



CRITICAL ILLNESS POLYNEUROPATHY IN A FEMALE ADMITTED IN TERTIARY CARE CENTRE: A CASE REPORT

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ABSTRACT Critical Illness Polyneuropathy (CIP) is a neuromuscular disorder affecting critically ill patients, often complicating the management of conditions like sepsis, multiple organ dysfunction syndrome (MODS), and prolonged mechanical ventilation. This case report presents a 55-year-old female admitted with septic shock secondary to a urinary tract infection, who developed CIP during her ICU stay. The patient's clinical course was marked by multiple organ dysfunction, requiring prolonged mechanical ventilation and hemodialysis. Despite improving respiratory function, difficulty in weaning from the ventilator and developing symmetrical limb weakness prompted further investigation. Neurological examination revealed marked muscle weakness (1/5 distal, 2/5 proximal) in all four limbs, with decreased reflexes. Nerve conduction studies indicated axonal polyneuropathy, consistent with CIP. Management focused on treating the underlying sepsis, ensuring strict glycemic control, and implementing early physiotherapy to prevent further muscle atrophy. Gradual improvement in limb strength was observed, allowing successful weaning from mechanical ventilation by the end of the ICU stay. Proximal muscle strength improved to 3/5, and distal strength to 2/5 at discharge, though sensory deficits persisted. A comprehensive rehabilitation plan, including outpatient physiotherapy and occupational therapy, was established. The patient and her family were educated on the importance of continued therapy to facilitate recovery. This case emphasizes the importance of early diagnosis and intervention in CIP, especially in patients with prolonged ICU stays and sepsis, as timely management can improve outcomes, though recovery may be slow and incomplete. Further research is needed to better understand CIP and develop targeted therapies.

KEYWORDS : Critical Illness Polyneuropathy (CIP), Sepsis, Multi-organ Dysfunction Syndrome (MODS), Mechanical Ventilation, Electrophysiological Studies

INTRODUCTION

Critical Illness Polyneuropathy (CIP) is a neuromuscular disorder affecting patients in intensive care units (ICUs), particularly those with sepsis, multiple organ failure, or prolonged mechanical ventilation.[1] It manifests as symmetrical limb weakness and reduced reflexes, often leading to difficulty weaning from mechanical ventilation. This condition has become increasingly recognized as a contributor to morbidity in critically ill patients. [2] The exact pathophysiology of CIP is multifactorial, including inflammation, microcirculatory dysfunction, and metabolic disturbances. Early diagnosis is crucial for timely management and rehabilitation. [3]

This case report discusses the presentation, diagnosis, and management of a 54-year-old female diagnosed with Critical Illness Polyneuropathy in a tertiary care hospital following a prolonged stay in the Intensive Care Unit (ICU) due to sepsis and multiorgan dysfunction syndrome (MODS).

CASE STUDY

PATIENT PROFILE: A 55-year-old female, with a history of type 2 diabetes mellitus and hypertension, was admitted to the tertiary care hospital's ICU with a diagnosis of septic shock secondary to a urinary tract infection. The patient presented with fever, dysuria, confusion, and hypotension. She was initially managed with intravenous fluids, broad-spectrum antibiotics, and vasopressors. Mechanical ventilation was initiated on the second day due to acute respiratory failure.

ICU Course: During her ICU stay, the patient developed multiple organ dysfunction syndrome (MODS), requiring hemodialysis and prolonged mechanical ventilation. After three weeks of ICU stay, the treating team noticed that despite improving respiratory function, the patient was difficult to wean off the ventilator. Additionally, she complained of weakness in all four limbs, and physical examination revealed bilateral symmetrical weakness, predominantly in the distal muscles, with decreased reflexes.

NEUROLOGICAL EXAMINATION: The neurological examination revealed significant motor weakness in both the upper and lower extremities. Muscle strength was markedly reduced, with distal muscles exhibiting a strength grade of 1/5 and proximal muscles graded at 2/5 in all four limbs. Sensory examination indicated diminished sensation to pinprick and temperature, most notably in the distal areas, particularly the feet and hands, suggesting a length-

dependent sensory loss. Tendon reflexes were globally diminished, further indicating peripheral nervous system involvement. Cranial nerve assessment was unremarkable, with all cranial nerves functioning normally. Despite improving respiratory parameters, the patient remained dependent on ventilatory support, likely due to diaphragmatic weakness, a hallmark feature in critical illness polyneuropathy that complicates weaning from mechanical ventilation. This extensive neurological profile is consistent with the diagnosis of critical illness polyneuropathy.

ELECTROPHYSIOLOGICAL STUDIES: Nerve conduction studies (NCS) showed reduced amplitudes of compound muscle action potentials (CMAPs) and sensory nerve action potentials (SNAPs), consistent with axonal polyneuropathy. Electromyography (EMG) demonstrated reduced recruitment of motor unit potentials, further supporting the diagnosis of CIP.

LABORATORY FINDINGS: Blood work revealed ongoing inflammation with elevated C-reactive protein (CRP) and procalcitonin levels. Blood glucose levels were well-controlled during her stay. Renal and liver function tests were abnormal due to multi-organ involvement.

DIAGNOSIS: Based on the clinical presentation and supportive electrophysiological findings, a diagnosis of Critical Illness Polyneuropathy was established. The differential diagnosis included Guillain-Barré Syndrome (GBS), but the absence of preceding neurological symptoms, along with electrophysiological findings pointing to axonal damage rather than demyelination, made CIP the more likely diagnosis.

MANAGEMENT: The patient's management was focused on supportive care, rehabilitation, and treatment of the underlying sepsis. Key elements of the patient's management included several targeted interventions aimed at addressing both the underlying sepsis and the complications of critical illness polyneuropathy (CIP). Continued antibiotic therapy was crucial, with appropriate broad-spectrum coverage maintained to control the underlying septic infection. Gradual ventilator weaning was attempted, though the process was slowed due to significant diaphragmatic weakness. Non-invasive ventilatory support was utilized when feasible to reduce dependence on mechanical ventilation. Early and intensive physical therapy played a critical role in preventing further muscle atrophy, with a focus on

both passive and active-assisted range-of-motion exercises to improve limb function and reduce the risk of contractures. Maintaining strict glycemic control was a priority, given that hyperglycemia can exacerbate the progression of CIP and impact overall recovery. To ensure the patient had the nutritional reserves needed for healing, enteral nutrition was carefully optimized, ensuring an adequate caloric intake to support both recovery from critical illness and ongoing rehabilitation efforts. This multifaceted approach was essential for the patient's gradual improvement in both neuromuscular function and overall clinical condition.

OUTCOME: The patient exhibited a gradual but steady improvement in limb strength over several weeks of intensive care and rehabilitation efforts. By the end of her ICU stay, she had progressed sufficiently to be weaned off mechanical ventilation, marking a significant milestone in her recovery. Her limb strength, which had initially been severely compromised, showed notable improvement, with proximal muscles graded at 3/5 and distal muscles at 2/5 by the time of her transfer to a step-down unit. While her strength had improved, sensory deficits, particularly reduced sensation to pinprick and temperature, persisted, especially in her hands and feet. Despite these ongoing sensory symptoms, the patient was able to perform limited activities of daily living with assistance, such as eating and minimal self-care tasks, indicating functional improvement.

A long-term rehabilitation plan was established to facilitate her continued recovery. This included outpatient physiotherapy, aimed at further strengthening her limbs, improving her mobility, and preventing contractures, as well as occupational therapy to enhance her ability to perform daily activities independently. The patient and her family were thoroughly educated about the extended nature of her recovery, which would require months of continued therapy and supportive care. They were informed about the importance of adherence to the rehabilitation regimen, as well as the likelihood of a gradual but ongoing improvement in her functional abilities over time. The multidisciplinary team ensured that the patient had access to appropriate follow-up care and resources to optimize her long-term outcome.

DISCUSSION

Critical Illness Polyneuropathy (CIP) is a significant and frequently underdiagnosed complication in critically ill patients, particularly those with sepsis, systemic inflammatory response syndrome (SIRS), or multi-organ dysfunction syndrome (MODS).[4, 5] It is often discovered when patients exhibit difficulty in weaning from mechanical ventilation due to respiratory muscle weakness or when symmetrical limb weakness becomes evident. The underdiagnosis of CIP can severely affect patient outcomes, as failure to recognize this condition leads to delays in appropriate interventions like physiotherapy, prolonging the ICU stay, increasing morbidity, and potentially leading to higher mortality rates. Early recognition of CIP through clinical findings such as distal muscle weakness and decreased reflexes, along with supportive electrophysiological studies showing axonal neuropathy, is key to improving patient management.[6, 7]

The pathophysiology of CIP is complex and multifactorial, primarily driven by systemic inflammation, ischemic injury to peripheral nerves, and metabolic disturbances in critically ill patients. Studies have demonstrated that inflammatory cytokines, particularly tumor necrosis factor-alpha (TNF- α), play a significant role in damaging peripheral nerves by promoting inflammation and disrupting the microcirculation within the nerves. Additionally, ischemia due to microcirculatory dysfunction contributes to nerve damage, further aggravating muscle weakness. Medications commonly used in ICU settings, such as corticosteroids, vasopressors, and sedatives, may also contribute to muscle and nerve dysfunction, worsening the clinical presentation of CIP. This highlights the importance of careful management of these medications in critically ill patients to minimize the risk of neuromuscular complications.[8]

Although no specific treatment exists for CIP, early mobilization, optimal nutritional support, and strict glycemic control have been shown to improve outcomes. Early mobilization through physiotherapy can help prevent further muscle wasting, reduce the risk of contractures, and enhance recovery of neuromuscular function. Nutritional optimization is essential, as malnutrition exacerbates muscle weakness and delays recovery. Furthermore, maintaining strict glycemic control is critical because hyperglycemia has been associated

with worse outcomes in CIP by impairing nerve regeneration and contributing to further neuropathic damage. Multidisciplinary care, including physiotherapists, dietitians, and critical care specialists, is crucial to ensuring that these supportive strategies are implemented early.[9]

This case underscores the need to consider CIP in patients with prolonged ICU stays, especially those with sepsis or MODS. Early recognition and intervention are essential to improving functional outcomes. Rehabilitation, including physiotherapy and occupational therapy, is vital in mitigating long-term disabilities associated with CIP. While the recovery process is often slow and incomplete, timely interventions can significantly reduce the burden of the disease, enhance quality of life, and reduce the duration of ICU and hospital stays. Therefore, increasing awareness of CIP among healthcare providers and ensuring routine assessment for neuromuscular dysfunction in critically ill patients can help in early diagnosis and better management of this condition.

CONCLUSION

This case emphasizes the need for vigilance in identifying CIP in critically ill patients. Timely diagnosis and supportive management, including early rehabilitation and optimal medical care, can lead to improved outcomes, although recovery may be slow and incomplete. Further research is needed to understand the mechanisms behind CIP and to develop targeted therapies for its prevention and treatment.

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