CHAPTER 5

COMPLEXITY

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INTRODUCTION

The level of complexity of patients admitted to the intensive care unit (ICU) over past decades has increased significantly. Reasons for this include advances in technology, pharmacology, and the aging population with pre-existing conditions.

SOURCES OF COMPLEXITY

The literature on complexity addresses not only patients but also the ICU. There is a direct correlation between the acuity and complexity of patients, the complexity of the ICU environment, and technological advances needed to care for patients with life-threatening conditions. Advances in modes of mechanical ventilation, renal replacement therapies, the molecular adsorbent recirculating system (MARS) (extracorporeal liver support for patients with hepatic failure), ventricular assist devices, and features on infusion pumps are just some of the technological advances adding to the complexity of the ICU environment.

Patients admitted to the ICU typically have a grave or catastrophic condition. Examples of patients admitted to the ICU with complex needs include those with severe sepsis, hepatic failure, respiratory failure, multiple organ dysfunction syndrome, diabetic ketoacidosis, hyperosmolar hyperglycemic syndrome, acute coronary syndrome, acute kidney injury, pulmonary hypertension, cardiomyopathy, drug overdose, febrile neutropenia or other oncologic emergencies, life-threatening electrolyte or acid-base imbalance, or following cardiopulmonary arrest or multiple trauma from a motor vehicle crash. Patients with complex conditions admitted to the surgical ICU include those following solid organ transplantation and cardiac surgery (e.g., valve repair/replacement, coronary artery bypass grafting, aortic aneurysm repair). Complex patients in a neuro ICU may include those with a seizure disorder, head trauma, traumatic brain injury, stroke, spinal cord injury, or neuromuscular disorders (e.g., amyotrophic lateral sclerosis, Guillain-Barré syndrome, myopathies).

Any of these patients may require management that includes airway management, mechanical ventilation, hemodynamic monitoring, titration of vasoactive agents, renal replacement therapies, management of sedation, or any combination of these. In addition to providing evidence-based care for the specific condition, the level of complexity of care is attenuated with the need to prevent complications of these conditions and treatments. For example, hazards of immobility have been documented for decades. As a result, there has been an increased emphasis on progressive mobility. In the past, patients on mechanical ventilation would be maintained on bedrest. Now, it is not uncommon to see patients ambulating in the ICU while still tethered to a ventilator.

With the disparity between the number of organ transplant candidates and the number of donated organs, there are increasing numbers of patients with ventricular assist devices as destination therapy (Andrews & Kaplow, 2016). In the neonatal ICU, infants are admitted following premature birth, low birth weight, or congenital anomalies (Mandy, 2011).

Compounding the complexity of patients based on their physiologic status and therapeutic interventions received is the ICU environment. The complexity is felt to contribute to delirium. Noise is defined as "any unwanted or undesirable sound which is subjectively annoying or disrupts performance and is physiologically and psychologically stressful" (Wenham & Pittard, 2009, p.178). Sources of noise in the ICU environment include those generated by alarms from ventilators, physiologic monitoring devices, functioning of other therapeutic equipment, and voices of healthcare providers. Such noise is perceived by patients as causing sleep disruption. It has been suggested that exposure to noise can cause stimulation of the sympathetic nervous system with resultant increase in myocardial workload and possible unfavorable sequelae on respiratory muscle function. Exposure to noise may also increase the amount of sedation needed by patients (Wenham & Pittard, 2009).

Another environmental stressor of the ICU that augments patient complexity is lack of exposure to natural light. Being unable to differentiate day from night may influence the development of disorientation, delirium, or both (Wenham & Pittard, 2009). The lighting in the ICU and turning on lights to provide care contributes to sleep disruption.

Environmental temperature may alter patients' sleep patterns as well. It is suggested that lower temperatures decrease patients' ability to sleep (Wenham & Pittard, 2009).

Technological advances have also contributed to the increased complexity of patients. The number and type of monitoring devices and the capacity to monitor increasing numbers of patient variables and organ function have increased exponentially. The amount of data generated on a minute-to-minute basis requires complex and critical thinking to make appropriate care decisions (Vincent, 2004–2015).

An additional source of complexity of acute and critically ill patients is polypharmacy. The complexity of pharmacologic interventions can lead to drug-drug and food-drug interactions and increased numbers of associated adverse events (Shah & Hajjar, 2012).

As people are living longer, the number of older adults being admitted to the ICU is growing. In one study, patients aged 65 years and older accounted for 45% of the 5 million admissions to the ICU annually. Of those, 10% were aged 85 years and older (Bell, 2014). Care of older adults is more complex for a variety of reasons. These include polypharmacy, more procedures being performed on this group of patients, and atypical ways they often present with different conditions (Hoonakker, Mcguire, & Carayon, 2010).

DEFINITION

Complexity is defined as "the intricate entanglement of two or more systems (e.g., body, family, therapies). Based on the tenets of the Synergy Model, a Level 1 patient is highly complex, intricate, has complex patient/family dynamics or a vague, atypical presentation. A Level 3 patient has moderately complex patient/family dynamics. A Level 5 patient is simple, is uncomplicated, has a clear-cut presentation, and has routine family dynamics (AACN, 2015).

CASE STUDY

A 25-year-old newly diagnosed patient with Burkitt lymphoma, an aggressive form of non-Hodgkin's lymphoma is admitted. Burkitt lymphoma is characterized by a large number of rapidly dividing cells and requires rapid and aggressive treatment with chemotherapy. The patient is newly married. He and his wife ultimately wanted to start a family. Being given this devastating news of his diagnosis and after being told of the reproductive risks associated with treatment, the patient requested delaying treatment for a day so that sperm donation can be performed. All fresh specimen deliveries needed to occur by early afternoon in the facility the patient was being treated at; that time had passed for that day. The physician attempted to convince the patient not to delay treatment. Ultimately, all agreed to wait until the following afternoon to start chemotherapy.

The patient received prechemotherapy hydration and was started on sodium bicarbonate to alkalinize his urine. He also received allopurinol (Zyloprim) to help prevent uric acid build up. All of these pretreatments were to prevent development of acute tumor lysis syndrome (ATLS), which is an anticipated oncologic emergency associated with Burkitt lymphoma.

Despite preventive measures being implemented, 36 hours after the start of therapy, the patient developed hyperkalemia (K 5.8 mEq/L). He was treated with polystyrene sulfonate (Kayexalate), insulin and glucose, as was placed on telemetry. Twelve hours later, he developed hyperphosphatemia and hypocalcemia. He was treated with appropriate therapies for these electrolyte imbalances but developed acute kidney injury from development of calcium-phosphorus precipitate. He was transferred to the ICU for management of his electrolyte imbalances and for continuous renal replacement therapy. The patient was ultimately stabilized and was transferred back to the hematology unit.

APPLICATION OF THE CASE STUDY TO THE SYNERGY MODEL

Acute tumor lysis syndrome is one of several oncologic emergencies that can occur after the start of chemotherapy for the treatment of aggressive cancers—those with rapidly dividing cells. It is characterized by severe and potentially life-threatening electrolyte abnormalities and acid-base imbalance. Acute tumor lysis syndrome can lead to the development of acute kidney injury and death.

This patient had high levels of complexity. First, he had high levels of complexity from a physiologic perspective. The life-threatening electrolyte imbalances and resultant development of acute kidney injury were significant. From a psychosocial perspective, he was unexpectedly hit with devastating news of his diagnosis. He and his wife had to make a difficult decision to delay treatment so that sperm banking can take place despite this being discouraged by the physician. The patient also recently had started a new job. While insurance was covering most of his hospitalization and treatment, there were still going to be significant costs he would be responsible for. The patient was also uncertain about his ability to have continued employment following treatment.

The patient also was highly complex from a psychosocial perspective. As he developed life-threatening electrolyte imbalances during treatment, the antineoplastic therapies were placed on hold until his lab values returned closer to baseline. This caused concern that his cancer would continue to grow while therapy was on hold.

EXAMPLES OF HIGH COMPLEXITY LEVELS IN PRACTICE

- Patients with multiple organ dysfunction syndrome
- Patients with sepsis
- Patients with challenging family issues
- Patients receiving complicated drug regimens
- Patients with financial issues who require expensive drug therapy

CONCLUSION

Acute and critically ill patients have increasingly complex care requirements. Following transfer from the ICU to a progressive care unit or general unit, patients may continue to have complex needs as they recover from their serious illness and ICU course of care. Some may require weaning from mechanical ventilation as well as recovery from muscle weakness and neurologic compromise (Shostek, 2007). Meticulous nursing care of these highly complex patients throughout the disease trajectory is essential for optimal patient outcomes.

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