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"IMMEDIATE EFFECT OF INTERCOSTAL STRETCH VERSUS VERSUS ANTERIOR BASAL LIFT ON RESPIRATORY RATE, CHEST EXPANSION AND SPIROMETRY IN ACUTE STROKE PATIENTS"

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ABSTRACT

Backround –

Stroke, when present for considerable duration or when it has a greater extent,often leads to respiratory complications like abnormal breathing pattern and restricted chest wall movement etc. There are many therapeutic techniques which can improve respiratory functions.1 Literature says that respiratory PNF is a technique which alters the rate and depth of breathing and helps to improve respiratory muscle activity. Amongst this,intercostal stretch and anterior basal lift are the techniques which enhance chest wall elevation, chest expansion, diaphragm excursion and respiratory muscle activity thereby increasing intrathoracic lung volume.

Aim –

To assess the immediate effect of intercostal stretch versus anterior basal lift on respiratory rate, chest expansion and incentive spirometry in acute stroke patients.

Method –

44 acute MCA stroke patients were taken for the study. The subjects were be divided into 2 groups. Incentive spirometry, respiratory rate and chest expansion will be taken pre-intervention. Group A were given conventional physiotherapy and intercostal stretch and group B were given conventional physiotherapy and anterior basal lift. 10 repetitions of conventional exercise were given with 1-2 min of rest period. Respiratory PNF were given for 3 breaths with 1 min of rest for 3 repetitions. Total treatment

protocol were for 45 to 50 mins. Then post-intervention respiratory rate, chest expansion and incentive spirometry were taken.

Outcome Measures –

1.Respiratory rate 2.Chest expansion 3.Incentive spirometry

Result - p value of respiratory rate and chest expansion is not significant across both the time frames as well as difference score at 5% level significance. P value of spirometry is less than 5% level of significance. Clinically there is significant effect of respiratory PNF on respiratory rate, chest expansion and spirometry in acute stroke patients.

Conclusion – The study concluded that respiratory PNF along with conventional physiotherapy has positive effects on respiratory parameters like respiratory rate, chest expansion and spirometry in acute stroke patients.

Key words : Acute stroke, Respiratory PNF, Intercostal stretch, Anterior basal lift, Incentive spirometry

INTRODUCTION

Stroke which is also called as cerebrovascular accident is one of the most prevalent brain illnesses that results in long-term disability[1]. It is defined as sudden loss of neurological function caused by an interruption of blood flow to the brain[2]. Ischemic or hemorrhagic abnormalities of cerebral blood circulation can cause a stroke[3]. It is a type of acute neurological dysfunction with signs and symptoms that correlate to the involvement of specific brain areas. According to the World Health Organization, stroke is "a focal neurological impairment of sudden onset and lasting more than 24 hrs and of presumed vascular origin[1].

Due to stroke patient suffers from flaccidity, areflexia, affected sensation like touch, pain, temperature, pressure, language and speech disorders, dysphagia, bowl and bladder impairment, etc [2] . The skeletal system's weakness following a stroke affects not only the peripheral muscles, but also respiratory muscle strength, chest wall motion, and postural thorax dysfunction[4]. Flaccidity and areflexia is gradually replaced by spasticity and hyperreflexia[2]. Because of neurological and musculoskeletal system deficiencies associated with brain damage, a stroke is frequently accompanied by secondary complications such as nutritional and metabolic issues, endocrine dysfunction, behavioural problems[5].

Out of all the respiratory disorders are more likely to cause problems with respiration and these are more related to life. The key muscle for inspiration is the diaphragm. Internal intercostal muscles and external intercostal muscles are the two basic types of intercostal muscles. When the inspiration-expiration process happens, these muscles act in collaberation. Physical inactivity might cause this breathing muscle to undergo weakness. This may impair chest wall movement and expand the chest, as well as diminish lung compliance [6]. There are studies which also says that Acute respiratory failure affects a huge

percentage of ICU patients, and the high mortality rate is linked to some preventable variables including the length of stay in the ICU.[7]

The respiratory disorders are abnormal breathing pattern, restricted chest wall movements, swallowing dysfunction, reduced strength and endurance of respiratory muscles, etc.[5,8] Stroke-related respiratory problems can be caused by discrete or diffuse lesions to critical components of the respiratory controller[9]. The respiratory alterations are dependent on the central structures affected by stroke and may be linked to trunk postural dysfunctions induced by hemiplegia/hemiparesis, resulting in respiratory mechanics impairment, asymmetry, and decreased chest wall displacement and ventilation[10]. Therefore, therapies for stroke patients should focus on improving exercise tolerance as well as respiratory muscle adequacy [4].

There are many techniques like breathing exercise, chest expansion exercise, respiratory muscle training which improves respiratory functions [11]. Out of which respiratory PNF is the technique which alters the rate and depth of breathing. Respiratory PNF helps to improve respiratory muscle activity and breathing pattern [6].

PNF (Proprioceptive Neuromuscular Facilitation) is a type of stretching in which a muscle is stretched passively and constricted alternately[1]. Neurophysiological facilitation of respiration is used to describe externally applied proprioceptive and tactile stimuli that produces reflex respiratory movement response [12]. In a healthy person, type I and type II fibres are equally numerous in the diaphragm, but type II fibres are more prevalent in the intercostal muscles[13]. Intercostal stretch(IC), higher thoracic spine vertebral pressure, lower thoracic spine vertebral pressure, anterior stretch lift to the posterior basal area, mild manual pressure, perioral pressure, and abdominal co-contraction are all facilitatory stimuli[1].

Out of all respiratory PNF techniques intercostal stretching is a PNF technique that aids in the improvement of breathing patterns and respiratory muscle function. The IC stretch improves chest wall elevation, chest expansion, and diaphragm excursion, all of which contribute to increased intrathoracic lung volume and a higher flow rate percentage [6].

Another respiratory PNF technique is anterior basal lift, which promotes respiratory muscle activity and thus intra-thoracic lung volume, contributing to an increase in flow rate percentage [6].

In this study we had compared intercostal stretch and anterior basal lift in acute stroke patients and checked their effects on respiratory rate, chest expansion and spirometry.

AIM AND OBJECTIVES

AIM: To see the immediate effect of Intercostal stretch versus Anterior basal lift on respiratory rate, chest expansion and spirometry in acute Stroke patients

OBJECTIVES:

- To find out the effect of intercostal stretch on respiratory rate, chest expansion and spirometry in acute stroke patients.
- To find out the effect of anterior basal lift on respiratory rate, chest expansion and spirometry in acute stroke patients.
- To assess the respiratory rate, chest expansion and spirometry in acute stroke patients.
- To see the immediate effect of intercostal stretch versus anterior basal lift on respiratory rate, chest expansion and spirometry in acute stroke patients.

MATERIALS AND METHODOLOGY:

Ethical clearance was obtained from the Institutional Ethical Committee. Subjects were selected according to the inclusion criteria and exclusion criteria and were divided into 2 groups. Prior to the study subjects were explained the procedure in vernacular language. A written informed consent was taken from the subjects prior to the intervention. Before the intervention subjects pre values were taken by the measuring respiratory rate, chest expansion and spirometry. Patients in Group A were given conventional physiotherapy along with Intercostal Stretch. Patient in Group B were given conventional physiotherapy along with Anterior Basal Lift. After the intervention subjects post values were taken by measuring respiratory rate, chest expansion and spirometry . The immediate effect of intercostal stretch was noted on respiratory rate, chest expansion and spirometry was noted in acute stroke patients. The immediate effect of anterior basal lift on respiratory rate, chest expansion and spirometry was noted in acute stroke patients. Then comparison between the effects of intercostal stretch and anterior basal lift on respiratory rate, chest expansion and spirometry in acute stroke patients was done and results were noted.

Pre intervention respiratory rate, chest expansion and spirometry was measured. Patient is then taken to supine position and group A was given with intercostal stretch along with conventional physiothetapy and group B was given with anterior basal lift along with conventional physiotherapy.

GROUP A : Intercostal Stretch along with Conventional Physiotherapy

Conventional physiotherapy –

- Inspiratory diaphragm breathing exercise and expiratory pursed lip breathing exercise –
- Therapist places their hand on superior rectus abdominis and then instruct the patient to breath in deeply and slowly through nose while this therapist applies resistance .
- Immediately after completion of this patient is asked to continuously exhale air while puckering the lips.

Thoracic mobility exercise –

- In standing – The patient should stand straight with knees straight, the patient instructed to exhale while bending forward to touch the floor with arm then patient should extend up by lifting his hands simultaneously taking a deep inspiration.
- In sitting – the patient should exhale while bending forward to touch the floor with arms crossed at the feet then patient should extend up while taking deep inspiration.

Intercostal stretch –

- Subject positioned in supine position, limbs in neutral position
- Therapist stands behind the patient
- The technique is applied over 2nd and 3rd rib and is given with index finger
- Pressure is applied in downward direction towards next rib and is applied during expiration phase

GROUP B: Anterior Basl Lift along with Conventional Physiotherapy

Conventional physiotherapy –

- Inspiratory diaphragm breathing exercise and expiratory pursed lip breathing exercise –
- Therapist places their hand on superior rectus abdominis and then instruct the patient to breath in deeply and slowly through nose while this therapist applies resistance .
- Immediately after completion of this patient is asked to continuously exhale air while puckering the lips.

Thoracic mobility exercise –

- In standing – The patient should stand straight with knees straight, the patient instructed to exhale while bending forward to touch the floor with arm then patient should extend up by lifting his hands simultaneously taking a deep inspiration.
- In sitting – the patient should exhale while bending forward to touch the floor with arms crossed at the feet then patient should extend up while taking deep inspiration

Anterior basal lift –

- The patient is positioned in supine position
- The hand placement of therapist is under the posterior ribs of supine patient
- The procedure is performed by gently lifting the ribs upward
- The lift is maintained which provides maintained stretch and pressure posteriorly and stretches anteriorly also
- This can be performed bilaterally if patient is small enough

Protocol for exercise –

For conventional physiotherapy

- 10 repetitions of each exercise with 1 to 2 min of rest after each exercise.

For respiratory PNF –

Applied for 3 breaths with 1 min of rest 3 repetitions

- Total treatment protocol will be for 45 to 50 min.

Post intervention respiratory rate, chest expansion and spirometry was taken. Both pre and post test data was compared and the effect was evaluated.

RESULT:

Data analysis was performed using Statistical Package for Social Science [SPSS] version 23 Software. The level of significance of pre and post test respiratory rate, chest expansion and spirometry within group was calculated using Wilcoxon test. Comparison between two groups is done by using Mann Whitney Test.

Normality test using Kolmogorov-Smirnova

Variable	Time frame	Intercostal Group		Anterior Group	
		z-value	p-value	z-value	p-value
RR	Pre	0.139	0.200	0.217	0.009
	Post	0.159	0.155	0.221	0.007
	Diff	0.280	0.001	0.318	0.001
Chest expansion	Pre	0.150	0.200	0.118	0.200
	Post	0.121	0.200	0.126	0.200
	Diff	0.206	0.016	0.274	0.002
Spirometry	Pre	0.202	0.020	0.160	0.148
	Post	0.227	0.005	0.264	0.001
	Diff	0.452	0.001	0.280	0.001

Data set for group Intercostal is not normally distributed as the variables have indicated significant outcome in the observation. The researcher shall use non-parametric test for data analysis purpose in the following sections for Group Intercostal

Data set for group Anterior is not normally distributed as the variables have indicated significant outcome in the observation. The researcher shall use non-parametric test for data analysis purpose in the following sections for Group Anterior

Between groups Mann Whitney Test

	Group	Mean	SD	z –value	p –value
Age	Intercostal	49.63	8.79	0.419	0.678
	Anterior	50.72	8.48		

Within group Pre and post Wilcoxon test for Group Intercostal

Variable	Pre		Post		Diff		Effect size	z – value	p – value
	Mean	SD	Mean	SD	Mean	SD			
RR	19.55	2.30	17.45	2.11	2.09	0.68	3.06	14.343	0.001*
Chest expansion	1.11	0.26	1.34	0.24	0.23	0.09	2.43	11.400	0.001*
Spirometry	454.55	147.12	627.27	157.91	172.73	45.58	3.79	17.773	0.001*

From the above within groups' analysis using Wilcoxon paired test, it is observed that RR mean value indicated changes post treatment and lower mean values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value.

The effect size Cohen's D indicates 3.03 value which is assumed to be very high in effect size as per the standard parameters of reference.

Thus reference to the results of the Wilcoxon test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

Within group Pre and post Wilcoxon test for Group Anterior

Variable	Pre		Post		Diff		Effect size	z – value	p – value
	Mean	SD	Mean	SD	Mean	SD			
RR	20.18	2.08	18.18	1.87	2.00	0.62	3.24	15.199	0.001*
Chest expansion	1.18	0.26	1.47	0.23	0.29	0.08	3.59	16.821	0.001*
Spirometry	531.82	167.29	740.91	133.31	209.09	68.38	3.06	14.343	0.001*

From the above within groups' analysis using Wilcoxon paired test, it is observed that RR mean value indicated changes post treatment and lower mean values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value.

The effect size Cohen's D indicates 3.24 value which is assumed to be very high in effect size as per the standard parameters of reference.

Thus reference to the results of the Wilcoxon test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

Between groups Mann Whitney Test

Variable	Time frame	Group	Mean	SD	z-value	p-value
RR	Pre	Intercostal	19.55	2.30	0.961	0.342
		Anterior	20.18	2.08		
	Post	Intercostal	17.45	2.11	1.211	0.233
		Anterior	18.18	1.87		
	Diff	Intercostal	2.09	0.68	0.463	0.646
		Anterior	2.00	0.62		
Chest expansion	Pre	Intercostal	1.11	0.26	0.861	0.394
		Anterior	1.18	0.26		
	Post	Intercostal	1.34	0.24	1.845	0.072
		Anterior	1.47	0.23		
	Diff	Intercostal	0.23	0.09	2.411	0.020*

		Anterior	0.29	0.08		
Spirometry	Pre	Intercostal	454.55	147.12	1.627	0.111
		Anterior	531.82	167.29		
	Post	Intercostal	627.27	157.91	2.579	0.013*
		Anterior	740.91	133.31		
	Diff	Intercostal	172.73	45.58	2.075	0.044*
		Anterior	209.09	68.38		

From the above table it is observed that between groups analysis is not significant for RR across both the time frames as well as difference score at 5% level significance. From the above table it is observed that between groups analysis is not significant for Chest expansion across both the time frames but it is significant at difference score at 5% level significance. From the above table it is observed that between groups analysis is significant for Spirometry across post time frame as well as difference score at 5% level significance

Comparative analysis between groups using effect size outcome

Variable	**Intercostal Group Effect size**	**Anterior Group Effect size**	**Remarks**
RR	3.06	3.24	Group Anterior is better
Chest expansion	2.43	3.59	Group Anterior is better
Spirometry	3.79	3.06	Intercostal Group is better

DISCUSSION:

PNF (Proprioceptive Neuromuscular Facilitation) is a type of stretching in which a muscle is stretched passively and constricted alternately. Neurophysiological facilitation of respiration is used to describe externally applied proprioceptive and tactile stimuli that produces reflex respiratory movement response. PNF technique aids in the improvement of breathing patterns and respiratory muscle function. The Intercostal Stretch improves chest wall elevation, chest expansion, and diaphragm excursion, all of which contribute to increased intrathoracic lung volume and a higher flow rate percentage .

Another respiratory PNF technique is Anterior Basal Lift, which promotes respiratory muscle activity and thus intra-thoracic lung volume, contributing to an increase iin flow rate percentage .

The highlight of this study was to evaluate the immediate effect of intercostal stretch versus anterior basal lift on respiratory rate, chest expansion and spirometry in acute stroke patients. In this study, we selected 44 acute stroke patients which were divided into two groups to see the immediate effect of intercostal stretch versus anterior basal lift on respiratory rate, chest expansion and spirometry in acute stroke patients. The results of the Wilcoxon test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention. **Khushboo C. valodwala, et al (2021),** the effectiveness of respiratory proprioceptive exercise (PNF) on respiratory functions in subacute stroke patients of south gujrat concluded positive effects of respiratory PNF on PFT parameters. Total 34 participants were taken in the study which are divided into 2 groups 17 in each group. Group A was given conventional physiotherapy and Group B was given conventional physiotherapy along with respiratory PNF. Hence the study concluded significant improvement in FVC, FEV1 FEV1/FVC ratio. In another study by **Snehaben Patel , et al (2019),** respiratory PNF was given in spastic cerebral palsy childrens to see their effect on respiratory rate and chest expansion. The intervention given was intercostal stretch, vertebral pressure and anterior stretch basal lift for 5 days a week for 2 weeks. The study concluded that neurophysiological facilitation of respiration can improve respiratory rate and chest expansion. **Payal Gupta, et al (2014),** this study examined the effect of intercostal stretch technique and anterior basal lift technique on respiratory rate, saturation of peripheral oxygen and heart rate among ICU patients. Total 30 patients were taken for the study which were divided into 2 groups. Group A was given with intercostal stretch and Group B was given eith anterior basal lift for 3 days. They concluded that IC stretch is more effective in reduction of respiratory rate and heart rate and improving oxygen saturation over anterior basal lift technique. **Hetal M. Mistry, et al (2021),** the Immediate effect of Chest Proprioceptive Neuromuscular Facilitation on Respiratory Rate, Chest Expansion and Peak Expiratory Flow Rate in patients with Chronic Obstructive Pulmonary Disease said the improvement of respiratory parameters after intervention. Total 65 participants were taken for the study and intervention given was intercostal stretch applied for 10 breaths with 1 minute rest and for 10 repetitions for approximately 35- 40 minutes. They concluded that there is immediate effect of Chest PNF- intercostal stretch on, Respiratory rate, Chest expansion at three level that is axillary, nipple and xiphisternal and Peak expiratory flow rate.

As earlier said in this study many patients with stroke will face problems with respiration leading to poor quality of life. Respiratory disorders like abnormal breathing, restricted chest wall movements, etc. Therefore respiratory muscle training should also be given in stroke patients. Hence this study focuses on improvement of respiratory parameters in stroke patients. As there are studies which says respiratory PNF has immediate effects on respiratory parameters this study focus on improving respiratory parameters by giving respiratory PNF technique. The results of this study shows significant improvement in respiratory parameters after intervention of respiratory PNF. Hence respiratory PNF is a technique which can be used is day to day practice on stroke patients for improving their respiratory functional capacity.

CONCLUSION:

Many patients with stroke suffers from respiratory problems and respiratory PNF is of the technique to improve respiratory functions in stroke patients. In this study we have divided the 44 participants in 2 groups and one group is given with intercostal stretch along with conventional physiotherapy and another group is given with anterior basal lift along with conventional physiotherapy. Comparative study between 2 groups says that group B which is provided with anterior basal lift is more effective to improve respiratory rate and chest expansion where group A which is provided with intercostal stretch is more effective for improving spirometry parameters.

LIMITATIONS :

- long term effect can be seen.
- Follow can be taken monthly.
- Other techniques of respiratory PNF can be applied.

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