

Post-Acute Rehab after COVID-19 Infection



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Objectives



- Participants will be able to:
 - Describe functional and physiological impairments resulting from COVID-19 infection
 - Identify patients who will benefit from post-acute rehabilitation
 - Compare and contrast functional outcome measures and how they relate to functional recovery
 - Implement/explain cardiopulmonary rehabilitation principals to promote recovery post-COVID-19 infection

Overarching Goals of Post-Acute Rehab



- Maximize safety and independence
- Promote return to prior level of function
- Facilitate return to work, school, or hobbies
- Educate patient and family on management of residual impairments

Patient Presentation Post-COVID-19



- Varied presentations depending on severity of illness and multi-system involvement
- In most cases we see:
 - Impaired skeletal muscle strength and endurance
 - Decreased ability to complete daily activities
 - Ongoing shortness of breath, cough, tachycardia, fatigue, brain fog, and oxygen desaturation with activity even once acute infection is resolved
- Two general broad categories:
 - Those presenting similar to other patients post-ARDS/critical illness
 - Those presenting similar to patients with myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS)

Patients who were critically ill often have
more impairments ...

...but not always!

Patient Presentation Post-COVID-19 – Post-Critical Illness



- Presentation most closely matched to Acute Respiratory Distress Syndrome (ARDS) with additional aspects of Post Intensive Care Syndrome (PICS)
 - Severely impaired endurance with decreased oxygen saturations
 - Profound strength deficits and loss of muscle mass consistent with ICU acquired weakness
 - Cognitive and neurological deficits
 - Restricted breathing pattern similar to pulmonary fibrosis
 - Mental health involvement including anxiety, depression, and PTSD
 - Impaired safety due to all of the above which increases risk for falls

Patient Presentation Post-COVID-19 – Neuroimmune



- Presentation most closely matched to patients with myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS), and/or postural orthostatic tachycardia syndrome (POTS)
 - ***Many of these patients never required hospitalization***
 - ME/CFS CDC description: “Myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS) is a serious, long-term illness that affects many body systems. People with ME/CFS are often not able to do their usual activities. At times, ME/CFS may confine them to bed. People with ME/CFS have severe fatigue and sleep problems. ME/CFS may get worse after people with the illness try to do as much as they want or need to do. This symptom is called post-exertional malaise (PEM). Other symptoms can include problems with thinking and concentrating, pain, and dizziness.”
 - Post-Exertional Malaise (PEM) CDC description: “Post-exertional malaise (PEM) is the worsening of symptoms following even minor physical or mental exertion, with symptoms typically worsening 12 to 48 hours after activity and lasting for days or even weeks. PEM can be mitigated by activity management (pacing). The goal is to avoid PEM flare-ups and illness relapses by balancing rest and activity.”
 - Postural Orthostatic Tachycardia Syndrome (POTS): “POTS is a form of orthostatic intolerance, the development of symptoms that come on when standing up from a reclining position, and that may be relieved by sitting or lying back down. The primary symptom of an orthostatic intolerance is lightheadedness, fainting and an uncomfortable, rapid increase in heartbeat.” (from the Cleveland Clinic website)

WHO Definition of "Long COVID"



- *"Post COVID-19 condition occurs in individuals with a history of probable or confirmed SARS CoV-2 infection, usually 3 months from the onset of COVID-19 with symptoms and that last for at least 2 months and cannot be explained by an alternative diagnosis. Common symptoms include fatigue, shortness of breath, cognitive dysfunction but also others and generally have an impact on everyday functioning. Symptoms may be new onset following initial recovery from an acute COVID-19 episode or persist from the initial illness. Symptoms may also fluctuate or relapse over time."*
- **Essentially: new or ongoing symptoms related to COVID infection that persist or have onset/recurrence at least 3 months after initial infection**

Identifying Patients for Rehab



- Any patient who is below their baseline level of function may benefit from referral for post-acute or outpatient rehabilitation
- Rehabilitation can include many different disciplines, and rehabilitation professionals can help determine additional multidisciplinary needs of individual patients
- Some disciplines can overlap a bit, but generally complement each other, and rehab providers can work collaboratively to maximize patient participation and progress

Identifying Patients for Rehab



- Many patients will qualify and benefit from traditional outpatient pulmonary rehabilitation programs
- Patients with the neuroimmune presentation are more likely to require individual PT, OT, and SLP interventions and would not do well in a pulmonary rehab group
- Nursing staff on inpatient units often know that patients the best and are in a unique position to help identify patients' needs!

Rehab Services A Patient Might Need

- Physical Therapy
 - Strength and endurance assessment and training
 - Monitoring of vital signs and supplemental oxygen needs with activity
 - Balance and flexibility assessment and training
 - Breathing retraining and energy conservation techniques
 - Airway clearance techniques
 - Education on disease process, symptom management, and initiation of long-term exercise training plan



Rehab Services A Patient Might Need

- Occupational Therapy
 - Cognitive assessment and training
 - Training for activities of daily living (ADLs) and instrumental activities of daily living (IADLs)
 - Assessment of readiness to return to work and driving
 - Strength and endurance training



Rehab Services A Patient Might Need

- Speech-Language Pathology
 - Cognitive assessment and training
 - Swallow assessment and training
 - Speech assessment and training
 - Respiratory muscle training
 - Assessment of readiness to return to work and higher level cognitive tasks



Other Services A Patient Might Need



- Dietary/Nutrition
 - Assessment of caloric and nutritional needs
 - Recommendations for diet and nutrition within new constraints of new medical conditions
 - Assessment of protein needs for regaining muscle mass after critical illness
 - Management of diabetes which may be poorly controlled in the setting of critical illness

Other Services A Patient Might Need



- Psychology/Counseling
 - Assessment and management of new mental health conditions including anxiety, depression, and PTSD
 - Education on coping mechanisms
 - Support for family and caregivers who can also experience mental health conditions

Other Services A Patient Might Need

- Pulmonologist, Cardiologist, or Primary Care Physician
 - Management of medical conditions
 - Central point of contact for concerns about patient status
 - Many patients have lasting pulmonary function or cardiac impairments that may need testing and follow up long term



Functional Outcome Measures in Rehab



- Endurance:
 - 6 Minute Walk Test – age predicted norms, MCID for ARDS, useful for oxygen titration
 - Step tests – useful for small spaces where walk tests are not feasible, useful for oxygen titration
 - Repeated sit to stand tests – useful for small spaces, also give measure of lower extremity strength and power, age predicted norms

Functional Outcome Measures in Rehab



- Frailty and Falls Risk
 - Short Physical Performance Battery
 - Static standing balance
 - Gait speed – indicator of falls risk, community mobility, morbidity, and risk for re-hospitalization
 - 5x Sit to Stand – lower extremity strength and power, risk for falls
 - Timed Up & Go – general mobility and falls risk, functional endurance, age-predicted norms

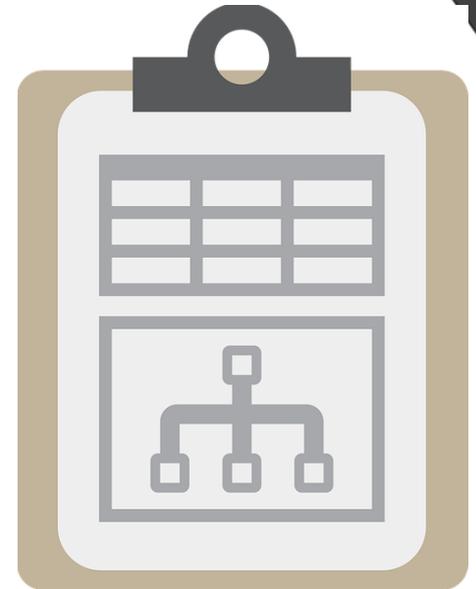
Functional Outcome Measures in Rehab

- Activity tolerance
 - Ability to complete daily activities
 - Ability to safely and effectively mobilize in the home
 - Ability to access the community
- Social supports
- Medical/assistive equipment needs



Written Outcomes

- Depression screenings
- Quality of life measures
- Symptom-based questionnaires
- Cognitive assessments



- Lifestyle Management
 - Pacing
 - Know when to slow down, stop, and rest
 - Energy Conservation Techniques
 - Including completing activities in sitting, building in rest breaks, and using adaptive equipment
 - Activity Modification
 - Decreasing energy demands of daily and work activities, learning alternate methods for completing activities, setting up for success for return to home and return to work

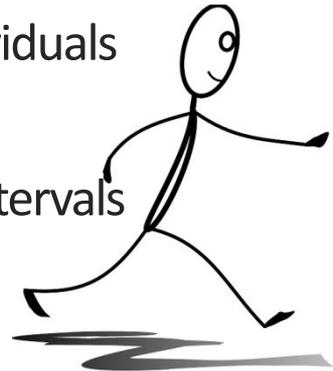
Therapy Interventions

Aerobic training – ARDS/PICS presentation

- Goal: improve endurance to improve ability to complete activities
- Modes: walking, cycling, rowing, arm ergometry
- Duration: generally working towards 20-40 minutes per session
- Frequency: 4-6 days per week
- Intensity: moderate, may incorporate HIIT for higher functioning individuals

Aerobic training – Neuroimmune presentation

- Very variable, but usually starting with low intensity, short duration intervals



Monitoring Intensity – Modified Borg Scales

Perceived Exertion Scale		Breathlessness Scale
No effort	0	No breathlessness at all
Very, very light	0.5	Very, very slight
Very light	1	Very slight
Light Exertion	2	Slight breathlessness
Moderate	3	Moderate
Somewhat intense	4	Somewhat severe
Intense exertion	5	Severe breathlessness
	6	
Very intense exertion	7	Very severe breathlessness
	8	
Very, very intense exertion	9	Very, very severe breathlessness
Maximal exertion	10	Maximal breathlessness

- Patients may not have access to equipment with a "workload" or "speed"
- Self-report subjective symptom rating scales are very useful to help patients achieve the desired exercise intensity

Therapy Interventions

Strength training

- Goal: improve general strength to improve movement efficiency, decrease effort with activities, maintain healthy bones and muscles
- Modes: hand weights, resistance bands, weight machines, body-weight, putty
- Muscle groups: Primarily focus on proximal and trunk generally, other areas as indicated
- Frequency: 2-4 days per week
- Intensity: Generally focused more on endurance over power, therefore typically lower weight, higher reps; may also focus on specific areas of weakness such as grip strength

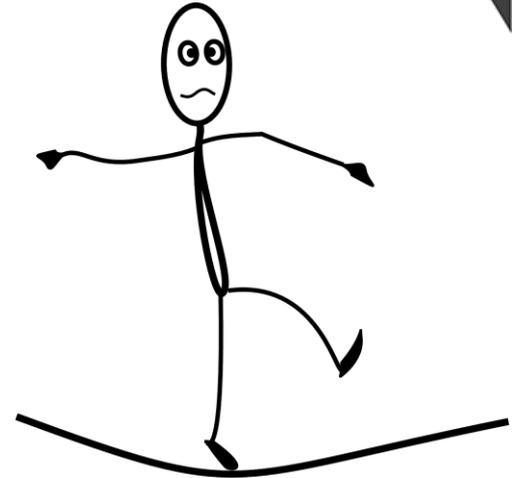


Flexibility

- Goal: improve/maintain ROM and posture, improve movement efficiency, decrease risk for injury
- Muscle groups: focus on hips, shoulders, chest, thighs, calves, and any other areas with a specific impairment
- Frequency: 4-6 days per week

Balance

- Goal: improve postural reactions and decrease falls risk
- Static and dynamic balance training
- Seated or standing depending on needs



Therapy Interventions



Breathing retraining

- Goal: improve breathing efficiency and effectiveness to decrease symptoms and improve oxygenation
- Breathing techniques: pursed-lip, diaphragmatic, paced, paired, inspiratory hold
- Chest wall mobility: manual rib mobilization and muscle facilitation, paired breath and movement techniques
- Respiratory muscle training: incentive spirometry, inspiratory/expiratory muscle training

Cognitive training

- Problem solving and memory exercises
- Concentration and recall exercises
- Reaction time and decision-making activities

Therapy Interventions



Oxygen titration

- Many patients need different amounts of supplemental O₂ with activity than they do at rest
- Some patients may need O₂ still with exercise even after weaning from O₂ at rest
- PT and OT can help determine O₂ needs with various activities and report back to providers to facilitate appropriate prescription
- Continuous monitoring of vital signs during exercise to ensure safety

Home Exercise Program

- PT, OT, and SLP can give patients home exercises to perform simultaneously with therapy sessions
- PT, OT, and SLP can initiate long term exercise training programs and teach patients how to progress
- Based on what we know of ARDS, ME/CFS, POTS, and other cardiopulmonary conditions, regular exercise will likely need to be a lifelong pursuit for patients who have had COVID-19

Prognosis and Goal Setting

- PT, OT, and SLP can assist patient in setting realistic and achievable goals for recovery, which can keep the patient motivated and engaged
- Patients who participate in early rehab can regain function more quickly and completely than those who do not participate
- “Long Haulers” can still benefit from rehab even months after their acute illness
- Long term prognosis is still uncertain at this time, but based on our experience with ARDS and PICS, rehab during the first 2-3 months after critical illness are vital to maximizing recovery
- Patients with the neuroimmune presentation tend to have a slower recovery with more frequent setbacks

Referral Process and Considerations



- Ideally want to find a multidisciplinary program that can accommodate all the patient's needs
- Give the patient some info about why they are being referred and how it will help – this improves the chance they will buy in and attend
- Get the patient's family involved to help promote improved recovery and support
- If you or the patient are unsure if rehab will be beneficial, encourage the patient to get a referral and at least attend an evaluation with the therapists. Most patients are unaware of the benefits rehab can provide

What Questions Do You Have?



Image: <https://pixabay.com/vectors/crossfit-fitness-sports-3180368/>

References and Sources



- Center for Disease Control and Prevention. <https://www.cdc.gov/coronavirus/2019-nCoV/index.html>
- Dong Y, Mo X, Hu Y, et al. Epidemiological Characteristics of 2143 Pediatric Patients with 2019 Coronavirus Disease in China. Pediatrics. Pre-Release Publication Release.
- Yuki K, Fujjogi M, Koutsogiannaki S. COVID-19 Pathophysiology: A Review. Elsevier Review Article. 20 April 2020.
- Lan J, Ge j, Yu J, et al. Structure of the SARS-CoV-2 Spike Receptor Binding Domain bound to the ACE2 Receptor. <https://www.nature.com/articles/s41586-020-2180-5>
- Grimwood K, Chang A. Long-term effects of pneumonia in young adults. Pneumonia. 2015 Oct 27; 6:101-114.
- Roupie E, Lepage E, Wysocki, et al. Prevalence, etiologies and outcome of the acute respiratory distress syndrome among hypoxemic ventilated patients. Intensive Care Med (1999) 25: 920-929.
- Bruck E, Schandi A, Bottai M, Sackey P. The impact of sepsis, delirium, and psychological distress on self-rated cognitive function in ICU survivors- a prospective cohort study. Journal of Intensive Care (2018) 6:2.
- Wang T, Du Z, Zhu F, et al. Comorbidities and multi-organ injuries in the treatment of COVID-19. March 2020.
- Wichmann D, Sperhake J, Luthehmann M, et al. Autopsy Findings and Venous Thromboembolism in Patients with COVID-19: A prospective cohort study. Annals of Internal Medicine. May 2020.

References and Sources



- American Physical Therapy Association Post-Acute COVID-19 Exercise and Rehabilitation (PACER) Project: <https://www.youtube.com/playlist?list=PLne40IpTInF62gkGJYkRvty0Mzfxect2g>
- Spruit MA, Holland AE, Singh SJ, et al. COVID-19: interim guidance on rehabilitation in the hospital and post-hospital phase from a European Respiratory Society- and American Thoracic Society-coordinated international task force. *Eur Respir J* 2020; 56: 2002197 [<https://doi.org/10.1183/13993003.02197-2020>].
- Spruit MA, Holland AE, Singh SJ, Troosters T. Report of an ad-hoc international task force to develop the expert-based opinion on early short-term rehabilitative interventions (after the acute hospital setting) in COVID-19 Survivors (version April 3, 2020)
- Kho ME, Brooks D, Namasivayam-MacDonald A, Sangrar R, Vrkljan B. (2020) Rehabilitation for Patients with COVID-19. Guidance for Occupational Therapists, Physical Therapists, Speech-Language Pathologists and Assistants. School of Rehabilitation Science, McMaster University. <https://srs-mcmaster.ca/covid-19/> Accessed April 18, 2020.
- Smith JM, Lee AC, Zeleznik H, et al. Home and Community-Based Physical Therapist Management of Adults With Post-Intensive Care Syndrome. *Phys Ther.* Apr 2020.
- Jensen LA, Onyskiw JE, Prasad NGN. Meta-analysis of arterial oxygen saturation monitoring by pulse oximetry in adults. *Heart Lung.* 1998;27(6):387-408.
- Bansal M. Cardiovascular disease and COVID-19. *Diabetes Metab Syndr.* 2020;14(3):247-250
- Steffan Nollinger L. Age- and Gender-Related Test Performance in Community-Dwelling Elderly People: Six-Minute Walk Test, Berg Balance Scale, Timed Up & Go Test, and Gait Speeds. *PhysTher.* 2002; 82(2): 128-137.

References and Sources



- Hillegass E. Essentials of Cardiopulmonary Physical Therapy 4th ed. St. Louis, MO: Elsevier; 2017.
- Gandotra S, Lovato J, Case D, et al. Physical Function Trajectories in Survivors of Acute Respiratory Failure. *Ann Am Thorac Soc*. 2019;16(4):471–477.
- Hillegass E, Fick A, Pawlik A, Crouch R, Perme C, Chandrashekar R, McNamara SB, Cahalin LP. Supplemental Oxygen Utilization During Physical Therapy Interventions. *Cardiopulm Phys Ther J*. June 2014;25(2):38–49.
- Interim Guidance for Implementing Home Care of People Not Requiring Hospitalization for Coronavirus Disease 2019 (COVID-19). <https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-home-care.html>. Updated 2/12/20. Accessed 4/15/20.
- Marley WP, Linnerud AC, A three-year study of the Astrand-Ryhming step test *Research Quarterly*. 1976 May;47(2):211–7.
- Needham DM, Sepulveda KA, Dinglas VD, et al. Core Outcome Measures for Clinical Research in Acute Respiratory Failure Survivors. An International Modified Delphi Consensus Study. *Am J Respir Crit Care Med*. 2017;196(9):1122–1130.
- Sanderson B, Bittner V. Practical interpretation of 6-minute walk data using healthy adult reference equations. *J Cardiopulm Rehabil*. 2006 May-Jun;26(3):167–71.
- CDC Website on ME/CFS: <https://www.cdc.gov/me-cfs/index.html>. Accessed 7/15/2021
- Cleveland Clinic Website on POTS: <https://my.clevelandclinic.org/health/diseases/16560-postural-orthostatic-tachycardia-syndrome-pots>. Accessed 7/15/2021
- Thomas P, Baldwin C, Beach L, et al. Physiotherapy management for COVID-19 in the acute hospital setting and beyond: An update to clinical practice recommendations. *Journal of Physiotherapy*. 2022;68(1):8–25. doi:10.1016/j.jphys.2021.12.012
- <https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/index.html>
- <https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/care-post-covid.html>