Assessment Of Manifestations And Functional Status Of Post-COVID-19 Patients.

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Abstract:

Introduction: The subjects who recovered from COVID-19 should undergo long-term monitoring for evaluation and treatment of symptoms and conditions that might be precipitated with the new coronavirus infection. About 90% of the recovered participants had post-COVID-19 manifestations, which included various symptoms and illnesses ranging from mild to severe.

Aim: This study analyses post COVID-19 manifestations severity and impact on recovered patients based on hospitalization.

Materials and methods: The sample size was calculated using RAO software to be 514 samples. COVID-19 survivors (RT- PCR positive result) were included in the study. COVID-19 survivors include the patient under phase 1 category (2-5 weeks), 1st section: socio demographic factors like name, age, gender. 2nd section: to observe the clinical manifestations, questions were developed based on previous studies validated. To study the functional status post covid-19 functional status scale has be used.

Result: In the study, most people shows that the post-COVID-19 symptoms persists after COVID-19 were found to be higher. Even though hospitalized patients shows more recurrance of the symptoms than the non hospitalized patients. Gastrointestinal symptoms shows more recurrance than other symptoms in hospitalized patients.

Conclusion: The study result provided an insight to the complications of COVID-19 recovery when left unchecked and unattended. In this study higher count of hospitalized patients reporting post COVID-19 manifestations with more severity than non-hospitalized patients.

Key-Words: *COVID-19, Post COVID-19, Hospitalization, ACE Inhibitor*

Key Messages: The post-COVID-19 symptomatology is quite similar to the post-SARS symptomatology. All subjects who recovered from COVID-19 should undergo long-term monitoring for evaluation and treatment of symptoms and conditions that might be precipitated with the new coronavirus infection.

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Introduction:

The latest threat to global health is the ongoing outbreak of the respiratory disease that was recently given the name Coronavirus Disease 2019 (COVID-19). COVID-19 was recognized in December 2019. It was quickly determined that a new coronavirus caused it with structural similarities to the virus that causes severe acute respiratory syndrome (SARS). The post-COVID-19 symptomatology is quite similar to the post-SARS symptomatology. All subjects who recovered from COVID-19 should undergo long-term monitoring for evaluation and treatment of symptoms and conditions that might be precipitated with the new coronavirus infection. About 90% of the recovered participants had post-COVID-19 manifestations, which included various symptoms and illnesses ranging from mild to severe[1,2]. Post viral infection syndrome was previously reported after SARS. Follow-up for four years showed that chronic fatigue and psychiatric conditions continued to

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be clinically significant among subjects who survived SARS infection. As a result, a multidisciplinary strategy combined with long-term rehabilitation should be used to maximise mental health morbidity treatment[3,4]. Regarding COVID-19 survivors, each subject reported one or more manifestations, which persisted with all subjects for more than 20 days from the last negative PCR. The severity of COVID-19 was divided into three categories: mild instances with manageable symptoms, moderate cases with uncontrollable symptoms, and severe cases with uncontrollable symptoms and have been treated at home without the need for oxygen therapy, moderate cases which suffered from difficult breathing and the requirement for oxygen therapy at home to severe instances requiring hospitalisation and treatment[5,6].

The relation between age, comorbidities, and severity of COVID-19 showed a strong link between the presence of other comorbidities and the severity of COVID-19. Increasing age was also linked to a worsening of the disease's course. Many studies are providing an in-depth knowledge on the post COVID-19 impact on the health and functional quality of life of recovered patients. But there were no studies or comparative research on post COVID-19 manifestations their severity and effect on recovered patients. As a result, our research focuses on the severity of post-COVID-19 symptoms and their influence on recovered patients. on hospitalisation, as well as various co-morbidities such as smoking history, gender, age, ICU history, days in the hospital [7].

Subjects And Methods:

2.1 Study Population

The sample size was collected to be 514 samples (sample was Patients aged 20 to 80 were enrolled in the research, which was computed using RAO software. The inclusion of COVID-19 survivors (RT-PCR positive patients) in the trial was validated by an RT-PCR negative result. The research did not include recovered patients who lived with active COVID-19 patients. Patients under the age 10 were not included in our research. COVID-19 survivors include the patient under the phase 1 category (2-5 weeks),

2.2 Data collection

1st section: socio-demographic factors like name, age, and gender. 2nd section: to observe the clinical manifestations, questions were developed based on previous studies validated [7,8,9].The functional status measure was used to investigate post COVID-19 functional state[9]. Neurological issues like Headache, Tremors, Seizures/ Cramps, Musculoskeletal issues like Lack of coordination/ Dysmetria, Muscle atrophy, Abnormal muscle tone, Neurocognitive issue like sensory disturbances, taste disturbances, visual disturbances, decreased sensation or sensitivity, and speech difficulty /dysarthria. and Gastrointestinal issues like Nausea, Vomiting, Diarrhoea, Loss of Appetite, Weight Loss, Bloody Stool, and Stomach Pain[10,11].

2.3 Statistical analysis

The data was analysed using SPSS SOFT software 2.0. Post COVID associated risk factors were analysed by using Wilcoxon signed-rank test, this test helps to identify the association of risk between hospitalized and non-hospitalized patient ($p = 0.001 < 0.05$) were found to be significant.

2.4 Research Stage

Direct access mode of data collection were been practiced for the patient details with the safety protocol. Wearing double mask, Gloves, with the guidance of local health officer.

Results:

Total 514 patients' data were collected. Of 514 patients, 325 were hospitalized for the management of COVID-19, while remaining 189 patients did not require hospitalization for COVID-19. In our study we observed that most of the hospitalized patients were smokers and past smokers. Out of the 325 hospitalized patients 84.80% had coughing, 70.40% and 71.70% had nausea and vomiting, breathing difficulty(61.80%) as primary clinical manifestation. Out of 514 patients, 129 experienced headache, 139 experienced taste disturbance, and 120 experienced a decreased sensation. Neurological symptoms for the patients in this study shows, 59 patients experienced muscle pain, and 43 patients experienced joint pain. In our study 23 non hospitalized patients and 160 hospitalized

patients reported with anxiety, 16 non hospitalized patients and 124 hospitalized patients reported with depression, 23 non hospitalized patients and 133 hospitalized patients reported with sleep disorder, 24 non hospitalized patients and 148 hospitalized patients reported with dysphoria. Upper respiratory issues on 514 patients, nearly 56.5% experience breathing difficulty, of which 38% have been admitted to the hospital for the management of COVID-19. Out of 514 participants nearly 208(40.46%) experienced tiredness and 130(25.29%) experienced frequent fever after COVID-19 recovery.

Symptoms	Non Hospitalized Patients			Hospitalized Patients			P Value
	Before COVID-19	After COVID-19	New Occurrence	Before COVID-19	After COVID-19	New Occurrence	
Neurological symptoms							
Headache	26	63	37	35	127	92	0.001
Tremor	22	56	34	45	119	74	0.003
Seizure	24	60	36	33	124	91	0.005
Lack of coordination	15	45	30	35	137	102	0.002
Muscle atrophy	22	48	26	50	157	107	0.001
Abnormal muscle tone	30	55	25	53	156	103	0.002
Smell disturbance	19	39	20	86	215	129	0.003
Taste disturbance	22	44	22	76	193	117	0.002
Visual disturbance	21	31	10	44	198	154	0.005
Decreased sensation or sensibility	11	23	12	56	164	108	0.004
Speech difficulty	11	23	12	99	285	186	0.002
Musculoskeletal symptoms							
Muscle Pain	56	83	27	64	129	65	0.001
Joint Pain	78	107	29	51	118	67	0.003
Mobility	12	26	14	18	42	24	0.005
Systemic Symptoms							0.002
Tiredness	25	63	38	19	97	78	0.001
Frequent Fever	17	48	31	23	92	69	0.002
Gastrointestinal Symptoms							
Nausea	12	28	16	63	205	142	0.002
Vomiting	10	34	24	53	210	157	0.005
Diarrhoea	13	31	18	52	216	164	0.004
Loss of appetite	10	35	25	49	219	170	0.002
Weight Loss	13	39	26	96	372	276	0.001
Bloody Stool	16	37	21	83	237	154	0.002
Stomach Pain	15	33	18	87	259	172	0.003
Neurocognitive Symptoms							
Memory impairment	12	41	29	67	177	117	0.003
Concentration	12	35	23	102	232	130	0.002
Confusion	9	38	29	103	215	112	0.004
Psychological Symptoms							
Anxiety	8	31	23	56	216	160	0.003
Depression	11	27	16	55	179	124	0.002
Sleep Disorder	12	35	23	69	202	133	0.004
Dysphoria	9	33	24	57	205	148	0.003
Breathing Difficulties							
During Rest	12	29	17	68	223	155	0.003
Casual activities	10	24	14	63	210	147	0.005
Climbing Stairs	8	20	12	61	169	108	0.003

Discussion:

Total 514 patients' data were collected. Of 514 patients, 325 were hospitalized for the management of COVID-19, while remaining 189 patients did not require hospitalization for COVID-19.

In our study we observed that most of the hospitalized patients were smokers and past smokers. A similar type of difference was reported in the previous study[12]. It may be due to the severity of COVID-19 infection. Since smoking tobacco damages the lungs, it increases the risk of respiratory infections and makes it easier for the coronavirus disease (COVID-19).

Out of the 325 hospitalized patients 84.80% had coughing, 70.40% and 71.70% had nausea and vomiting, breathing difficulty (61.80%) as primary clinical manifestation[13].

Out of 514 patients, 129 experienced headache, 139 experienced taste disturbance, and 120 experienced a decreased sensation as their major Post COVID-19 clinical manifestations, similar to the previous study. Hospitalized patients experience more Post COVID-19 clinical manifestations when compared to non-hospitalized patients[14].

The major metabolic pathophysiology of the SARS-COV-2 virus occurs by the competitive binding of ACE-2 enzyme. This process interferes with the metabolic processes of the enzyme. This enzyme has numerous physiological functions such as RAS network to balance blood pressure as well as electrolyte and fluid[15]. It also circulates in lung tissues to prevent pulmonary hypertension, pulmonary fibrosis. Neurological symptoms for the patients in this study shows, 59 patients experienced muscle pain, and 43 patients experienced joint pain, which was similar to the previous study. This may be because erythrocytes' oxygen-carrying capacity is impaired, and they remains hypoxic[16,17]. Therefore, the musculoskeletal system remains ischemic with a mechanism similar to sickle cell disease and also during hypoxic ischemia, the increase of growth factors, cytokine levels ischemic condition and microvascular, and microvascular changes can trigger pain by over expression in the dorsal root ganglion. LDH increases when the virus damages the muscle and other tissue, due to an increase of both LDH and anaerobic glycolysis, lactate level may increase excessively cytosolic

pH may decrease more. Muscle pain may increase further due to increased lactate levels, low pH, and low oxygen levels [18].

In our study 23 non hospitalized patients and 160 hospitalized patients reported with anxiety, 16 non hospitalized patients and 124 hospitalized patients reported with depression, 23 non hospitalized patients and 133 hospitalized patients reported with sleep disorder, 24 non hospitalized patients and 148 hospitalized patients reported with dysphoria [19].

Gastrointestinal issues for the patients were found to be statistically significant ($p<0.05$) between hospitalized and non-hospitalized patients. This may be due to the cells in the lungs become infected by SARS-CoV-2, effector CD4+T cells reach the small intestine through the gut-lung axis, causing intestinal immune damage and diarrhoea [20,21]. The musculoskeletal system remains ischemic with a mechanism similar to sickle cell disease and also during hypoxic ischemia, the increase of growth factors, cytokine levels, ischemic condition and microvascular and microvascular changes can trigger pain by overexpression in the dorsal root ganglion. LDH increases when the virus damages the muscle and other tissue; due to an increase of both LDH and anaerobic glycolysis, lactate level may increase excessively cytosolic pH may decrease more[22]. Muscle pain may increase further due to increased lactate levels, low pH, and low oxygen levels. Mobility issues for the patients were found to be statistically significant ($p<0.05$) between hospitalized and non-hospitalized patients. The immobilization problems occurs may be due to excessive production of cytokine during Post COVID-19 infection which promotes the production of corrosive molecules, that cause severe myocyte damage[23,24].

Upper respiratory issues on 514 patients, nearly 56.5% experience breathing difficulty, of which 38% have been admitted to the hospital for the management of COVID-19. This may be because that COVID-19 simultaneously affects three compartments of the lungs, thereby leading to disruption of oxygenation: inflammation of the alveolar space, immune thrombosis of the juxtaposed pulmonary (J Receptors) vascular compartment, and thrombotic obstruction of the pulmonary and bronchial circulation[25]. Elevation of proinflammatory cytokines gets triggered by an infection or prolonged and repetitive stress. In support of this is the wide spectrum of cytokines and chemokines described in PTSD, this affects the concentration. [26,27]. Neuroinflammation, blood-brain-barrier disruption, peripheral immune cell invasion into the CNS, neurotransmission impairment, hypothalamic-pituitary adrenal (HPA) axis dysfunction, microglia activation and indoleamine 2,3-dioxygenase (IDO) induction, all represent interaction pathways between immune systems and psychopathological mechanism underpinning psychiatric disorders [28]. The excessive cytokine directly induce skeletal muscle damage such as degenerative transformation and muscle shrinkage. Out of 514 participants nearly 208(40.46%) experienced tiredness and 130(25.29%) experienced frequent fever after COVID -19 recovery [29,30].

Conclusion:

Our study result provided an insight to the complications of COVID-19 recovery when left unchecked and unattended. We observed a higher count of hospitalized patients reporting post COVID-19 manifestations with more severity than non-hospitalized patients. A steep increase of psychological, musculoskeletal and respiratory symptoms were observed in both hospitalized and non-hospitalized patients. Post-COVID-19 symptoms may be persist for lifetime but with proper therapeutic index can manage the severity

Limitation Of The Study

This research is a single cantered study, randomisation of study population is less and was conducted on patients who were in phase 1 and 2 of post COVID-19 infections, leaving out the 3rd phase(12-24 weeks). Further research on long term period of post-COVID-19 will help to understand and prevent future incidence.

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Tables And Figures:

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