

# Complications of Sedation in Critical Illness: An Update



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## KEYWORDS

• Sedation • Complications • Post-ICU syndrome • ICU-acquired weakness • Costs

## KEY POINTS

- Oversedation is associated with short- and long-term complications, namely post-ICU syndrome (PICS), and excessive costs.
- Management and prevention of complications are most successful with a collaborative, team approach, using research-based strategies.
- Assessment of sedation level and muscle strength with valid and reliable instruments promotes communication, care planning, and early intervention that reduces the risk of long-term complications of sedation.

## INTRODUCTION

In the mid-1990s Dave, a 41-year-old otherwise healthy man, presented to the emergency department of a small community hospital with shortness of breath and altered mental status. He was placed on a nonrebreather oxygen mask, but with increasing hypoxemia and dyspnea was intubated and placed on mechanical ventilator support with maximum settings. He was diagnosed with community-acquired pneumonia and sepsis; over the next several weeks he developed acute respiratory distress syndrome (ARDS), empyema, and sinusitis. Management was complicated by allergy to sensitive antibiotics, along with nicotine and opiate withdrawal, which he took for chronic cervical neck and back pain from an earlier injury. Agitation, high fevers, and tachycardia remained for days, despite heavy doses of lorazepam, propofol, and occasional doses of cisatracurium or pancuronium to facilitate work of breathing. Three weeks later Dave was weaned from sedation and extubated. This was not, however, the end of his medical problems.

Dave experienced extreme muscle wasting, leaving him very weak and unstable during ambulation attempts. He also reported disturbed sleep patterns with frequent

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bizarre dreams during and following sedation administration, leaving him so fatigued it interfered with pulmonary and physical rehabilitation during the day. Focal weakness in his right leg became apparent, along with foot drop. Electromyography and nerve conduction studies demonstrated a peroneal nerve injury. Physical therapy was initiated in the acute care hospital and continued in a rehabilitation facility following discharge. Years later, impaired dorsiflexion interfered with safe operation of a motor vehicle and Dave was rendered unable to drive.

Although use of sedation is a necessary component of care for the critically ill, careful and vigilant monitoring to guard against oversedation, with frequent sedation holiday attempts, is necessary to prevent complications not only in the acute care setting but also to minimize long-term problems, delayed return to functional status, and jeopardized quality of life following critical illness. Despite prudent use of sedatives and neuromuscular blocking agents, with dosing guided by a sedation scale and peripheral nerve monitoring, respectively, parenteral and enteral nutrition, and physical therapy, Dave suffered some of the long-term sequelae of critical illness, heavy sedation, and neuromuscular blockade frequently reported in the literature.

Two decades later, this constellation of deficits, among others, has been termed post-intensive care syndrome (PICS).<sup>1</sup> Cumulative data of intensive care unit (ICU) admissions, discharges, mortality, and survivorship indicate that in the United States, nearly 6 million patients are admitted to ICU annually, with approximately 5 million survivors discharged.<sup>2</sup> Although they have survived the critical illness, long-term deficits in pulmonary, neuromuscular, and physical function remain. Psychiatric symptoms and cognitive impairment may develop and/or persist; these problems in turn lead to compromises in quality of life for survivors and family members.<sup>3</sup>

## **POST-INTENSIVE CARE SYNDROME**

### ***Pulmonary Complications***

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Pulmonary complications following critical illness are documented predominately in patients who had ARDS. Most studies have been conducted within 6 to 12 months following ICU discharge; however, one study occurred with a median follow-up time of 5.5 years. At least one abnormal pulmonary function test was present in 27 of 50 patients (54%) who had ARDS; the most common impairment was a restriction in forced expiratory volume in 1 second/forced vital capacity ratio, found in 16 patients.<sup>4</sup> This is a measure of the proportion of vital capacity able to be expired in the first second of a forced expiration; it indicates that obstructive lung condition persisted following ARDS. The researchers also found that patients with abnormalities in multiple pulmonary function tests (diffusion capacity and total lung capacity) reported significantly lower health-related quality of life, measured by Short Form-36 scores.<sup>4</sup>

### ***Neuromuscular Complications***

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An estimated 50% of ICU patients have severe weakness during critical illness that persists for months or even years.<sup>5,6</sup> Critically ill individuals have multiple reasons for the development of skeletal muscle weakness, stemming from neuropathophysiologic and myopathic abnormalities. Although there have been some conflicting results, studies have identified local and systemic inflammatory mediator release during sepsis and other severe insult, multiorgan dysfunction, ARDS, prolonged ventilator dependence, corticosteroid use, neuromuscular blockade, hyperglycemia, and immobility and disuse atrophy as causes for neuromuscular dysfunction in the critically ill.<sup>5-7</sup>

Critical illness polyneuropathy (CIP) has been described in the literature for more than three decades. It is characterized by severe weakness in proximal and distal

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