Leveraging on Rehabilitation in Long Covid Management

Babatunde G Ogundunmade

Head Medicine/Cardiopulmonary Unit & PCEU Coordinator, Physiotherapy Department, JUTH, Jos

Abstract

Several cases of pneumonia of unknown cause were reported in Wuhan, Hubei Province, China on 31 Dec. 2019 while novel strain of coronavirus, SARS-CoV-2 was subsequently identified as causative factor ofCOVID-19. It thenspread from that first cluster in Wuhan to become a public health emergency of international concern (PHEIC) and was later recognised by WHO as a pandemic.The COVID-19 pandemic has since caused unprecedented public health challenge and reorganization of the world order. Long term effects of COVID-19 (Long COVID) was recognized in 2020 summer. It wasinitially described as symptoms that lasted for longer than 4weeks before a better definition came up as symptoms persisting for 12weeks and beyond. The cardiopulmonary, neurological and musculoskeletal presentations in Long COVID makes leveraging on rehabilitation in its management inevitable.

Key Words: *Pneumonia, COVID-19, SARS-CoV-2, PHEIC, pandemic, Long COVID, leveraging, rehabilitation.*

Introduction

The course of COVID-19 started with early reports of cases of pneumonia of unknown cause in Wuhan, Hubei Province, China on 31 Dec. 2019. The COVID-19 pandemic was later identified as being caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). WHO declared it a public health emergency of international concern (PHEIC) on 30 Jan. 2020 with far spread to 18 countries outside China.Its further rapid spread makes it to be recognised as a pandemic on 11 March 2020. Later that month, the number of cases outside of China quickly surpassed the number of cases inside China (with >118,000 cases in 114 countries + 4291 deaths). Africa recorded her first COVID-19 case in Egypt on 14 Feb. 2020 andthe first confirmed case in Nigeria was announced on 27February 2020, when an Italian citizen in Lagos tested positive for the virus[1, 2, 3].

The COVID-19 pandemic has since caused unprecedented public health challenge and reorganization of the world order.Its then being an era of border closures; trade restrictions; confinement measures/lockdown; jobs & income losses with livelihoods placed at risk; endangered nutrition; socioeconomic coping strategies (like distress asset sales, child labour and loans); workers health & safety issues; disruptions in Rx of malaria, TB & HIV; passive learning by students; unprepared working force for online education and others;mask mandates[4]. Long term effects of COVID-19 (Long COVID) was recognized in 2020 summer. It wasinitially described as symptoms that lasted for longer than 4weeks. However, a better definition by NICE (National Institute for Health & Care Excellence) surfaced by 2020 ending.NICE stated thatCOVID-19 can last up to 4weeks; persistent symptoms lasting 4-12weeks is described as "ongoing symptomatic COVID-19" and symptoms that persisted 12weeks/more were classified as "post- COVID-19 syndrome"[5, 6, 7, 8, 9].

Prevalence of Long Covid

Between 2-3% and 10% of + COVID-19 experience some symptoms for 12wks or longer

while5-36% non-hospitalized & 39-72% hospitalized COVID-19 patients reported long lasting symptoms, 1-3months post - acute infection;2-21% non-hospitalized & 51-68% hospitalized COVID-19 patients had recurrent symptoms 3-6months post - acute infection;

13-25% non-hospitalized & up to 60% hospitalized COVID-19 patients had persistent symptoms after more than 6months post- acute infection. Common reported symptoms in Long COVID are:fatigue(16-98%); shortness of breath(10-93%); headache (9-91%, 1-3months post- acute infection);fatigue (16-78%); cognitive impairment (13-55%); Respiratory Problems (16-21%, 3-6mtnhs post- acute infection)[8, 10]. Long COVID affects female more than male, middle aged women being worst affected; Female>male, by 4:1, due to genetic disposition; anxiety; more reactive immune response (women of productive age) with lingering virus fragments in remote pockets of the body (viral reservoirs) triggering waves of chronic inflammation. Prevalence increases with age, likelihood increases by 3.5%for each decade of life:There is higher chance with higher weight; smoking; lower incomes; living in deprived areas; chronic illness; hospitalization with COVID-19[8, 10]. Imperial College London recently reported that 2m Adults in England may have had Long COVID and one in 20 Adults reporting persistent COVID-19 symptoms for 12weeks/more[11].

Pathophysiology of Long COVID

Presently, there is limited literature on pathophysiology of Long COVID. However, present findings support multifaceted pathophysiology driven by long term tissue damage (lung, brain, heart) & pathological inflammation from viral persistence, immune dysregulation & autoimmunity[12].Pulmonary scarring (with defective pulmonary gas exchange function/pulmonary radiological abnormalities/ functional impairments) may be responsible for persistent dyspnoea/cough in long COVID[13, 14]. Pathophysiology beyond pulmonary lesions have been suggested since there were reports of persistent symptoms in those with pulmonary, radiological & functional improvements (lasting neurological complications – memory loss/anosmia/ fatigue)[15].A meta-analysis found delirium as a common complication in the acute phase of COVID-19 possibly leading to various neurological sequelae –depression, anxiety, PTSD, memory loss & fatigue[16]resulting from ANS dysfunction[17, 18]. Radiological report of Cardiac abnormalities & myocardial inflammation not associated with initial COVID-19 severity[19]& radiological abnormalities of ventricular remodelling in some[20].Cardiac symptoms (chest pain/heart palpitations/tachycardia) commonly persists for up to 6mths suggesting substantial cardiac sequelae[9, 21, 22, 23]. Radiological evidence of impairments of pancreas, spleen, heart, lung, brain, liver & kidney) persisting for at least 2-3months post hospital discharge in moderate to severe cases[24]. Increased risks of new events of respiratory, diabetes, & cardiovascular diseases occurring within 140days following acute onset have also been reported[25]while auto immunity pathophysiology is seen in T-cells dysfunction through bystander activation with associated thyroid dysfunction[26, 27]. The discovery of SARS-CoV-2 nuclei acid & proteins in small intestines of 50% asymptomatic cases at 4months post disease onset points to induced immune activation at some level[28].

Non Pharmaceutical Interventions

Non Pharmaceutical Interventions (NPIs), are public health measures aimed at preventing and/or control SARS- CoV-2 transmission in the community. They are actions that can be taken apart from getting vaccinated and taking medicine to help slow the spread of COVID-19.It's self-protection & community protection intervention, also known as community mitigation strategies which incorporate

behavioural insights into covid-19 response work (attitudes, behaviour and beliefs) that enhance compliance with NPIs[29]. NPIs which are best used concurrently and in combination are isolation and quarantine; physical distancing; use of facemasks; hand hygiene; surface & object cleaning; travel advice; public & school closures; lockdown.NPIs has been in existence since 1918 when it was used to manage the influenza pandemic('Spanish Flu'). The effectiveness of NPIs is not in doubts, compliance is the issue.Early & Sustainable institution of NPIs in the cultural & socioeconomic context is recommended[30, 31, 32].The relative effectiveness of NPIs in reducing COVID-19 transmission across 130 countries and territories have been reported[33].

Vaccination Intervention

Vaccines long existed before COVID-19 came. COVID-19 increase its awareness and discussions. Apathy & Hesitancy in acceptance have been reported. Vaccine hesitancy are concerns about the decision to get vaccinated or to make one's ward and relation available for vaccination. Hesitancy Attributable Factors are:doubts about its actual needs; safety concerns; possible adverse effects concern; misconceptions; doubts about efficacy; past –ve experiences; heuristic thinking; philosophical issues; religious issues; lack of trust in corporations & public health agencies[34].Currently approved COVID-19 vaccines are:Pfizer-BioNtech; Moderna; Johnson & Johnson's Janssen; Sinopharm; Sinovac; Oxford/AsraZenecca. All the currently authorized & recommended COVID-19 Vaccines are safe, effective and reduce risk of severe illness.

Signs and Symptoms of Long COVID

There are prolonged mutiorgan symptoms & complications beyond initial period of acute infection & illness. The cardiorespiratory symptoms arechronic cough; shortness of breath; chest tightness; chest pain; extreme fatigue; palpitations.Neurological symptoms are cognitive impairment ('brain fog'; loss of concentration; memory issues; dramatic mood changes); headache; sleep disturbance; peripheral neuropathy symptoms (pins & needles & numbness); dizziness; delirium (in older populations). Musculoskeletal symptoms are joint and muscle pains while depression and anxiety are psychological symptoms. Theear, nose and throat symptoms are tinnitus, earache; dizziness; loss of taste & /or smell; sore throat. Abdominal pain; nausea; diarrhoea; anorexia & reduced appetite (in older populations) are gastrointestinal symptoms[6, 7].

Necessity of Rehabilitation in Long COVID Management

Clinical assessments to be done are detailed history taking special notice of comorbidities; travelling history; hospitalization within past few months (ICU, duration, M/V); history of tiredness/lack of strength; history of comorbidity; social demographics. Qualitative tests should take note of BP; PR; RR; Body Temp; Functional Capacity (PFTs-FEV, FEV1); BMI; Waist circumference ; P/A Level (IPAQ)/Sedentary Lifestyle; QoL (SF-36 ≤40 points); Pulse Oximetry; Muscle Weakness (oxford muscle grading); Joint Mobility; NPRS/PPS; cognitive impairment; balance; neuralgic/neuropathic pain; gait; 6MWT (Walked distance/ Gait Speed). Special investigations required are full blood count; renal function test; liver function test; C-reactive protein test; exercise tolerance test (breathlessness/HR/ O2 Saturation)and Check X-Ray by 12weeks post- acute infection in cases of continuing respiratory symptoms). Clinical presentations that warrant rehabilitation arebreathlessness; cough; fatigue; joint pain; muscle pain; cognitive defects; balance defects and ambulatory dysfunctions.

Rehabilitation takes special consideration of NICE guidelines which was published in december 2020[5, 6, 7]. It provided a guideline on the management and care of people with long-term effects of COVID-19 and involvesdetailed assessment of referred COVID-19

patient; symptoms that can affect start of rehabilitation safely should be first investigated. Record of and use of tracking app to monitor goals/recovery/any changes in symptoms should be kept.It further reflects personalised rehabilitation program and provision of additional support for older pts.In cases of postural symptoms (palpitations/dizziness on standing), there is need to carry out lying & standing BP & HR recordings (3mins active stand test/10mins if postural tachycardia syndrome is suspected/other forms of autonomic dysfunction[7, 35].

The clinical implications of breathlessness are possible altered breathing pattern; decreased diaphragmatic movement; greater use of neck & shoulder accessory muscles; shallow breathing; increasing fatigue & breathlessness and higher energy expenditure.Aims of rehabilitation in this instance are to normalise breathing patterns; to increase the efficiency of the respiratory muscles; to lessen energy expenditure; to lessen airway irritation; to reduce fatigue and to lessen & improve breathlessness. The needed protocols are breathing control Technique (well supported sitting position with relaxed chest & shoulder; I:E =1:2; inspiration via nose & expiration via mouth @ 5-10mins per session done at regular intervals throughout the day); diaphragmatic breathing; slow deep breathing; pursed lip breathing and patient education on management of breathlessness.Patient with significant respiratory illness will benefit from personalized pulmonary rehabilitation in forms of ACBT (Breathing Control/Deep Breathing/Huffing), done @ 10mins interval until the chest is cleared of sputum with lighter feeling; respiratory muscle training (RMT) and patient education.Fatigue rehabilitation treatment approach takes the form of planning, pacing & prioritising with specific aim of energy conservation for ADL.Pacing which is aimed at improving QoL & to stabilize health is done by breaking challenging elements into smaller & more manageable ones. Typical practical instances are modifying activities (if showering is exhausting, then sitting instead of standing should be adopted while in the bathroom) and identification of strategies to make ADL easier & effectively manage energy. Patients are encouraged to break between activities.Lastly, patient education on management of fatigue is included in fatigue rehabilitation protocol. The necessity for muscle strength rehabilitation is heightened by the estimated 2% muscle mass loss per day. The useful protocols are moderate exercises intervention in the mode of free active exercises still individually packaged without exacerbation of breathlessness; walking & exercising "little & often" with adequate rest periods and small goals with gradual progression. Patient education is still required in muscle strength rehabilitation. 2017 Study (Pandharipande et al) [36] showed 80% of people who receive M/V experience delirium, which can include hallucinations while for critically ill who do not need M/V, the condition affects 20-40%.Though studies are still on, however Cognitive Rehabilitation Therapy (CRT) can help manage/potentially recover from delirium. CRT protocols are memory training; mental exercises; patient counting of numbers while undergoing exercises; specific thinking pattern practises; psychological support for confused/ disoriented patients; relaxation strategies; pursed lip breathing and patient education.

The justification for leveraging on rehabilitation in long COVID management had a boost with a recent observational study by Daynes et al (2021)[37] revealing that COVID-19 rehabilitation appears feasible & significantly improves clinical outcomes (viz: 112m on Incremental Shuttle Walking Test & 544secs on the Endurance Shuttle Walking Test) with no adverse effects recorded & no drop outs related to symptom worsening. Adopted rehabilitation protocols in this study are 6wks duration;2 supervised sessions/week; aerobics (walking/treadmill based); strengthening Training – upper and lower extremities; educational discussions with hand outs; pacing advice & reinforced alongside the exercise component. Further

evidence is seen in RCT of 72 Elderly COVID-19 survivors which showed productive 6week rehab program (breathing/ stretching/home exs) with improved Lung function; exercise capacity; QoL; anxiety but not depression (Liuk et al, 2020). The adopted protocols in this study were combined breathing & light exercises rehabilitation amongst some discharged COVID-19 patients with ongoing symptoms resulting in healed/improved fatigue symptoms[38].

Pulse oximeter, BP apparatus, thermometer are recommended as home care package for safety purposes and continuous monitoring. Rehabilitation outcomes are the Incremental & Endurance Shuttle Walking Test (ISWT/ESWT) completed on a 10m course with familiarisation test at baseline; COPD Assessment Test (CAT); Functional Assessment of Chronic Illness Therapy FACIT); Medical Research Council Scale; Hospital Anxiety and Depression Scale (HADS); EuroQual 5 Domains (EQ5D); Pulse Oximetry; 6 Minute Walking Test (6MWT); LANSS: Leads Assessment of Neuropathic Symptoms & Signs; Visual Analogue Scale, VAS; Montreal Cognitive Assessment (MoCA); Borg Breathlessness Scale; Rate of Perceived Exertion and Short Form-36 Health Survey, SF-36.

Pertinent Lessons

The salient lessons are need for continuous rethinking of the future of Long COVID management; building back better post COVID; rehabilitation is an established institution in health care management whose importance will continue to unfold with ages; continuous provision of solidarity & support in health care delivery; necessity of swift response in the management of critical conditions. Furthermore, emphasis on environmental health safety can never be too much; travelling is closely related to health, 'continuous look' on travelling/transport industry will enhance public health; home grown health institutions should be better funded and given due financial considerations; continuous knowledge sharing across the divide of health care management because with togetherness we can overcome pandemic knowing that the new normal can become the better normal.

Conclusion

Provision of holistic, multifaceted and well monitored individualized rehabilitation programme in management of Long COVID is safe & demonstrates improvements in exercise capacity and symptoms of breathlessness, fatigue and cognition. Cognitive decline in Long COVID can be arrested and improved upon with rehabilitation.Physical Activity Reactivation (PAR) in Long COVID can be safely and productively carried out with the patient being made to 'step out' of Long COVID with reassured health life. The Functional Physical Activity Tempo (FPAT) can be sustained post Long COVID Rehabilitation. Rehabilitation has a huge role to play in the future of Long COVID, as such research funds sponsors should look in the direction of Rehabilitation.

Ethical Clearance – This is an article

Source of Funding – Self

Conflict of Interest – Nil

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