

Research Report

The Association of Pain, Fatigue and Functional Capacity with Function in Subjects with Post-Polio Syndrome in Gujarat, India

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Abstract: Background: Almost 80 lakh people are affected by polio in India. Post-polio syndrome (PPS) refers to a clinical disorder affecting polio survivors' years after the initial polio attack. These patients report new, late onset, neuromuscular symptoms like fatigue, pain, new and unusual muscular deficits, and decreased functional abilities. Although these are common problems in individuals with PPS, less research especially in India, has examined the role that these symptoms might exert on physical or psychological function. **Aims:** To find co-relation of pain, fatigue, functional capacity with function in subjects with Post-Polio Syndrome. **Design:** Co-relational study. **Methods:** A convenience sample of 20 subjects with PPS according to Halstead criteria 1985 was selected. Pain was examined using Brief Pain Inventory (BPI), Fatigue by fatigue severity scale (FSS) and functional capacity by 2 minute walk distance. Physical and psychological functions were examined using PROMIS (Patient Reported Outcomes Measurement Information System) and PHQ-9 (Patient Health Questionnaire-9) questionnaires.

Statistical Analysis: Spearman's test for co-relation was applied. **Results:** A positive linear co-relation was found between functional capacity and physiological function ($r = 0.873$); negative linear co-relation between functional capacity and psychological function ($r = -0.743$). Fatigue showed a positive linear co-relation with psychological function ($r = 0.486$). A negative correlation was

calculated between pain and fatigue with physical function ($r = -0.258$; $r = -0.396$ respectively). Correlation of pain and psychological function ($r = 0.130$) was weak. **Conclusion:** Reduced functional capacity co-relates with the physical and psychological function of subjects with PPS, and fatigue co-relates with psychological function. Physiotherapy for decreasing pain, fatigue and improving functional capacity may improve physical and psychological function.

Keywords: Physical function, Psychological function, Pain, Fatigue, Functional capacity.

Introduction

Acute polio is no longer a constant threat to the people in the polio free areas of the world. But there are still thousands of polio survivors who are at a risk of developing late manifestations of the disease. In the past few years polio survivors have experienced late-onset neuromuscular symptoms and decreased functional abilities.¹ Post-polio syndrome (PPS) refers to a clinical disorder affecting polio survivors with sequel years after the initial polio attack.² They report symptoms like fatigue, pain, new and unusual muscular deficits.³

Ostlund et al and On et al found pain and fatigue to be significantly associated with lower levels of physical and psychological functioning.^{4,5} Hildegunn et al noted that self-perceived muscle strength, disability and pain intensity were

associated with fatigue and activity level.⁶

India, although declared a polio-free country since 2012 with the last case seen in 2011, has a large number of polio survivors, almost around 80 lakh [8 million] people.⁷ According to a previous study, the prevalence of PPS among polio survivors was found to be almost 86% in Gujarat which is similar to studies of other countries.⁸ The subjects had difficulty in walking, joint and muscle pain, muscle weakness and fatigue.⁸ No specific treatment is available for PPS. Rehabilitation is considered the mainstay of management with an emphasis on exercise and lifestyle modification.⁹

Although India would be one of the foremost in number of polio survivors in the world, research about PPS in India is less. Post-polio syndrome subjects sooner or later develop pain, fatigue and weakness as a sequel to the initial attack of polio. These symptoms may lead to a change in the physical capacity or depression. So the objective of the present study was to find if a co-relation existed between pain, fatigue, functional capacity with physical and psychological function in subjects with Post-Polio Syndrome.

Methods

A co-relational study was conducted on a convenience sample of 20 subjects, both males and females with PPS according to Halstead¹⁰ criteria (1985) which included a confirmed history of polio followed by a partial or fairly complete neurological and functional recovery after the acute episode and a period of at least 15 years with neurological and functional stability. The subject should report two or more of the following neuromusculoskeletal problems occurring after the stable period: extensive fatigue, muscle and/or joint pain, new weakness in muscles previously affected or unaffected, new muscle atrophy, functional loss, cold intolerance. There should be no other medical explanation found and there should be a gradual or abrupt onset of new neurogenic weakness.

The subjects were explained about the study. Informed consent was obtained from the subjects.

Demographic data was collected. The outcomes assessed were pain, fatigue, functional capacity and function in post-polio survivors. Pain was examined using Brief Pain Inventory, fatigue by Fatigue Severity Scale and functional capacity by 2 minutes walk distance. Physical and psychological functions were examined using PROMIS (Patient Reported Outcomes Measurement Information System) and PHQ-9 (Patient Health Questionnaire-9) questionnaires.

A 12-item scale, Pain Interference Scale (PIS) adapted from the Brief Pain Inventory (BPI)¹¹ was used to measure pain interference with daily activities. Participants were asked to rate the degree to which pain interfered with 12 different activities during the preceding week, each activity score ranging from 0 (does not interfere) to 10 (completely interferes). The original BPI pain interference scale consists of 7 items: general activity, mood, walking ability, normal work (including both work outside the home and housework), relations with other people, sleep, and enjoyment of life. Because many people with PPS are unable to walk irrespective of pain level, the original scale was altered, by changing item 3 from “walking ability” to “mobility” (ability to get around) to make it more appropriate for persons with disabilities.

The Fatigue Severity Scale (FSS) was developed to measure fatigue in medical and neurological diseases. It has also been used to measure general fatigue in PPS.¹² It has a good internal consistency (Cronbach’s alpha=0.81 to 0.95). FSS consists of 9 statements that are scored on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree) to explore severity of fatigue symptoms. A low value indicates that the statement is not very appropriate whereas a high value indicates agreement. Subjects were asked to encircle a number from 1 to 7, depending on how appropriate they felt the statement applied to them over the preceding week.

The 2 MWD (2 minute walk distance) is a test of choice for functional capacity in post-polio

subjects.¹³ It has good validity when compared with SF36 ($r=0.69$) and reliability (ICC=0.92 to 0.94). Subjects were asked to walk at a comfortable speed for 2 minutes as far as they could. The distance walked in meters for 2 minutes was recorded. Test was terminated if subjects reported any discomfort, fatigue or increase in pain.

Patient Reported Outcomes Measurement Information System (PROMIS)¹⁴ for Physical Functioning item bank assesses an individual's ability to perform a range of physical activities. Average performance in ability to engage in various tasks over the past week is measured on 5-point scales that range from "without any difficulty" to "unable to do." Higher the raw score of PROMIS, better the physical function.

PHQ-9 (Patient Health Questionnaire-9) is a 9-item measure which asks respondents to rate the frequency that they experienced nine symptoms of depression in the past two weeks by using a 4-point scale, where 0 is "not at all," and 3 is "nearly every day." The PHQ-9 total score can range from 0 to 27, as shown in table 1, and a higher score represents higher levels of depressive symptoms. The PHQ-9 has been widely used to assess depression severity and has a great deal of support for its validity in populations with physical disabilities.¹⁵

Level of significance was ascertained at 5%.

Table 1: Score distribution of the PHQ-9 scale to determine the severity of depression

Total score	Depression severity
1-4	Minimal
5-9	Mild
10-14	Moderate
15-19	Moderately severe
20-27	Severe

Results

Table 2 shows the demographic details of the subjects. Table 3 shows the mean values of the outcome measures. It shows that that functional capacity was markedly reduced, pain intensity was

found to be mild, and moderate level of fatigue was felt by the post-polio survivors.

Table 4 shows the correlation coefficient values between the various outcome measures.

Table 2: Demographic data of subjects (n = 20) diagnosed as PPS

Characteristics	Mean ± SD
Age (Years)	35.26 ± 3.34
BMI(Kg/m ²)	25.5 ± 1.25
Males (%)	15 (75)
Females (%)	5 (25)

Discussion

Pain intensity was found to be mild in the present study. The pain syndromes in post-polio survivors can be classified into three, as post-polio muscle pain seen in muscles affected by polio, overuse pain which includes injuries to soft tissue, muscle, tendons, bursa and ligaments and biomechanical pain which presents as a degenerative joint disease (DJD), low back pain or pain from nerve compression syndromes.¹⁶ Weakness induced by polio-affected muscles, as well as poor body mechanics, makes the joints more susceptible to the development of degenerative joint disease, which could be the cause of pain in this study.

Table 3: Mean ± SD values of all of the outcome measures used in a sample of PPS patients (n=20)

Characteristics	Mean ± SD
Pain (PSS)	2.67 ± 2.08
Fatigue (FSS)	29.00 ± 10.19
Functional capacity (2MWD)	90.11 ± 34.60 (m)
Physical Function (PROMIS)	38.35 ± 5.47
Psychological Function (PHQ-9)	3.16 ± 1.16

Fatigue symptoms in post-polio survivors may be classified¹⁷ as general fatigue which presents with increased weakness; increased fatigue, decreased endurance for usual activities; changes in lifestyle (need for bracing or ventilator); increased instability and falling; excessive weight gain; anxiety and depression or neuromuscular fatigue where the subject has increased pain and deformity of joints;

muscle pain; increased or new muscle weakness; increased fractures (as a result of weakness) or respiratory fatigue where increased shortness of breath; increased respiratory infections; difficulty in speaking is seen. Fatigue assessment according to the fatigue severity scale assesses some of the above symptoms and was found to be of a moderate level in the present study.

Table 4: Correlation values between variables

Variable 1	Variable 2	Co-Relation Co-Efficient (R)	P Value
Pain	Physical function	-0.258	0.287
	Psychological function	0.130	0.596
Fatigue	Physical function	-0.396	0.094
	Psychological function	0.486	0.035*
Functional capacity	Physical function	0.873	0.01*

*Significance of p was calculated at < 0.05

Functional capacity according to the 2 MWD test was markedly reduced in the polio survivors. Certain features of PPS such as generalized fatigue, generalized and specific muscle weakness, joint and/or muscle pain may result in physical inactivity deconditioning, obesity and dyslipidemia. In PPS a risk factor to an increased chance of developing CHD is a sedentary lifestyle. Changes of the musculoskeletal system in PPS are the main factors for physical inactivity.¹⁸

A positive linear co-relation was found between functional capacity and physiological function($r=0.873$); negative linear co-relation between functional capacity and psychological function($r=-0.743$), fatigue showed a positive linear co-relation with psychological function($r=0.486$). Correlation of pain and fatigue with physical function ($r=-0.258$; $r=-0.396$ respectively) and of pain and psychological function ($r=0.130$) was weak.

Similar studies have been done by previous authors like Jenson et al, On et al, Nollet et al and others.^{5,15,19} Jenson MP et al concluded that pain and fatigue both made independent contributions to the prediction of functioning in PPS.¹⁵ They

found the relationship to be similar across all age groups so pain or fatigue should not be attributed to aging process. The present study had subjects in the middle aged group only.

On et al assessed impact of PPS on quality of life. Fatigue was significantly higher in the PPS group than both non PPS group and control group. Also quality of life was affected according to NHP scores which were higher in the PPS group than in the control group with dimensions of physical mobility, energy, pain and emotional reaction particularly affected.⁵ Nollet et al found health problems mainly concerned with physical mobility, energy and pain on NHP were higher in PPS subjects as compared to non-PPS subjects. Most disabilities in PPS were concerned with physical and social functioning.¹⁹

In a similar study by Trojan DA et al (2009),²⁰ different variables were found to be associated with general, physical, and mental fatigue. Correlates of general fatigue included disease-related and psychosocial factors whereas correlates of physical fatigue were disease-related and behavioural factors, and correlate for mental fatigue was a psychosocial factor.

Studies of motor units have revealed an on-going denervation - reinnervation process which may lead to reduced function.²¹ A co-relation between pain and reduced function is believed to be either a measure of overuse or disuse that falls into a vicious cycle. Motor unit dysfunction leads to atrophy and cramping muscle pain, both of which lead to a combination of overuse and disuse in muscles. When musculoskeletal overuse occurs, pain develops. Rest and immobilization can relieve this pain, but this leads to decreased use of certain muscles, with development of disuse atrophy and further weakness. After this, relatively normal use of the muscle leads to pain and further disuse. Musculoskeletal dysfunction resulting in pain occurs as a consequence. And this pain restricts an individual's level of physical function and as a result to some extent, psychological function as well. Fatigue did not have a significant effect on function, indicating that affection in function was

mainly due to pain and not fatigue. Possible reasons for which could be self-pacing of daily activities, non-acceptance or denial of having fatigue.

Limitations of the study were that muscle strength was not assessed as an outcome measure which could also affect function, as also the role of assistive devices was not considered in the study. Also this being a correlational study it does not prove cause and effect relationship between the variables.

Conclusion

There is a strong correlation between functional capacity and physical and psychological function of subjects with PPS, and moderate correlation of fatigue with psychological function. Correlation of pain and fatigue with physical function and of pain and psychological function was weak.

Implications

There is a need for effective and accessible management options in polio survivors. Physiotherapy for decreasing pain, fatigue and improving functional capacity may improve physical and psychological function. The study highlights the need to screen subjects with PPS and suggest interventional strategies to reduce their problems.

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