Philippine Journal of Physical Therapy
ISSN: 2766-3086
Original Research

Physical Therapy Differential Diagnosis for a Patient with Viral Central Nervous System Infection in Acute Care: A Case Study

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To cite this article: Castillo, M (2022). Physical therapy differential diagnosis for a patient with viral central nervous system infection in acute care: A case study. *Philippine Journal of Physical Therapy.* 1(2):1-13. https://doi.org/10.46409/002.WHYB1519

Abstract

Introduction: This case report presents a patient with respiratory distress who went into coma and was admitted in the intensive care unit (ICU). The paper will discuss the initial impressions in the ICU and the differential diagnosis considered to arrive at an accurate diagnosis. It will demonstrate how information from physical therapy contributed to discern the proper diagnosis, and the evolving treatment plan and interventions as the patient progressed and discharged out of the ICU into the hospital floors.

Methods: This is a case of a 32-year-old male who self-admitted to the emergency department (ED) of his local hospital due to shortness of breath, weakness, and high fever. The study will detail how physical therapy helped analyze the patient's condition to arrive at the most appropriate management of the patient.

Results: The patient underwent 10 physical therapy sessions in the acute care setting before being transferred out to an acute rehabilitation unit, and then discharged to home.

Discussion: This article highlights the role of physical therapy in acute care rehabilitation of a patient with a complex presentation following a viral central nervous system (CNS) disease and its efforts in ensuring proper discharge disposition.

Keywords: viral cns infection, encephalitis, icu management, guillain-barre syndrome, critical illness polyneuromyopathy (cipnm), acute care physical therapy, discharge planning in acute care

Received: *February 12,2022.* ***Revised:*** *March 23, 2022.* ***Accepted:*** *April 10, 2022*
Published by ***University of St. Augustine for Health Sciences*** *on behalf of the Philippine Physical Therapy Association. ISSN: 2766-3086*

Introduction

Physical therapists (PT) in acute care have seen their roles change and evolve over the years. Physical therapy historically was involved in mobilization, ambulation, and safety assessment of patients in acute care, and expectations were that they will get the patients moving enough so they can be discharged home or to the next level of care. These interventions were usually limited by the patients' medical diagnosis and stability (Dubb, 2016). Physical therapists were seen as adjunct services that assisted to improve hospital throughput and continued availability of beds. Research on the importance of early mobilization in various patient populations started to change how physical therapy was utilized in the hospitals (Falvey, 2019; Shaik, 2014). The importance of therapeutic exercise early on to prevent deconditioning, muscle wasting and even depression have increased the demand for physical therapy in the acute care setting (Haider, 2019; Shaik 2014). When before, the rehab clinician will be involved close to the time of discharge because of patient stability and tolerance, more patients with higher acuity levels are being referred early on and physical therapy are being entrusted with their care (Hanekom, 2011). In the meantime, the physical therapy profession has also evolved and made changes on entry-level education and training, enhancing curricula, and elevating the profession to a doctoral level with expertise on movement science and expanded knowledge of pathophysiology and differential diagnosis (Grignon, 2014). In spite of all these changes, the Filipino physical therapists, along with the rest of their international peers are still faced with underutilization and challenges in perception as to their professional value (Al-Eisa, 2016). This highlights the need to increase collaborative opportunities between physicians and physical therapists to increase awareness of the roles and scope of practice of physical therapists (Callejo-Tiuseco, 2022). The American Physical Therapy Association (APTA) Guide in Physical Therapy practice stated that "Physical therapists use a systematic process (sometimes referred to as differential diagnosis) to classify an individual into a diagnostic category. This process includes integrating and evaluating the data that are obtained during the examination to describe the individual condition in terms that will guide the physical therapist in determining the prognosis and developing a plan of care" (Guide to PT Practice. Patient and Client Management, Diagnosis section, 3rd paragraph, 2014). This essentially means the physical therapist can and should synthesize any pertinent data available to them and utilize this data to deliver the most appropriate level of care to the patient.

The acute care environment is very demanding to any clinician. It is fast paced and exacting in its nature. Patients from the time they are admitted are triaged according to the severity of their condition. Due to the ever-changing conditions, clinical presentations may not be evaluated thoroughly, and accuracy can falter. These mistakes can occur in the best situation, without extenuating circumstances so the risk that it can happen when time is limited, and the urgency of the situation is of the utmost consideration (Goldsworthy, 2017). These conditions are ever present in the intensive care unit (ICU) (Zacharia, 2012). Medical errors are the third leading cause of death in the United States, resulting to as much as a quarter-of-a-million lives annually (Garrouste-Orgeas, 2016). This incidence is of course not all due from misdiagnosis, nor is it implied that misdiagnosis alone could result to a fatality. The point is medical errors can happen in any environment and it can potentially cause harm. An effective safeguard against medical errors is the multi-disciplinary team approach in patient management (Jeong, 2019; Kim, 2010). Each discipline contributes their own expertise to patient management, and also acts as another pair of expert eyes that can sound the alarm if the clinical picture is suspect. Physical therapists with their unique training and perspective are an important part of this process. PTs can help assess the acutely ill patient and competently compare their findings with the prevailing clinical diagnosis and whether the medical treatment plan coincides with their plan of care (Bemis-Dougherty, 2013; Falvey, 2019). This process can identify discrepancies, and inconsistencies can be identified and managed sooner rather than later. Critical thinking is required and should be consistently applied throughout the whole process.

For clinicians in the ICU the compelling dilemma is the unconscious neurological patient. This is the type of condition that will benefit most from a rapid assessment and intervention in order to prevent further damage to the CNS (Goldstein, 2009). While in the ICU, critical illness symptoms can obscure neurological differential diagnosis leading to mismanagement and mismatched intervention (Balin, 2012). The purpose of this case study is to feature the differential screening process of a physical therapist in acute care and how physical therapy intervention was planned and changed as the patient progressed up until his successful discharge to acute rehab.

Method

Case Description: Patient history and initial examination

Verbal consent from the participant was obtained for this case report. This is a case of a 32-year-old male who self-admitted to the emergency department (ED) of his local hospital due to shortness of breath, weakness, and high fever. The ED physician promptly diagnosed him with evolving pneumonia and admitted him, on day one. His condition spiraled downhill very quickly, and he was transferred to the ICU due to increasing respiratory distress. He was given the diagnosis of acute respiratory distress syndrome (ARDS) and soon he was intubated. Patient spent 7 days on a ventilator in the ICU before he was extubated, and on

Table 1: Summary of findings: Discrepancy from expected to actual findings

Impairment	Expected Signs and Symptoms from initial diagnosis (CIPNM)	Examination Findings
Cognition	Impaired	Alert, oriented x1, confused intermittently
Muscle weakness	Axial vs. distal	(+) proximal weakness
Sensory deficit	Intact sensation	Intact
Muscle tone	Increased muscle tone	(+) Rigidity
Muscle reflexes	Hyperreflexia	3+ DTRs, (+) ankle clonus
Pathological reflexes	(+) UMN reflexes	(+) Babinski reflex
Autonomic Dysfunction	Present	(+) Tachycardia, (+) hypotension
Cranial nerves	Possible weakness	Intact
Speech deficit	Possible deficit	Intact
Dysphagia	Possible deficit	Intact
Ventilator support	Early weaning	7 days on ventilator

day 8 he found himself unable to move on his own with severe weakness of both trunk and his extremities. The patient's Glasgow Coma Scale for level of consciousness at the time, as determined by the physician was 14 out of 15, due to intermittent confusion. His other symptoms included hyperreflexia and increased muscle tone. Patient was given another diagnosis of critical illness polyneuromyopathy (CIPNM). Physical therapy examined the patient and found that his clinical assessment did not completely fit his current diagnosis. The patient was tested in the areas of cognition, muscle strength, sensation, postural control, and functional mobility in addition to a neurological screening exam. The physical therapy assessment confirmed the initial physician's findings, but in addition observed that the patient had significant neurological deficits, most likely of upper motor neuron (UMN) etiology. Table 1 summarized the physical therapy findings, including those from other rehab disciplines. This was reported to the attending intensivist and patient was referred to a neurologic specialist for further testing.

Further tests and studies also ruled out other neurological conditions that may be coincide with the patient's current presentation. These included his current diagnosis, CIPNM and Guillain-Barre Syndrome (GBS). Critical illness polyneuromyopathy is a neuromuscular cause of weakness in ICU patients with sepsis and multi-organ failure. It is characterized as a systemic inflammatory disease. Pathogenesis of CIPNM is unknown with no specific toxin, infectious agents, looking at CIPNM should also then consider the possibility of GBS (Eldar, 2014).

The consulting neurologist concluded from the various laboratory testing and diagnostic imaging including magnetic resonance imaging (MRI) that the patient had a viral pathology affecting his central nervous system, viral CNS infection or encephalitis. Viral infections in the CNS can induce neurological dysfunction and serious life-threatening inflammatory conditions. In the United States, viral exposure can lead to CNS infection in 4.5% of cases and have up to an average of 26 days in the ICU (Bookstaver,2017; Dahm, 2016). In retrospect, this patient reported close contact with a person with flu-like symptoms a few days before he felt ill. This diagnosis confirmed what the physical therapy evaluation revealed and supported the therapy interventions instituted to mitigate his deficits or nutritional deficiency identified (Fan, 2009). The severe muscle weakness, initial confusion, and paralysis of CIPNM patients can mimic signs and symptoms of a neurological disorder. GBS is the most common form of neuromuscular paralysis in developed countries. The annual incidence of GBS in the United States is about 1-2 per 100,000 annually (Jasti, 2016; van Doorn, 2008). Its clinical symptoms are commonly inter-related with that of CIPNM.

Table 2. Common antiviral medications and adverse effects (Amirian, 2020; Bookstaver, 2017)

Antiviral medication	Adverse effects	Antiviral activity/ common use
Acyclovir	Nephrotoxicity, headaches, acute mental status change, gastrointestinal, bone marrow suppression	Herpes Simplex virus, Varicella Zoster virus
Foscarnet	Nephrotoxicity, electrolyte abnormalities, anemia, genital ulceration	Cytomegalovirus, Acyclovir-resistant Herpes Simplex virus, Varicella Zoster virus
Cidofovir	Nephrotoxicity, proteinuria, neutropenia	Cytomegalovirus, poxvirus, adenovirus, Human Papillomavirus, Acyclovir-resistant Herpes Simplex virus, Varicella Zoster virus
Remdesivir	Liver damage or liver toxicity, gastrointestinal	Coronavirus, COVID 19

Pharmacology

Having the diagnosis of viral CNS infection was crucial for this patient as the pharmacological management of his condition significantly differs from the other considered possible diagnoses. Medications have specificity and targets the pathology that it was designed to resolve. Drug selectivity increases its efficacy against a particular disease while completely unremarkable for another, or worse can be contraindicated or harmful if applied to a different diagnosis. The timing of medication is also important, as any delay can increase the grip of the pathogen making mitigation more difficult or futile.

Guillain-Barre Syndrome's standard of treatment are the use of plasmapheresis and intravenous immunoglobulin (IVIg) treatment (Jasti, 2016). Plasmapheresis or plasma exchange is the process of removing antibodies and other potentially injurious factors from the bloodstream using a cell separator. The plasma is substituted by a different solution, usually albumin. The remaining cells are then returned to the individual minus the antibodies. The rationale for its use in GBS is the moderation of the acute inflammation affecting the peripheral nerves and manifested as a severe neuromuscular paralysis, which is thought to be caused by an autoimmune reaction (Eldar, 2014; van Doorn, 2008). Intravenous immunoglobulin is the treatment of choice for GBS. This is made from donated blood containing healthy antibodies that is delivered by infusion therapy, hence halting the individual's own antibodies from wreaking havoc in his system. Both therapies are delivered within a course of several days and it is recommended to be started at the early onset of the disease (Jasti, 2016).

Critical illness polyneuromyopathy, CIPNM is best treated by a regimen that follows a tightened glycemic control and intensive insulin therapy (Pati, 2008). It is thought to control inflammation in patients at risk for or afflicted with the condition (Hermans, 2008). This approach is both for the prevention and treatment of CIPNM. The key is to lessen the time the patient remains in crisis or connected to a ventilator.

Viral infection in the CNS is treated by antiviral agents. These are specific and potent agents that's able to cross the blood-brain barrier and neutralizes the virus before it can cause further damage (Bookstaver, 2017). The dosage and timing of antiviral medications are important to consider, because if applied late, the viral load may be so high that it can overwhelm the hosts leading to a fatal outcome. Identification of the infectious agent has to be a priority. Anti-viral drugs can be effective on some, but not all viruses that afflict the CNS. Left unchecked, the virus will proliferate and wreak havoc and disrupt this sensitive neuro environment (Terry, 2012). So, if a pharmacological intervention is possible, it has to be applied immediately.

These differing scenarios have to be considered for this patient. If the diagnosis is inaccurate or missed, then use of IVIg or plasmapheresis would have been ineffective and/or attempting to tightly control his blood glucose levels would also be inappropriate. The consequence of attempting these ineffectual treatments would be dire as these trials would prevent the patient from receiving the antiviral agents in time, possibly causing irreversible CNS damage. In a case of a viral CNS infection, getting the accurate diagnosis early on and identifying the pathogen (virus), will allow for treatment to start promptly, hopefully increasing the patient's chances of recovery.

This patient's case evolved so fast and at dangerously precipitous level that the medical team was forced to act quickly and decisively. A dose of anti-viral agents was prescribed in consideration of all the input from the members of the ICU team (see Differential Screening section). A combination of the anti-viral drugs Acyclovir and Ganciclovir were administered intravenously for 14 days. Both anti-virals have shown more than

Table 3. Differential diagnosis for viral CNS infection

Impairment	Expected signs and symptoms	Exam findings	Supporting the diagnosis
Cognition	Impaired	Alert, oriented x 1, intermittent confusion	Consistent with CNS infection (CNS-I)
Muscle weakness	Axial vs. distal	Axial weakness	Consistent with CNS-I
Sensory deficit	Intact sensation	Intact	Consistent with CNS-I
Muscle tone	Increased muscle tome	+ Rigidity	Consistent with CNS-I
Muscle reflexes	Hyperreflexia	3+ DTRs, + Ankle clonus	Consistent with CNS-I
Pathological reflexes	+ UMN reflexes	+ Babinski reflex	Consistent with CNS-I
Autonomic Dysfunction	Present	+ Tachycardia, hypotensive response	Consistent with CNS-I
Cranial nerves	Possible weakness	Intact	Inconsistent with CNS-I
Speech deficit	Possible deficit	Intact	Inconsistent with CNS-I
Dysphagia	Possible deficit	Intact	Inconsistent with CNS-I
Ventilator support	Early weaning	7 days on ventilator	Consistent with CNS-I

promising potency in treating CNS infections (Giovane, 2018). The principal factor is prompt action in order to prevent the development of long-term complications and increased mortality to the disease.

Other pertinent medications include the sedation used during the patient's intubation period. Sedation and analgesia are generally recommended for patients on mechanical ventilation in the ICU. The primary reasons were for patient comfort, prevent anxiety and to avoid accidental extubation due to patient agitation or irritation from the endotracheal tube and the lung pressure from the ventilator machine (Frade-Mera, 2016). Any of the conditions can result to patient-ventilator asynchrony, a serious disorder that can contribute to poorer outcomes (Bruni, 2019). These safeguards are usually important for the general well-being and safety of the patient. However, in the backdrop of the COVID-19 pandemic, this is also important for the health and safety of the medical staff in the ICU. Forceful self-extubation can result to uncontrolled release of aerosolized bodily liquids that can spread infectious sputum all over the room. This can increase the risk of transmission and infection to the virus. The process of reintubation will also cause unnecessary exposure risk to healthcare workers. In a droplet precaution environment where heightened risk of cross-infection to a life-threatening contagion is high-stakes, these risks need to be carefully mitigated (Hanidziar, 2020). The patient received propofol for sedation which is also used for intubated patients with COVID-19. The side effects and special considerations for sedation will be discussed in the next section.

Medication side effects: Antivirals

Antiviral medications have their own risks when used. One of the common side effects of this class of medication is acute kidney injury or nephrotoxicity that leads to acute renal failure (Wong, 2017). The mechanisms of which is still being debated because it can vary depending on the drug and the individual. However, the consequence remains serious and severe, up to the point that the patient may require dialytic therapy (Leowattana, 2019). Table 2 summarizes some of the serious side effects of well-known antivirals.

Table 4. Outcomes-based assessment of patient progress

Outcomes	Initial Evaluation (ICU)	Session 5 (Treatment) Medical Surgical Unit	Session 10 (Treatment) Discharge
Receptive and Expressive communication • One-step commands • Two-step commands	• 2 out of 10 (20%) • 0 out of 10 (0%)	• 5 out of 10 (50%) • 3 out of 10 (30%)	• 10 out 10 (100%) • 7/8 out of 10 (75%)
Level of Arousal and Attention • Time in minutes awake during 60 minute session • Attention to tasks	• 20 cumulative minutes • 20% attention to tasks	• 45 to 50 cumulative minutes • 50% attention to tasks	• 60 minutes (out of 60) • 100% attention to tasks •
Postural Control • Sitting balance (amount of assist) • Sitting unsupported (time in minutes) • Functional reach in sitting	• 100% assistance • 10 minutes	• 6 inches	• 25% assistance • 25 minutes • 12 inches
Functional Mobility • Rolling in bed • Supine to sit • Sit to stand from bed	• Dependent • Dependent • Unable	• Moderate assist (<50%) • mod to max assist (>50%) • Mechanical lift assist	• Minimum assist (<25%) • Mod assist (<50%) • Max assist of 2 (>75%)
Activity Tolerance • Rating of perceived exertion (RPE)	• 18 out of 20 (very hard) overall	• 13 out of 20 (somewhat hard) overall	• 8 out of 20 (very light) overall

As can be seen on Table 2, antivirals such as *Acyclovir*, can cause acute kidney injury along with headaches, mental changes, and bone marrow suppression. Myelosuppression or bone marrow suppression is a serious side effect usually from chemotherapy, wherein there is a decrease bone marrow activity and reduction in blood cells production. If allowed unabated, this condition will lead to severe infections and even uncontrolled hemorrhage which can be fatal (Epstein, 2020). These side effects should be monitored by the medical team and considered by the treating physical therapist. Patients showing signs of nephrotoxicity may require rest and avoid strenuous activities to help the body to recuperate. Patients with severe electrolyte imbalance may require aggressive hydration and need monitoring for signs and symptoms of dehydration during physical therapy (Bookstaver, 2017). These conditions will affect the patient's tolerance to activities and physical therapy treatment have to be modified accordingly. At the time of writing of this paper, there is an ongoing public health crisis around the world, a global pandemic caused by a coronavirus, SARS-CoV-2. The devastating effect of this virus has been unprecedented in modern history. *Remdescivir* is an antiviral drug that underwent clinical trials at the National Institute of Health (NIH) for the treatment of COVID-19 (NIH,

2020). The scientists at the NIH have recommended *Remdescivir* for advanced COVID-19 cases. There is still a lot of data to be fully analyzed, but initial reports show the drug can cause elevated liver enzymes and possibly significant liver damage along with other long-term unknowns (Amirian, 2020). Knowing what we know now, will the risks still outweigh the benefits?

Side effects of sedating agents

Sedation and analgesia are important to address in a mechanically intubated patient. Pain relief or pain control is an important first step in managing tolerance in intubated patients. Once pain is controlled by pharmaceutical means, getting the patient under sedation is less troublesome, but in no way less complicated (Kapp, 2020). Over sedation and under sedation have their own complications. Over sedation can lead to symptoms of respiratory failure, prolonged intubation, possibly delirium and thus longer ICU stays. Inadequate sedation can result to greater patient discomfort, anxiety and as mentioned earlier, patient-ventilator asynchrony and hence poorer ventilatory support (Chanques, 2020, Kapp, 2020). The ICU intensivist has to carefully balance the need for unconsciousness with the end goal of resolving the cardiopulmonary problem, and eventually regaining consciousness and coherence at the soonest possible time. It is important for the ICU staff to continually assess and monitor patients under sedation for any signs of distress or abnormal physiologic responses.

The sedating agent used in this case was *Propofol*. It belongs in the class of non-benzodiazepine lipophilic drugs that can quickly cross the blood-brain barrier and effect sedation. Its accelerated effect in inducing sedation is equaled by its reputation for early recovery of consciousness once continuous infusion is discontinued. The drug is also regarded to have neuroprotective properties in cases of brain ischemia, which may be advantageous for our patient with viral encephalitis (Patel, 2012). *Propofol* does have its share of adverse drug reactions, ranging from hypotension, spike in triglyceride levels, and a rare but highly fatal infusion syndrome characterized by bradycardia, cardiac failure, and asystole (Smuszkiewicz, 2016). As with every other powerful drug used in the ICU, proper titration, dosing, and monitoring is essential to avoid catastrophic complications.

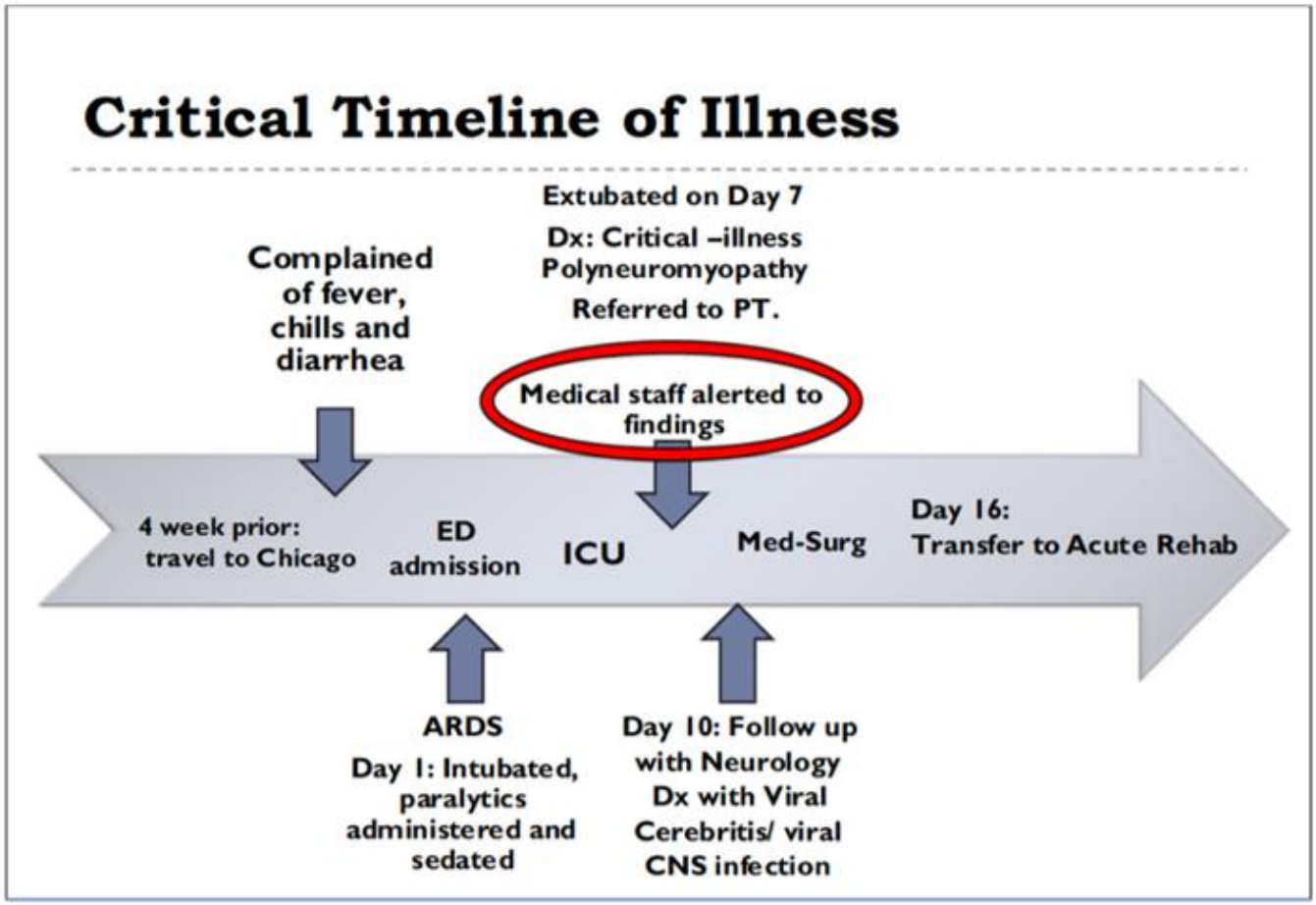

Figure 1. Critical Timeline of Illness

Table 5. Summary of problems and goals

Problems	Goals
Initial eval in ICU to transfer to Medical Unit	
1. Altered level of consciousness	1. Increase level of arousal during activities as measured by vigilant time. 2. Increase attention in therapy sessions as measured by percentage of time patient was attending to tasks.
2. Severe axial muscle weakness	3. Increase head and trunk control against gravity, able to hold head over body.
3. Impaired postural control	4. Increase bed mobility activities, rolling, supine to sit, sit to supine. 5. Increase unsupported sitting activities with symmetrical posture, over period of time and amount of assist.
4. Impaired activity tolerance	6. Increase tolerance to therapeutic activities, measured by RPE.
Medical-Surgical Unit to Discharge from acute care	
1. Decreased mobility activities	1. Increase in following commands and task sequencing. 2. Initiate weight transfer activities to LE in preparation for standing, increased transfer response.
2. Continued caregiver education	3. Complete caregiver education for ROM exercises, positioning and sensory stim, in preparation for discharge.

Differential Screening and Red Flags

The physical therapy differential screening exam findings are summarized on Table 3. The findings from the physical therapy assessment taken cumulatively pointed towards an upper motor neuron disease. This input helped the medical team to rule out the other diagnoses being considered, CIPNM and GBS. To clarify, and referencing the exam findings in Table 3, CIPNM would've been consistent for two of the impairments, speech deficit and dysphagia. GBS would only be consistent for autonomic dysfunction. A viral CNS infection would have the most consistent findings. This convinced the intensivist to refer the patient to a neurologist who confirmed the above findings and ordered more definitive tests. Radiologic imaging is the usual first step in the diagnostic process of a CNS pathology. Magnetic resonance imaging (MRI) has significantly greater sensitivity for evaluating cerebral parenchyma and is generally superior to computed tomography (CT) for characterizing viral, fungal, and parasitic infections of the CNS (Swinburne, 2017). More advanced magnetic resonance (MR) techniques can also be employed, such as MR spectroscopy which can assess metabolic profiles of normal and pathologic brain tissues, hence useful for detecting CNS lesions. In addition, other diagnostic techniques that can be used is a lumbar puncture, which can identify elevated levels of protein and lymphocytes present in the cerebrospinal fluid, at differing concentration thresholds which can be characteristic with a particular CNS infection. (Bookstaver, 2017). Recently, new technologies have been developed that can assist diagnosis at the molecular level. Refinements in the detection of viral polymerase chain reaction (PCR) has improved the sensitivity and specificity of testing for viral CNS infections (Moffa, 2019). Results for these tests along with the patient's clinical presentation led to the final diagnosis of a viral CNS infection.

In summary, the clinical findings observed in the physical therapy exam (refer to Table 3), served as red flags and were the catalyst for reconsideration of the patient's diagnosis by the medical team. The speed in which his symptoms worsened and quickly deteriorated was cause for alarm. Patient came in for shortness of breath and chest congestion, which led to respiratory distress and an ED diagnosis of rapidly evolving pneumonia necessitating ICU

admission and intubation. The precipitous degradation of his condition leading to an acute respiratory distress syndrome (ARDS) can be indicative of a severe virulent infection (Shah & Wunderink, 2017). Other factors to consider are the patient's health history, in this case having a history of asthma, and obesity along with a sedentary lifestyle, could all be factors that can predispose him to a pulmonary insult (Hibbert, 2012). It is worth mentioning that the patient's marked improvement after the administration of the anti-viral medications, further confirmed his diagnosis. Figure 1 shows a timeline of events that happened from onset of symptoms to the patient's movement through the different levels of acute care, up to his discharge to acute rehab.

Results

Physical Therapy Evaluation, Diagnosis and Outcomes

The patient had a comprehensive physical therapy evaluation and assessment. His status was continually assessed and reassessed during his entire hospitalization, as he moved from the ICU to the medical-surgical unit. Due to the patient's history of anxiety and depression, behavioral symptoms were monitored, and he was followed throughout his acute stay by the social worker and chaplain, who also provided support to his family. Figure 2 classifies the patient's findings according to the International Classification of Functioning, Disability and Health (ICF) Model (WHO, 2001). An outcomes-based approach to evaluation was adapted. These outcome measures are summarized in Table 4. Receptive and expressive communication was measured by the amount of times patient would follow commands. This improved from 20% of the time to 100% for one-step commands and zero percent to 75% for two-step commands. The level of arousal and attention span measures were directly proportional. As the patient sustained his aroused state from a cumulative time of 20 minutes to 60 minutes, his attention span increased from an average of 20% to 100% of the time. Postural control exhibited by improvement in sitting balance and time in unsupported sitting, had a converse relationship whereas his assist level decreased (max assist to minimal assist), his time unsupported increased (average of 10 minutes to 25 minutes) in a 60-minute session. A modified sitting functional reach test showed improvement from the 5th session at 6 inches, to 12 inches at the time of discharge. Functional mobility activities were divided by part tasks from rolling in bed to sitting from supine, and up to attempted transfer

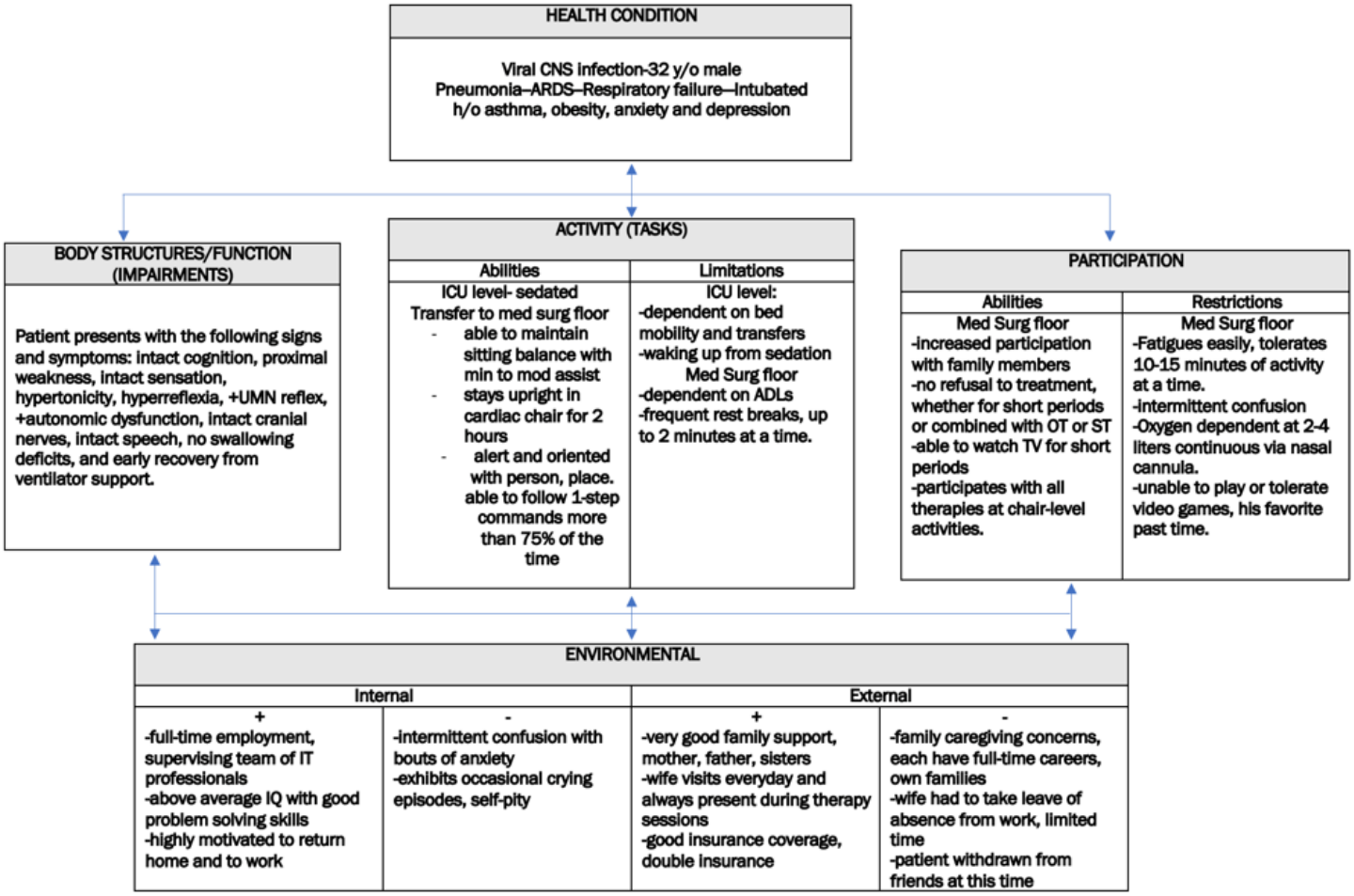

Figure 2. Classification of patient's findings according to the ICF Model

activity. Mobility levels steadily improved from dependent in most activities, changed to moderate-minimum assist, except for sit to stand as patient still had significant axial muscle weakness. Most importantly, his tolerance to physical therapy interventions continued to increase. The rating of perceived exertion (RPE) was chosen to gauge endurance as it has been found suitable for patients with critical illness (Amidei, 2012). It was modified accordingly due to his impaired cognition by using a visual analog scale for patient to indicate by pointing when prompted. This outcome measure had marked improvement, perhaps due to patient's own motivation to be discharged to an acute rehab facility. One of the main criteria for a successful transition to acute rehab is for the patient to exhibit sustained and significant tolerance to therapy, enough to indicate that he can participate for at least three (3) hours per day. The use of these outcome scales afforded the treating physical therapists an objective measure to weigh proper dosing of activity, while working within safe treatment parameters (Johnson, 2017). Co-treatment with occupational therapy accorded much needed patient handling assistance, improved patient safety, and prevented over-taxing the patient with multiple discipline visits. The hospital required the use of the Activity Measure for Post-Acute Care (AM-PAC) "6-clicks" daily activity short form as a determinant for discharge planning and disposition (Pfoh, 2020). The patient's AM-PAC score increased from 6 out of 24 at initial evaluation, to a 10 out of 24 the day before discharge showing significant potential for improvement.

Physical Therapy Goals/Patient Goals

The physical therapy evaluation done on day 8, when patient was extubated and 3 days before the MRI confirmed a neurological disorder clearly showed that the findings are not consistent with the medical diagnosis of CIPNM and points more towards a CNS pathology. Prognosis was judged as fair, due to his age and potential for progress, but restrained by his significant symptoms and neurological diagnosis. A Response-dependent treatment approach was adopted for the treatment plan. It required detailed continuous dynamic assessment and evaluation before, during and after each mobilization session to ensure that the intervention had the intended effect (Amundadottir, 2018). Table 5 summarizes the problems and PT goals as the patient progressed through the different levels of the hospital.

These goals were quantified by the patient's performance of activity, time and amount of assistance needed. In addition, using the outcome measures outlined in table 4, with functional reach test in sitting, and the modified Borg scale for rating of perceived exertion. The patient and family members, his wife and patient's mother were all involved in setting the therapy goals. Patient's stated goal of "walk out of the hospital", was translated to progressive levels of activity that will allow him to appreciate his progress and motivate him to actively participate in the process. His wife and mother supported his goals and were instrumental in keeping the patient's positive outlook and enthusiastic with therapy. The patient completed a total of 10 physical therapy sessions (twice on the last day) in acute care before being discharged to the acute rehabilitation facility for continuation of therapy services.

Discussion

The process of differential screening for acute care physical therapists should be standard practice in every country, such as the Philippines. Critical thinking and methodical analysis are expectations for our profession in order to achieve best possible outcomes for our patients. Physical therapists in the Philippines have to consider themselves as an integral part of the medical team, providing a unique perspective and skill set which they're most qualified to do.

Proper physical therapy differential diagnosis in acute care requires a process of continual dynamic assessments. The process should reflect the highly changeable nature of the patient's physiological status. It should be prompted by our sense of professional responsibility by advocating for better patient outcomes and quality of care (Masley, 2011). The challenge of a complex environment such as acute care makes it more pressing for us to use best judgment in our examinations. The processing of information can be daunting. There are multiple diagnoses to consider, each one has to be carefully examined and eliminated until the clinician can arrive at the most logical finding. Physical therapy findings have valuable information. The physical therapist can communicate that to the medical staff as additional consideration for their treatment choices for their patient. The team has to remain on target, because the ramifications for a missed diagnosis can be quite serious. In the case of this patient the other diagnoses considered, CIPNM and GBS has medical interventions very different from a viral CNS infection (Latronico 2011). It may cause more harm if applied inappropriately and also equally concerning is the possible delay of an effective treatment. In using a methodical approach, the physical therapist made it clear that the evidence points towards the diagnosis of a viral CNS infection.

In differentiating CIPNM and GBS, these patients do not usually present with cognitive deficits (Latronico, 2011). In those cases, consider possibility of delirium from sepsis, respiratory compromise, or medication effects. Patients with CIPNM and GBS would have more distal muscle weakness vs. axial weakness (Cunningham, 2018). In that case, facilitation of head and trunk extension may not be a primary consideration in the ICU. In order to increase postural control, mass movement pattern was initially used to facilitate axial and proximal muscle recruitment. The transitions to upright activities provided afferent sensory feedback to improve postural awareness. Due to the distal muscle weakness in patients with CIPNM or GBS, treatment focus may take advantage of axial stability to facilitate diagonal movement

patterns to accomplish specific tasks. In this patient case, facilitating weight bearing and use of upper and lower extremities allowed initial stability in upright activities. This is built upon to coincide with the utilization of motor learning principles of structuring practice from part to whole task complexity to promote acquisition and use of random practice for retention of the learning. Additionally, CIPNM and GBS will need a more gradual progression even more so than viral CNS infection patients due to expected severe ICU-acquired weakness and prolonged ventilation (Nordon-Craft, 2012). Treating this patient in distributed practice allowed for rest and proper pacing while fading feedback.

The examination process was limited by the lack of functional outcome measures that are sensitive to detect changes in patients with ICU-acquired weakness. There is a paucity of evidence-based early mobilization programs for patients with viral CNS infections in the ICU.

Patients with viral CNS infections can be differentiated from other critically-ill patients in the ICU, as well as from those diagnosed with CIPNM and GBS by utilizing qualitative analysis applied to physical therapy neurological examination and assessment. As exemplified in this case, a response-dependent treatment approach for critically ill patients in the ICU can lead to increased level of consciousness, postural control, functional mobility, and activity tolerance in this population.

Acknowledgements

The author would like to acknowledge the faculty of the Kaiser Permanente Northern California Neurologic Physical Therapy Residency, in particular the following individuals: CK Andrade, PT, PhD, Arlene McCarthy, PT, DPT, MS, and Cheryl D. Pierson, PT, MS, for their expertise, guidance and support to this author during the original writing of this case study.

I would also like to thank my former co-neuroresidents, Kathleen N. Parafinczuk, PT, DPT, and Preeti D. Oza, PT, PhD, for making my learning fun and inspirational. Thank you everyone.

Conflict of interest statement

The author declares no competing interests.

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