2. To determine the association of respiratory status among children undergoing Nebulization therapy with their selected variables.

And Following hypotheses were tested at 0.05% level of significance

Hypothesis 1: There will be significant difference in the mean post-intervention respiratory status among children undergoing Nebulization therapy in experimental and comparison group.

Hypothesis 2: There will be significant association of respiratory status among children undergoing Nebulization therapy with selected variables.

A randomized controlled trial was conducted to assess the effectiveness of blow bottle exercise on respiratory status among children with lower respiratory tract infection in Porur, Chennai. A quantitative research approach was used with a pre-test post-test design and the sample was selected by simple random sampling and the sample consists 30 in study group and 30 in control group with lower respiratory tract infections after that blow bottle exercise was given thrice a day for ten days for study group along with routine care and no intervention was given in the control group. The result showed that in pre-assessment the overall mean of respiratory status in study group was 13.9 with SD of 5.45 whereas in control group was 138.63 with SD 4.88. In post-assessment mean value in study group 125.4 with SD 2.94 and the respiratory parameters within the study group and control group pre assessment and post-assessment day 2 and 3 were found statistically significant at level of 0.001. The study concluded that there was a significant difference in the respiratory parameters in the study group than the control group which was attributed to the use of respiratory exercise and shows that blow bottle exercise is one of the effective non-pharmacological method in treating the children with lower respiratory tract disorders [11]. The conceptual framework used for the study was health promotion model that includes Individual characteristics, Behaviour specific cognition & affect, Behaviour outcome [12].

Material and methods

Study design

We evaluate the effectiveness of breathing exercises as therapeutic play among children undergoing Nebulization therapy with lower respiratory tract disorder. The study used non-equivalent control group pre-test post-test design.

Study Participants

The study included the patients with lower respiratory tract disorder who were 5-18 years of age, prescribed with Nebulization therapy, able to understand Hindi, available during the period of data collection and willing to participate in study and the study excluded the children who were having upper respiratory tract infection, on ventilator support, coming to hospital for OPD visits.

Study Setting

The setting of the study was Civil Hospital Ambala city and AVS Ravi hospital Yamuna-Nagar, Haryana. A total 60 sample were selected, 30 in experimental group and 30 in comparison group from pediatric ward of the hospital using purposively sampling technique. The respiratory status was assessed by Modified Clinical Respiratory Score and reliability of the tool was 0.86.

Intervention

Group	Pre-assessment (day 1st)	Intervention (day 1st, 2nd and 3rd)	Post-assessment (day 1st, 2nd and 3rd)
Experimental group (n=30)	Pre-assessment of respiratory status among children undergoing Nebulization therapy	Administration of Breathing exercises as therapeutic play (balloon inflation, candle blowing and blow air into water with a straw) for 15 minutes, once in a day for 3days consecutively after 5minutes of Nebulization therapy	Post-assessment of respiratory status among children was done after 5 min of administration of breathing exercises as therapeutic play.
Comparison group (n=30)	Pre assessment of respiratory status among children undergoing Nebulization therapy	Only Nebulization therapy was given to the children	After 25minutes of giving of Nebulization therapy Post-assessment of respiratory status among children was done.

Data Collection Procedure

Pre-assessment of respiratory status was done before administration of breathing exercises as therapeutic play, after that nebulization therapy was given and after 5 minutes of administration of nebulization therapy, breathing exercises as therapeutic play(balloon inflation, candle blowing & blow air into water with a straw) was administered for 15 minutes for 3 days consecutively and post-intervention assessment was taken after 5 minutes on each day after the intervention whereas in comparison group pre-assessment of respiratory status was done and only nebulization therapy was given and post-intervention assessment was taken after 25 minutes on each day after the intervention.

Results

Homogenity

Participant characteristics are shown in table 1. It shows more than half of the children in the experimental group 66.6% and comparison group 56.6% were in the age group of 5-8years respectively. Nearly half of the children in experimental group is 56.6% whereas, more than half of the children in comparison group 60% were male. Most of the children in experimental 60% and comparison group 53.3% was having past history of respiratory disease in which less than half of the children in experimental group were having asthma 33.3% whereas in comparison group having asthma 16.6% and bronchiolitis 16.6%. More than half of the children in experimental 63.3% and comparison group 56.6% were having duration of disease more than 2 weeks. More than half of the children in experimental group 53.3% were not having family history of smoking whereas in comparison group 56.6% most of the children were having family history of smoking. And more than half of the children in experimental 66.6% and comparison group 60% were not having family history of respiratory disease.

Clinical variables are shown in table 2. It shows that current diagnosis of more than half of the children in experimental group were having asthma 56.6%, whereas less than half of the children in comparison group were having pneumonia 36.6% and bronchiolitis 36.6%. More than half of the children in experimental group used saline for Nebulization 53.3% whereas in comparison group used bronchodilator 53.3%. More than half of the children in experimental 53.3% and comparison group 60% were having 4 hourly Nebulization. Majority of children in experimental and comparison group were having use of antibiotics 100%. Chi-square was applied in between experimental & comparison group of participant characteristics and clinical variables and all are found to be non-significant. So it infers that experimental and comparison group of participant characteristics and clinical variables were homogenous and comparable.

Hypothesis Testing

We accepted the research hypothesis 1(Table 3), in which post intervention respiratory status was more improved in experimental group as compared to comparison group. There was no-significant difference was found on post-intervention 1st (t= 1.17, p=0.24) in experimental & comparison group, where as the mean respiratory status was improved in experimental & comparison group on post-intervention 2nd (t=2.47, p=0.01) & 3rd (t=6.27, p=0.001).

Further in table 4 the differences between the mean respiratory status in experimental & comparison group was statistically significant as evaluated by repeated measure ANOVA (p=0.001) and post hoc was applied to find out the significant difference occurred at four time points.

We partially accepted the research hypothesis 2 (table 5 & 6), participant characteristics in experimental group there was no significant association of age F=1.04, P=0.39, gender t=2.13, P=0.42, Past h/o of respiratory disease t= 0.46, p=0.64, duration of disease t= 0.03, p=0.97, family h/o smoking t= 0.92, p=0.36, family h/o respiratory disease t=1.53, p=0.36 among children with their respiratory status. In comparison group there is no significant association of age F=0.91, P=0.41, gender t=0.36, P=0.71, Past h/o of respiratory disease t= 0.39, p=0.69, duration of disease t= 1.23, p=0.22 of children with their respiratory status except family h/o smoking t= 1.03, p=0.001, family h/o respiratory disease t=2.85, p=0.008 which was found to be statistically significant at 0.05 level of significance.

Clinical variables in experimental group, there is no significant association of current diagnosis of child F=0.69, p=0.50, type of Nebulization medication administration t=0.80, P=0.42, frequency of nebulization administration F= 0.09, p= 0.96, use of antibiotics F=0.35, p=0.78) among children with their respiratory status. In comparison group also, there is no significant association of current diagnosis of child F=0.45, p=0.64, type of medication administration t=0.39, P=0.69, frequency of nebulization administration F= 0.21, p= 0.88, use of antibiotics F=0.36, p=0.78 in children with their respiratory status.

This shows that there is no significant association of respiratory status among children undergoing nebulization therapy with their selected variables except family h/o smoking and family h/o respiratory disease.

Table 1: Homogeneity of participant characteristics in experimental & comparison group.

S.no	Demographic variables	Experiment group (n-30) f (%)	Comparison group (n-30) f (%)	Chi-square (χ^2)	df	p value
1.	**Age**					
1.1	5-8year	20(66.6)	17 (56.6)	5.34	2	0.06^{NS}
1.2	9-13year	9(30)	6 (20)			
1.3	14-18year	1(3.33)	7(23.3)			
2.	**Gender**					
2.1	Male	17(56.6)	18(60)	0.06	1	0.79^{NS}
2.2	Female	13(43.3)	12(40)			
3.	**Past h/o any respiratory disease**					
3.1	Yes	18(60)	16(53.3)	0.27	1	0.60^{NS}
3.2	No	12(40)	14(46.6)			
	If yes, Specify					
3.1.1	Asthma	10(33.3)	5(16.6)			
3.1.2	Pneumonia	4(13.3)	4(13.3)	4.30	3	0.23^{NS}
3.1.3	WLARTIs	3(10)	2(7)			
3.1.4	Bronchiolitis	1(3.33)	5(16.6)			
4.	**Duration of disease**					
4.1	<1 week	1(3.33)	0(0)			
4.2	>1 week	10(33.3)	13(43.3)	0.19	1	0.66^{NS}
4.3	>2 week	19(63.3)	17(56.6)			
5.	**Family h/o smoking**					
5.1	Yes	14(46.6)	17(56.6)			
5.2	No	16(53.3)	13(43.3)			
	If yes, Specify					
5.1.1	Grandfather	4(13.3)	9(30)			
5.1.2	Father	10(33.3)	8(26.6)	1.87	1	0.17^{NS}
5.1.3	Mother	0(0)	0(0)			
6.	**Family h/o respiratory disease**					
6.1	Yes	10(33.3)	12(40)			
6.2	No	20(66.6)	18(60)			
7.	**If yes, Specify**					
6.1.1	Grandfather	3(10)	3(10)			
6.1.2	Father	6(20)	9(30)	1.43	2	0.48^{NS}
6.1.3	Mother	1(3.33)	0 (0)			

Table 2: Homogenity of clinical variables in experimental & comparison group.

S.no	Clinical variables	Experiment group (n-30) f(%)	Comparison group (n-30) f(%)	Chi-square	df	p-value
1.	**Current diagnosis of child**					
1.1	Pneumonia	9(30)	11(36.6)			
1.2	Bronchiolitis	4(13.3)	11(36.6)	6.70	2	0.61^{NS}
1.3	Asthma	17(56.6)	8(26.6)			
2.	**Type of medication used in Nebulization**					
2.1	Saline	16(53.3)	14(46.6)	0.26	1	0.60^{NS}
2.2	Bronchodilator	14(46.6)	16(53.3)			
3.	**Frequency of Nebulization administration**					
3.1	Every 2 hourly	7(23.3)	3(10)			
3.2	Every 4 hourly	16(53.3)	15(50)	3.10	3	0.37^{NS}
3.3	Every 6 hourly	4(13.3)	8(26.6)			
3.4	Every 8 hourly	3(10)	4(13.3)			
4.	**Use of Antibiotics**					
4.1	Yes	30 (100)	30(100)			
4.2	No	0(0)	0(0)			
	Specify					
4.1.1	Ceftriazone	11(36.6)	9(30)			
4.1.2	Tazobactam	11(36.6)	11(36.6)	2.34	3	0.50^{NS}
4.1.3	Piperacillin	5(16.6)	9(30)			
4.1.4	Amikacin	3(10)	1(3.33)			

Table 3: Mean, Mean Difference, S.D of Difference, Standard Error of mean difference and 't' value after Administration of Breathing Exercises as Therapeutic Play among Children undergoing Nebulization Therapy in Experimental and Comparison Group, N=60.

Intervention	Group	Mean ±SD	M_D	SE_{MD}	't'value	'p'value
Post-intervention-1	Experimental Comparison	6.90 ±2.46 7.60 ±2.12	0.70	0.59	1.17	0.24^{NS}
Post-intervention-2	Experimental Comparison	5.23± 1.94 6.43 ±1.81	1.20	0.48	2.47	0.01*
Post-intervention-3	Experimental Comparison	3.30± 1.26 5.46 ±1.40	2.16	0.34	6.27	0.001*

Maximum score= 12

Minimum score= 0 't' (1.17, 2.47, 6.27) = 2.00($p \leq 0.05$)

*significant ($p \leq 0.05$)-NS not significant ($p > 0.05$)

Table 4: Repeated measure ANOVA showing comparison of respiratory status pre-intervention to 3rd post-intervention in experimental and comparison group, N=60.

Group	Intervention	Mean± SD	df	F	p-value
Experimental group (n=30)	Pre-intervention	8.33± 2.84	3/87	128.3	0.001*
	Post-intervention-1	6.90 ±2.46			
	Post-intervention-2	5.23± 1.94			
	Post- intervention-3	3.30± 1.26			
Comparison group (n=30)	Pre-intervention	8.23 ±2.45	3/87	78.2	0.001*
	Post-intervention-1	7.60 ±2.12			
	Post-intervention-2	6.43 ±1.81			
	Post-intervention-3	5.46 ±1.40			

*significant ($p \leq 0.05$) -NS not significant ($p > 0.05$)

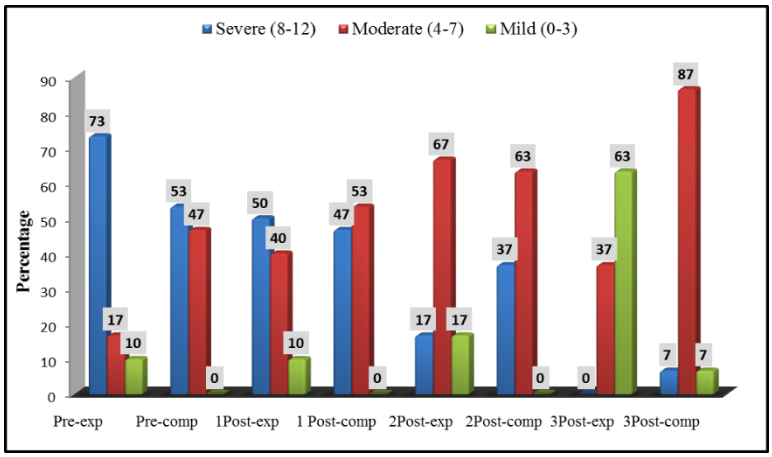

Fig 1: Bar Diagram showing Respiratory Status among Children undergoing Nebulization therapy in Experimental and Comparison Group.

Table 5: Association of respiratory status among children undergoing Nebulization therapy in experimental & comparison group participant characteristics.

S.no	Demographic variables	Experimental group				Comparison group			
		Mean	df	F/t	p- value	Mean	df	F/t	p-value
1.	**Age**								
1.1	5-8yr	3.20				5.18			
1.2	9-13yr	3.67	2/9	1.04	0.39^{NS}	5.67	2/27	0.91	0.41^{NS}
1.3	14-18yr	2.00				6.00			
2.	**Gender**								
2.1	Male	3.71	28	2.13	0.42^{NS}	5.39	28	0.36	0.71^{NS}
2.2	Female	2.77				5.58			
3.	**Past h/o respiratory disease**								
3.1	Yes	3.39	28	0.46	0.64^{NS}	5.56	28	0.39	0.69^{NS}
3.2	No	3.17				5.36			
	If yes, Specify								
3.1.1	Asthma	3.30				6.40			
3.1.2	Pneumonia	3.75	3/5	0.14	0.92^{NS}	5.25	3/13	1.05	0.40^{NS}
3.1.3	WALRTIs	3.33				4.67			
3.1.4	Bronchiolitis	3.00				5.60			
4.	**Duration of disease**								
4.1	<1 week	3.30	18	0.03	0.97^{NS}	5.08	28	1.23	0.22^{NS}
4.2	>1 week	3.32				5.77			
5.	**Family h/o smoking**								
5.1	Yes	3.07	28	0.92	0.36^{NS}	5.24	28	1.03	0.001^{*}
5.2	No	3.50				5.77			
5.1.1	**If yes, Specify**								
5.1.2	Grandfather	2.75	3	1.50	0.23^{NS}	6.22	15	4.07	0.06^{NS}
	Father	3.20				4.13			
6.	**Family h/o respiratory disease**								
6.1	Yes	3.60	1	1.53	0.36^{NS}	4.67	28	2.85	0.008^{*}
6.2	No	3.15				6.00			
6.1.1	**If yes, Specify**								
6.1.2	Grandfather	3.33	2/7	0.27	0.76^{NS}	4.67	10	0.001	1.00^{NS}
6.1.3	Father	3.83				4.67			
	mother	3.00				0			

Table 6: Association of respiratory status among children undergoing nebulization therapy in experimental & comparison group with clinical variables.

S.no	Demographic variables	Experimental group				Comparison group			
		Mean	df	F/t	p- value	Mean	df	F/t	p-value
1.	**Current diagnosis of child**								
1.1	Pneumonia	3.22	2/27	0.69	0.50^{NS}	5.36	2/27	0.45	0.64^{NS}
1.2	Bronchiolitis	4.00				5.27			
1.3	Asthma	3.18				5.88			
2.	**Type of medic--ation used in nebulization**								
2.1	Saline	3.13	28	0.80	0.42^{NS}	5.36	28	0.39	0.69^{NS}
2.2	Bronchodilator	3.50				5.56			
3.	**Frequency of nebulization administration**								
3.1	Every 2 hourly	3.43				5.00			
3.2	Every 4 hourly	3.31	3/26	0.09	0.96^{NS}	5.40	3/26	0.21	0.88^{NS}
3.3	Every 6 hourly	3.00				5.75			
3.4	Every 8 hourly	3.33				5.50			
4.	**Use of antibiotics**								
4.1	Yes	3.30	-	-	-	5.47	-	-	-
4.2	No	0				0			
	If yes, Specify								
4.1.1	Ceftriazone	3.18				5.11			
4.1.2	Tazobactam	3.18	3/26	0.35	0.78^{NS}	5.55	3/26	0.36	0.78^{NS}
4.1.3	Piperacillin	3.40				5.78			
4.1.4	Amikacin	4.00				5.00			

Discussion

In the present study, the mean post-intervention on day 1st the respiratory status in experimental group was 6.90 and in comparison group it was 7.60 with a mean difference of 0.70, the computed 't' value was found to be not significant t= 1.17, p=0.24 at 0.05 level of significance. On post-intervention day 2nd the respiratory status in experimental group was 5.23 and in comparison group it was 6.43, with a mean difference of 1.20, and the computed 't' value was found to be statistically significant t=2.47, p=0.01* at 0.05 level of significance. On post-intervention day 3rd the respiratory parameters in experimental group was 3.30 and in comparison group it was 5.46, with a mean difference of 2.16, and the computed 't' value was found to be statistically significant t=6.27, p=0.001* at 0.05 level of significance. The study findings were consistent with findings of Vimala Arul, conducted a study to evaluate the effectiveness of strelinkova breathing exercises on respiratory sign and parameters among children with lower respiratory tract infections. The results of the study showed that there is significant differences in independent 't' test regarding respiratory sign('t' value= 5.2), peak flow rate ('t' value= 16) and oxygen saturation level ('t' value= 5.27) at $p<0.05$ level of significance between experimental and comparison group [13]. The study findings were consistent with the findings of Beulah Hephzibah *et al*., Conducted a study to assess the effectiveness of blow bottle exercises on Respiratory status among children with lower respiratory tract infections. The result showed that in pre-assessment the overall mean of respiratory status in study group was 13.9 with SD of 5.45 whereas in control group was 138.63 with SD 4.88. In post-assessment mean value in study group 125.4 with SD 2.94 and the respiratory parameters within the study group and control group pre assessment and post-assessment day 2 and 3 were found statistically significant at level of 0.001 [11].

Conclusion

Conclusion drawn from the findings of the study was respiratory status of children improved significantly in experimental group where breathing exercises as therapeutic play was administered along with nebulization therapy as compared to comparison group. So it is concluded that Breathing exercises as therapeutic play was effective in improving the respiratory status among children undergoing nebulization therapy with lower respiratory tract disorders.

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Ethical approval and consent to participate

The study was approved by ethics committee at Maharishi Markandeshwar Institute of Medical Science & Research, Maharishi Markandeshwar University. Written informed consent was obtained from all participants.

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