

## Low Intensity Laser Therapy Added to Conventional Chest Physical Therapy Improves Treatment of Children with Bronchopneumonia

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**Abstract:** Pneumonia is the leading cause of child death worldwide, causing the deaths of more than 2 million of children every year. The aim of this study was to detect values of laser therapy added to the conventional chest physical therapy includes inspiratory muscle training and postural drainage in management of children with bronchopneumonia. Forty children with bronchopneumonia, their age ranged between 3 to 5 years and were included into 2 equal groups; group (A) received low intensity laser therapy, inspiratory muscle training using incentive spirometer associated with postural drainage in addition to medical treatment at a frequency of 3 sessions per week for one month. The second group (B) received inspiratory muscle training using incentive spirometer associated with postural drainage in addition to medical treatment. Measurements of IgG, WBCs, CRP and SaO<sub>2</sub> were obtained for both groups before treatment and after one month at the end of the treatment program. The mean values of WBCs and CRP were significantly lower, where the mean values of IgG and SaO<sub>2</sub> were significantly higher in both groups after treatments. There were significant differences between mean levels of the investigated parameters in group (A) and group (B) after treatment. Laser acupuncture therapy added to inspiratory muscle training combined postural drainage is of value in management of children with bronchopneumonia

**Key words:** Inspiratory muscle training • Postural drainage • Laser acupuncture therapy • Bronchopneumonia

### INTRODUCTION

Pneumonia occurs in an estimated 156 million children aged under 5 years and causes approximately a fifth of all deaths among such children, most of whom are in low-income nations [1-3]. Pneumonia is defined as an infection involving the alveoli of the lungs [4]. The most useful classification of pneumonia is based on the site of acquisition: community-acquired or hospital-acquired pneumonia. More than 95% of all new cases of pneumonia worldwide occur in developing countries [5].

Immunoglobulin G (IgG) is the most common Immunoglobulin found in the airway and alveolar space secretions diffusing into the lungs from the blood. With an absolute or functional deficiency of respiratory tract IgG recurrent and chronic types of infections occur [6]. Low level laser has an exciting role both in

immunobiological functions for immune system disease and to activate the normal reaction of the immune system components against harmful bodies [7].

Chest physical therapy represents a collection of diverse techniques designed to help clear airway secretions, improve distribution of ventilation and enhance efficiency and conditioning of respiratory muscles. These methods include positioning techniques, chest percussion and vibration, directed coughing and various breathing conditioning exercises [8]. Incentive spirometer was used to improve cough mechanism through improving inspiratory capacity and strengthen of the diaphragm [9].

The aim of this study was to detect values of laser therapy addition to the conventional chest physical therapy includes inspiratory muscle training and postural drainage in management of children with bronchopneumonia.

## MATERIALS AND METHODS

**Subjects:** Forty bronchopneumonia children of both sexes (22 girls and 18 boys), their age ranged between three and five years, they were in the first attack of pneumonia, they were free from any other chest problem, they were presented with bronchopneumonia. Subjects were included into 2 equal groups; group (A) received low intensity laser therapy, inspiratory muscle training using incentive spirometer associated with postural drainage assisted with vibration according to the site of pulmonary secretions in addition to medical treatment at a frequency of 3 sessions per week for one month. The second group (B) received inspiratory muscle training using incentive spirometer associated with postural drainage assisted with vibration according to the site of pulmonary secretions in addition to medical treatment. Informed consent was obtained from all participant parents. All participant parents were free to withdraw their children from the study at any time. If any adverse effects had occurred, the experiment would have been stopped, with this being announced to the Human Subjects Review Board. However, no adverse effects occurred and so the data of all the participants were available for analysis.

## Materials

### Evaluated Parameters

**A. Immune System Response:** Laboratory kits, centrifuge and disposable plastic syringes were used to measure immunoglobulin G (IgG) level in the serum, Acetic acid for white blood cells (WBCs) and Avitex RF for C - reactive protein (CRP). ADVIA 120 (by Bayer) was used for detection of WBCs.

**B. Arterial Oxygen Saturation (SaO<sub>2</sub>):** Pulse oximeter (Driesen + Kern GmbH, Germany) with a special sensor was used to measure SaO<sub>2</sub> non-invasively.

**Low Intensity Laser Therapy:** Gallium-Arsenide Laser (LTU - 904 H, Class I laser product manufactured by Laserex technologies PTY LTD, Australia, its maximum peak power was 5 watt, wave length equal  $904 \pm 10$  nm and pulse length equal 200 ns was applied on the acupuncture points of the immune system three sessions per week, 90 seconds for each acupuncture point, for one month. The child was bare skin; the sites of acupuncture points were detected and confirmed by the acupuncture point detector (Acuhealth professional 900 Acuhealth Australia) and cunometer for the respiratory system disorders. Both the patient and the therapist used protective glasses. The acupuncture

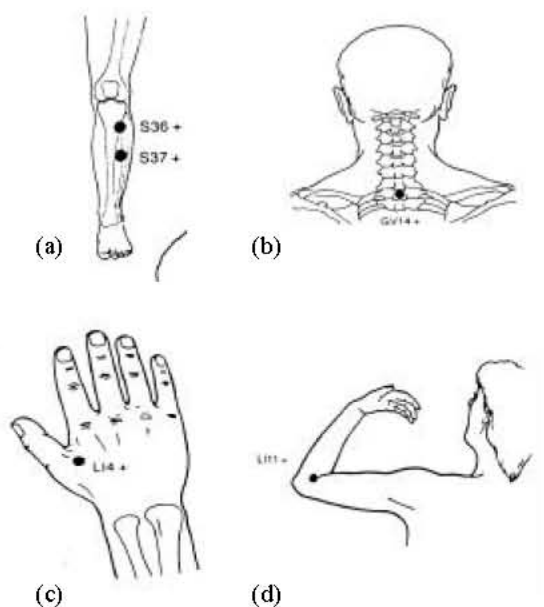


Fig. 1 a, b, c and d: The acupuncture points for the immune system [10].

points of the immune system are Dubi (St.36), Zusanli (St.37), Quchi (L.I.11), Dazhui (GV.14) and Hegu (L.I. 4) (Figure 1a,b,c and d) [10].

**Respiratory Muscle Training:** Incentive spirometer (Meddiciser, manufactured by Eastern dikit Company, India) which is a device consisted of three plastic tubes with graduated scale and ball and mouth piece. The child was asked to inhale through mouthpiece so that the ball moved upward on a graduated scale and maintained up as much as possible. This scale express thee amount of air inspired through the mouth piece connected with it. The child was encouraged to take more deep breath through the mouth piece to move the ball more up and to increase number of balls lifted. Incentive spirometer gives feedback on inspiratory effectiveness as a modality of respiratory muscle training. Each child was asked to breathe deeply for three times then relax and apply that for six cycles [11].

**Postural Drainage and Vibration:** By using vibrator (Germany-Thrive 707) with frequency 50-60 Hertz (HZ). Vibrator was applied on chest wall for ten minutes for both lungs while the child was in the postural drainage for assisting in clearance of pulmonary secretions [11].

**Statistical Analysis:** The mean values of IgG, WBCs, CRP and SaO<sub>2</sub> obtained before and after one month in both groups were compared using paired "t" test. Independent "t" test was used for the comparison between the two groups (P<0.05).

## RESULTS

Forty children with bronchopneumonia were included into 2 equal groups; group (A) received low intensity laser therapy, inspiratory muscle training and postural drainage in addition to medical treatment at a frequency of 3 sessions per week for one month. The second group (B) received inspiratory muscle training and postural drainage assisted in addition to medical treatment. The mean values of WBCs and CRP were significantly lower, where the mean values of IgG and SaO<sub>2</sub> were significantly higher in both groups after treatments (Table 1&2 and Figure 2&3 ). There were significant differences between mean levels of the investigated parameters in group (A) and group (B) after treatment (Table 3 and Figure 4). These results support addition of laser acupuncture therapy to inspiratory muscle training and postural drainage in clinical management of children with bronchopneumonia.

Table 1: Mean, standard deviation and significance of I gG, WBCs, CRP and SaO<sub>2</sub> in group (A) before and after treatment

	Mean ±SD		T-value	Significance
	Before	After		
IgG(mg/dl)	0.62±0.17	0.93±0.14	3.74	P <0.05
WBCs(thousands/mm <sup>3</sup> )	14.86±2.48	7.67±1.92	3.82	P <0.05
CRP(mg/dl)	17.80±2.18	7.97±2.83	3.91	P <0.05
SaO <sub>2</sub> (%)	91.81±4.28	98.76±5.42	6.54	P <0.05

Table 2: Mean, standard deviation and significance of I gG, WBCs, CRP and SaO<sub>2</sub> in group (B) before and after treatment

	Mean±SD		T-value	Significance
	Before	After		
IgG(mg/dl)	0.63±0.19	0.79±0.12	3.42	P <0.05
WBCs(thousands/mm <sup>3</sup> )	14.32±2.56	11.21±2.78	3.68	P <0.05
CRP(mg/dl)	18.45±2.32	13.15±2.86	3.27	P <0.05
SaO <sub>2</sub> (%)	91.85±4.23	94.12±3.61	5.47	P <0.05

Table 3: Mean, standard deviation and significance of I gG, WBCs, CRP and SaO<sub>2</sub> in group (A) and group (B) after treatment

	Mean ±SD		T-value	Significance
	Group ( A)	Group (B)		
IgG(mg/dl)	0.93±0.14	0.79±0.12	3.36	P <0.05
WBCs(thousands/mm <sup>3</sup> )	7.67±1.92	11.21±2.78	3.91	P <0.05
CRP(mg/dl)	7.97±2.83	13.15±2.86	3.82	P <0.05
SaO <sub>2</sub> (%)	98.76±5.42	94.12±3.61	3.54	P <0.05

IgG = Immunoglobulin G; CRP = C-reactive protein; WBCs = White blood cells; SaO<sub>2</sub> = Arterial oxygen saturation

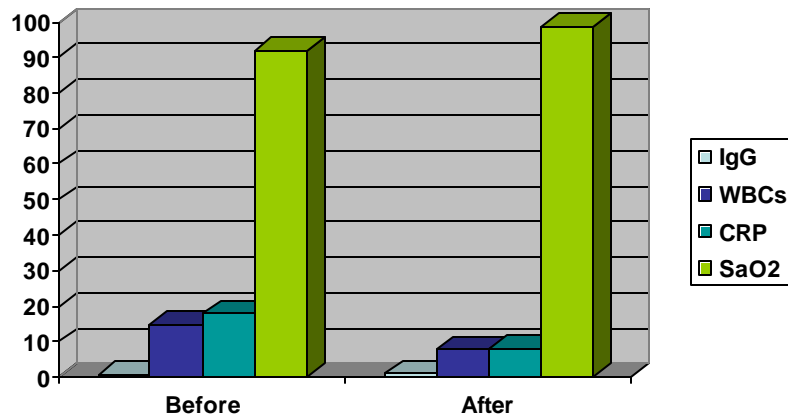


Fig. 2: Mean, standard deviation and significance of I gG, WBCs, CRP and SaO<sub>2</sub> in group (A) before and after treatment

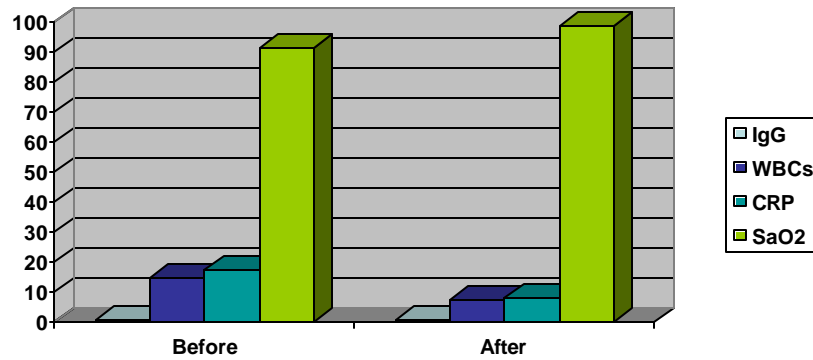


Fig. 3: Mean, standard deviation and significance of I gG, WBCs, CRP and SaO<sub>2</sub> in group (B) before and after treatment

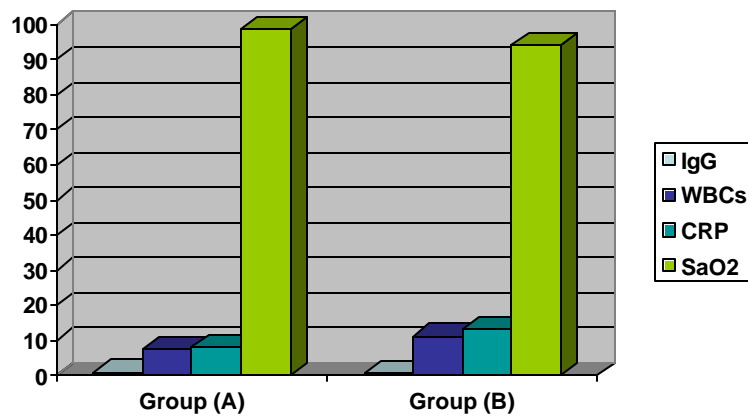


Fig. 4: Mean, standard deviation and significance of I gG, WBCs, CRP and SaO<sub>2</sub> in group(A) and group (B) after treatment

## DISCUSSION

Results of this study indicated that low intensity laser therapy added to the conventional chest physical therapy includes inspiratory muscle training and postural drainage improves treatment of children with bronchopneumonia. These results were supported and confirmed by previous studies.

Macrophage activity and level of secretory IgA were increased in patients with chronic bronchitis after low intensity laser therapy [12]. Also, the increased value of IgG serum level post laser acupuncture therapy may be attributed to enhance activities of cellular and humoral immunity in lymph nodes and lymphocytes [13]. The significant improvement in value of WBCs following application of laser therapy was due to activation of alveolar macrophages & phagocytes and anti-inflammatory effect [14].

Improvement of CRP after application of laser therapy was due to activation of nonspecific mechanisms of infectious immunity, intensifying antibacterial activity of serum and activation of phagocytosis [15]. Marked broncholytic effect due to its anti-inflammatory effect, improvement in patency of the peripheral bronchi are the mechanisms by which laser therapy improves the value of  $\text{SaO}_2$  in children with bronchial asthma [16].

Safe and effective physiotherapy management of infants and children with respiratory disorders includes careful positioning to optimize lung functions (ventilation and perfusion), postural drainage, percussion, vibration and breathing exercises [17].

Incentive spirometry provides the patient with visual feedback of the volume of air inspired during a deep breath. It provides low – level resistive training while minimizing the potential of fatigue to the diaphragm. It has been used to enhance lung expansion and inspiratory muscle strength [18]. Respiratory muscle training by incentive spirometer increases production of surfactant which leads to reducing surface tension, increasing lung compliance, decreasing the work of breathing and opening of collapsed alveoli to prevent atelectasis. The improvement of total lung and thoracic compliance may be contributed to increase partial arterial pressure of oxygen ( $\text{PaO}_2$ ) and arterial oxygen saturation ( $\text{SaO}_2$ ) [9,19,20].

## CONCLUSION

It is recommended to perform laser acupuncture therapy in addition to inspiratory muscle training using incentive spirometer associated with postural drainage

assisted with vibration in clinical management of children with bronchopneumonia.

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