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EFFECT OF DIAPHRAGMATIC BREATHING EXERCISE ON FATIGUE AND PEAK EXPIRATORY FLOW RATE IN INDIVIDUALS WITH GUILLAIN BARRE SYNDROME

Physiotherapy

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ABSTRACT

Guillain-Barre syndrome (GBS) is an acute onset, immune-mediated disorder of the peripheral nervous system. The study was conducted on 30 GBS individuals with age group between 18-45 years were included in the study. All the individuals performed diaphragmatic breathing exercise along with conventional physiotherapy for 3 weeks. The fatigue severity scale (FSS) and the peak expiratory flow rate (PEFR) was measured at baseline and completion of 3 weeks of protocol. Total of 30 GBS individuals included in the study with mean age group 35.73 6.443 years. The pre and post scores comparison of FSS and PEFR showed clinically statistical significance with $P<0.05$. The findings of the study concluded that diaphragmatic breathing exercise is one of the effective measure to reduce fatigue and improves peak expiratory flow rate in individuals with Guillain Barre Syndrome.

KEYWORDS

Guillain Barre Syndrome, Diaphragmatic Breathing Exercise, Fatigue, Peak Expiratory Flow Rate

INTRODUCTION

Guillain-Barre syndrome (GBS) is an immune-mediated polyneuropathy characterized by progressive weakness in all four limbs, areflexias, autonomic dysfunction and respiratory paralysis. [1-3]

Guillain-Barre syndrome is usually caused by infection or other immune stimulation that induces an aberrant autoimmune response targeting peripheral nerves and their spinal roots.[4,5]

Epidemiology suggests annual incidence of 1.55/100,000 and incidence increases from 0.8/100,000 in patients younger than 35 to 4.67/100,000 in patients older than 75 years. Men are affected approximately 1.5 times more than women.[6]

Molecular mimicry between microbial and nerve antigens is clearly a major reason behind the development of the disorder, at least in the case of Campylobacter jejuni infection.[7] The major predisposing causes include infections: Campylobacter jejuni, cytomegalovirus, Epstein-Barr virus and Mycoplasma pneumonia.[8]

The acute progression of limb weakness, often with sensory and cranial nerve involvement in 1–2 weeks after immune stimulation, progresses in 2–4 weeks.[9]

GBS can cause life-threatening complications if the respiratory muscles are affected or if autonomic nervous system is involved. The weakness reaches its nadir in 2-4 weeks.[1]

Respiratory muscle weakness is associated with reduced chest expansion, vital capacity (VC), shortness of breath (dyspnea), difficulty communicating, poor cough and impaired airway clearance.[10,11]

Fatigue as a multidimensional concept. The multidimensional concept of fatigue is integrated in the World Health Organization's International Classification of Functioning, Disability and Health (WHO-ICF), representing the effect of disease on body function and structure, activity and participation of the patient. [12]

Fatigue accounts for an important part of the burden experienced by patients with neuromuscular disorders. Substantial high prevalence rates of fatigue are reported in a wide range of neuromuscular disorders, such as Guillain–Barré syndrome.

NEED OF THE STUDY

GBS is associated with muscle weakness and respiratory dysfunction which has its impact on respiratory parameters. There is extensive literature on exercise training and rehabilitation of GBS. But there is minimal literature which has focused on breathing exercise and its effect on respiratory parameters in GBS individuals. Hence, this study focuses on the effects of diaphragmatic breathing exercise on respiratory muscle fatigue and peak expiratory flow rate in individuals with GBS.

Aim

The aim of the study "To know the effect of Diaphragmatic Breathing exercise on fatigue and peak expiratory flow rate in individuals with Guillain Barre Syndrome".

Objectives

- To evaluate the effects of Diaphragmatic breathing exercise on fatigue in individuals with Guillain Barre Syndrome using fatigue severity scale.
- To evaluate the effects of Diaphragmatic breathing exercise on peak expiratory flow rate in individuals with Guillain Barre Syndrome using peak expiratory flow meter.

MATERIALS AND METHODOLOGY

Materials

1. Peak flow meter
2. Fatigue severity scale
3. Pen and paper
4. Pillow

Methodology

Study Method

Study Design: Pre and post-test experimental design
Study Setup: SVIMS Hospital, Tirupati
Sampling Method: Purposive sampling
Sample Size: 30 samples
Study Duration: 3 weeks

Inclusion Criteria

- Bulbar type GBS individuals
- Both male and female
- Age group 18-45 years
- Individuals who weaned from ventilator or without ventilator

Exclusion Criteria:

- Chronic GBS individuals
- Individuals with cardiovascular disorders
- Psychological impairment
- Insufficient verbal/intellectual understanding
- Individuals who are not willing to participate in the study

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Outcome Measures
1. Fatigue severity scale (FSS)
2. Peak expiratory flow rate (PEFR)

Study Procedure
The study was conducted in SVIMS Hospital, Tirupati and the ethical clearance was obtained from the institutional ethics committee (CODE:1703)

The individuals who fulfilled the inclusion criteria were included in the study, after obtaining an informed consent from all the individuals. The fatigue severity scale and the peak expiratory flow rate was measured at baseline and completion of 3 weeks of protocol.

Fatigue severity scale (FSS) is a unidimensional fatigue scale frequently used in neuromuscular disorders. It measures fatigue by assessing the consequences of fatigue on daily functioning. It is a self-report questionnaire, easy to use in clinical practice, as the nine items of the test can be answered within <5 min. A mean score on these statements ranges from 1 (no signs of fatigue) to 7 (most disabling fatigue). An average score of 4 and higher is indicative for fatigue and a score of 5 and higher for severe fatigue. Scoring the results done by adding all the numbers that circled to get the total score. Interpretation is a total score of less than 36 suggests that individuals may not be suffering from fatigue. If the score is 36 or more suggests fatigue. This questionnaire has been applied to patients with GBS and shown to be most appropriate for evaluating fatigue. FSS having excellent test-retest reliability (ICC = 0.91) and validity was excellent (r = 0.84) correlation with Fatigue scale.[15,16]

Peak expiratory flow rate (PEFR) was measured using peak expiratory flow meter expressed in litres per minute [L/min]. Individuals were directed to relax before conducting the PEFR measurement. The testing procedure was thoroughly explained to each individual. Following a period of rest, individuals were guided to inhale deeply and then exhale forcefully in one continuous breath into the instrument. Three acceptable readings were recorded, and the highest value among the three was considered.[17]

Treatment Protocol:
Each session included: (1) diaphragmatic breathing, (2) breathing control, and (3) huffing and coughing.[13,14]

For diaphragmatic breathing exercise, position of the patient: semi-fowler's position, position of the therapist: standing beside the patient, technique: The individual was made to place the dominant hand over the mid-rectus abdominis area and nondominant hand on the midsternal area. The individual was instructed to inhale slowly through the nose and was instructed to watch the dominant hand move outwards as inspiration continues. The individual was cautioned to avoid excessive movement under the nondominant hand. The individual was asked to slowly exhale through the mouth.

For breathing control, the individual was made to perform relaxed abdominal breathing, keeping his/her hand on the abdomen to feel the movement.

For huffing, single large inspiration, followed by short expiratory efforts that are interrupted with pauses.

For coughing, the individual was instructed
(1) inspire to or maximal inspiration
(2) close the glottis
(3) "bear down" by tightening the abdominal, perineal, gluteal, and shoulder depressor muscles, which increases intrathoracic and intraabdominal pressures
(4) suddenly open the glottis to enable the pressurized inspired air to suddenly escape, which provides the expulsive force

The individual was made to cough two times

Exercise Protocol
Diaphragmatic breathing exercise includes 3 weeks. Each session includes 5 to 15 min long along with conventional physiotherapy. 3 sets of 5 deep breaths, daily 4 times, 6 days/week and the training period lasted for a total of 3 weeks.

Figure 1: Diaphragmatic Breathing Exercise

Statistical Analysis
Data was analysed using SPSS software version 23.

Individual data was analysed by intension to treat all continuous data was assessed for normality. Continuous data was described using mean and standard deviation. Dichotomous outcomes were presented as risk ratios with 95% confidence intervals using paired T- TEST

Difference in the outcome was compared within the group.

The "p" value <0.05 was considered statistically significant.

RESULTS
30 individuals between the age group 18-45 with a mean of 35.73+6.44 and with a mean BMI of 25.87+5.14 kg/m^2. A fatigue severity scale at baseline was 45.13+11.35. The peak expiratory flow rate at baseline was 88.67+55.5 l/min.

Table 1

N=30	Mean	Std. Deviation
Age	35.73	6.44
BMI	25.87	5.14
FSS_Pre	45.13	11.35
PEFR_Pre	88.67	55.51

Table 1 represents the baseline descriptions of the chosen population.

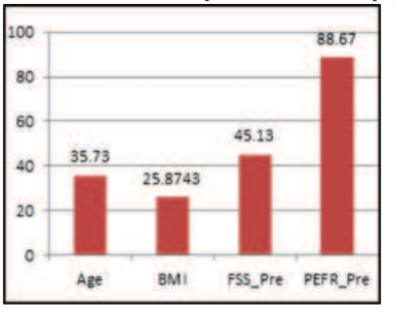

Figure 2

Figure 1 represents the baseline measures of age, BMI, FSS and PEFR.

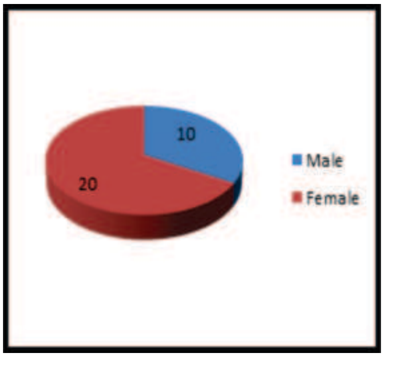

Figure 3

Figure 2 represents the gender-based subjects included in the study. There were 10 male participants and 20 female participants.

Table 2

Paired Samples Statistics				
		Mean	Std. Deviation	Std. Error Mean
Pair 1	FSS_Pre	45.13	11.35	2.07
	FSS_Post	28.87	10.69	1.95
Pair 2	PEFR_Pre	88.67	55.51	10.13
	PEFR_Post	127.00	60.18	10.99

The fatigue level of the participants before intervention are represented as mean and standard deviation as 45.13+11.35 and post intervention as 28.87+10.70 which represents decrease in the fatigue level after intervention.

The PEFR level of the participants before intervention are represented as mean and standard deviation as 88.67+55.5 and post intervention as 127+60.18 which represents increase in the peak expiratory flow after intervention.

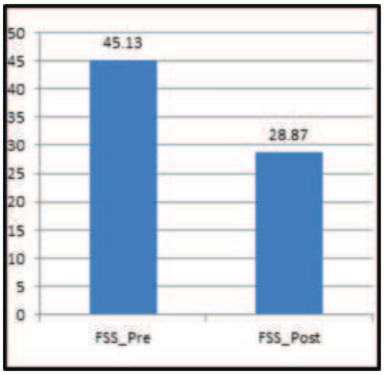

Figure 4 Fatigue Severity Scale

Figure 3 represents the mean difference in the fatigue levels before and after treatment.

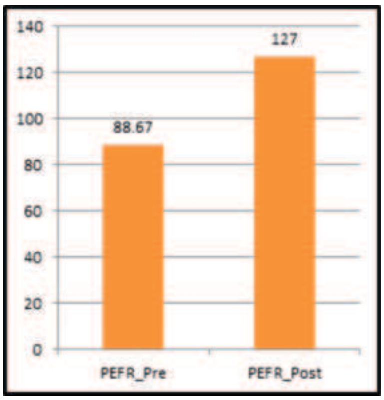

Figure 5 Peak Expiratory Flow Rate

Figure 4 represents the mean difference in the PEFR before and after treatment.

Table 3

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Dev-iation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair1	FSS_Pre - FSS_Post	16.27	5.63	1.03	14.16	18.37	15.82	29	0.00
Pair2	PEFR_Pre - PEFR_Post	-38.33	22.14	4.04	-46.60	-30.07	-9.48	29	0.00

*The mean is significant at the 0 .05 level
** The mean is significant at the 0 .001 level

A paired sample t-test was performed to evaluate the significance of the treatment intervention in GBS individuals. The fatigue level showed a mean of 16.27+5.63 with a t value of 15 .82 in [14.16, 18.37] and showed a p value of 0.00. This shows that there was a statistically significant decrease in the fatigue level after the individuals received diaphragmatic breathing exercise.

A paired sample t-test was performed to evaluate the significance of the treatment intervention in GBS individuals. The PEFR level showed a mean of -38.33+22.14 with a t value of -9.48 in [-46.6, -30.06] and showed a p value of 0.00. This shows that there was a statistically significant increase in the PEFR level after the individuals received diaphragmatic breathing exercise.

DISCUSSION

The study included 30 GBS individuals and treated with diaphragmatic breathing exercise along with conventional physiotherapy. The FSS and PEFR was measured at the baseline and at the end of the 3 weeks. The study revealed that the intervention decreased the fatigue and increased the peak expiratory flow rate in the GBS individuals.

Diaphragmatic breathing in which the breathing speed is reduced leading to an increase of alembic aeration so that meaningful reverse relationship existed between the fatigue intensity and the rate of diaphragmatic breathing exercise.

Diaphragmatic breathing exercise also increase the expiratory muscles action so that they remove the air trapped in the lungs. The diaphragm muscle become flattened at the time of inspiration, giving the lungs more room for expansion. Air enters the lungs, and the stomach expands due to the use of diaphragm muscle when doing diaphragmatic breathing exercises. The abdominal muscles help to release air during expiration and provide more force to empty the lungs so that expiratory power increases, and the PEFR increases after exercise. The maximum expiratory flow was much higher when the lungs were filled with a large air volume than when the lungs were almost empty.[20]

According to Natasha Shetty et al. showed that the PEFR before and after diaphragmatic breathing exercise showed clinically improvement on 3rd and 5th day comparative with baseline in 42 acute stroke subjects but were not statistically significant.[18]

The researcher Widya Sepalanita et al. studied 15 asthma respondents and did diaphragmatic breathing exercises with an average pre-test peak expiratory flow rate value of 246.67 L/minute and an average post-test result of diaphragmatic breathing exercises, namely 300 L/minute. Based on the paired T-test, it produces a significance value of 0.000 <0.05, which shows that diaphragmatic breathing exercises significantly influence the peak expiratory flow rate of bronchial asthma patients as in our study.[19]

According to Laily Widya Astuti et al. the mean peak expiratory flow in the intervention group was 306.84, while in the control group, it was 232.63, with the value of the t-test being -14.17 ($P < 0.0001$). Diaphragmatic breathing and therapeutic walking exercise significantly increased the peak expiratory flow in asthma patients after 2 weeks as in our study.[20]

The other researcher Alaparthi GK et al. studied 260 patients posted for laparoscopic abdominal surgery. In that one group 65 patients performed diaphragmatic breathing exercise. The PEFR showed statistically significant increase in diaphragm breathing group in the 1st and 2nd postoperative period when compared with the preoperative period with highly significant at $p < 0.001$ level as in our study.[21]

The researcher Priyanka Parida et al. studied 30 Forward Head Posture (FHP) subjects. The experimental group (n=15) was instructed to perform breathing exercises and posture correction exercises five days a week for four weeks, whereas the control group (n=15) was asked to perform only posture correction exercises. A comparison of peak expiratory flow rate showed a significant increase in the pre and post intervention and also the difference between the experimental and control group, (p=0.042).[22]

Zahraa Jasim Alwan et al. studied 48 patients with cancer undergoing chemotherapy were divided into two groups of 23 and 25 as intervention and control groups, respectively. more than one third 39.1% of participants in the intervention group have a high level and borderline fatigue level at pre-test period, and after implementing the slow, deep breathing exercises, more than one half (56.5%) within borderline fatigue and 43.5% does not have fatigue, in addition to that, there are a significant statistical difference in the fatigue levels (FSS) between pre-test and post-test at p-value of (0.001).[23]

Masoumeh Zakerimoghadam et al. studied 60 COPD patients. The average fatigue severity in FSS before (55.766) and after (40.166) using the breathing exercises in the experimental group (p=0%) was showed statistically significant difference as in our study.[24]

A literature review done by Askar SE et al. on heart failure subjects explained breathing exercises and inspiratory muscle training are considered as an important strength in improving exercise and functional performance with the link of dyspnoea and fatigue symptoms in heart failure patients.[25]

Mara Paneroni et al. evaluated 494 potential articles on COPD subjects. In those two studies (82 patients) assessed perceived fatigue by the Fatigue Severity Scale: the exercise training intervention improved significantly more than the control group [p < 0.001].[26]

A systematic review on Multiple Sclerosis Patients done by Lucía Torres-Alamo et al., included Nine articles, with a total of 290 participants. To measure fatigue, the Fatigue Severity Scale (FSS) was used in four studies. The studies combined breathing exercises with other treatment techniques. Fatigue Severity scale, observing a reduction in the perception of fatigue, in favor of the experimental group as in our study.[27]

Limitations And Recommendations

Study Limitations:

- Sample size was small
- Study duration was less
- Lack of randomization
- The study cannot be generalized as the sample size is smaller.

Future Recommendations:

- The future study is recommended with large sample size.
- The future study is recommended for more than three weeks duration for better results.
- Longitudinal study can be recommended.
- Gender specific studies can be conducted.

CONCLUSION

This study included 30 GBS individuals and treated with diaphragmatic breathing exercise along with conventional physiotherapy. Fatigue in individuals with GBS was measured using fatigue severity scale and expiratory flow rate is measured through peak expiratory flow meter at the baseline and at the end of the 3 weeks.

The findings of this study concludes that diaphragmatic Breathing exercise is one of the effective, inexpensive and non-pharmacological measure to reduce fatigue and improves peak expiratory flow in individuals with Guillain Barre Syndrome.

Hence the alternate hypothesis is accepted and the null Hypothesis is rejected.

This study contributes to the literature focusing on breathing exercise and its effects on respiratory parameters in individuals with GBS.

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