Critical Care and Occupational Therapy Practice Across the Lifespan

This AOTA Position Statement defines the distinct role and value of occupational therapy practitioners in critical care settings across the lifespan. Occupational therapy practitioners are essential interprofessional team members who address the needs of critically ill individuals by implementing evidence-based critical care guidelines that aim to improve the quality of survivorship.

The American Occupational Therapy Association (AOTA) affirms that occupational therapy practitioners are essential interprofessional team members who address the needs of critically ill individuals across the lifespan (Margetis et al., 2021). The occupational therapy scope of practice provides the holistic lens needed to best implement evidence-based critical care guidelines that aim to improve the quality of survivorship (AOTA, 2020c). Occupational therapy practitioners facilitate early engagement and rehabilitation, which mitigate the severity of conditions acquired in an intensive care unit (ICU), such as delirium, weakness, skin injury, and post–ICU syndrome (Devlin et al., 2018). Early initiation of critical care rehabilitation (including occupational therapy) has been shown to reduce ventilator days, improve functional clinical outcomes, and decrease lengths of stay (Costigan et al., 2019; Higgins et al., 2019; Schweickert et al., 2009). Occupational therapy practitioners bring added value to critical care teams and health systems by reducing hospital readmission risk through discharge planning and predischarge interventions (Pritchard et al., 2019). This Position Statement defines the distinct role and value of occupational therapy practitioners in critical care settings across pediatric and adult populations.

AOTA asserts that occupational therapy practitioners play an integral role on the interprofessional critical care team. Because of advances in modern medicine, individuals of all ages are now surviving conditions and traumatic injuries that were historically life ending. Reduced mortality has increased the number of patients living with long-term disability and chronic conditions after a critical illness. The expansion of morbidity introduces a new level of medical complexity and fragility in patients[1] receiving occupational therapy services in the acute care setting (Crimmins & Beltrán-Sánchez, 2011; Lilly et al., 2017). In the general acute hospital setting, the role of the occupational therapy practitioner[2] is well established, given the needs of patients to relearn or modify their participation in activities of daily living (ADLs; Margetis et al., 2021; Smith-Gabai & Holm, 2017). The critical care setting differs from the general acute care setting in that the occupational therapy practitioner must understand how occupational therapy interventions interact with invasive medical therapies.

[1]Because of the environment of care within the hospital setting, the term *patient* is used over *clients*.

[2]In this document, the term *occupational therapy practitioner* refers to both occupational therapists and occupational therapy assistants (AOTA, 2019).

The constellation of negative health outcomes that can persist after critical illness is well documented and includes impairments in physical, psychological, and cognitive functions that limit the return to occupational roles (Desai et al., 2011). Interprofessional teams, including occupational therapy practitioners, have acknowledged the importance of initiating early rehabilitation and its positive impact on patient outcomes (Ames et al., 2021; Moheet et al., 2018; Smith et al., 2022). Early rehabilitation of critically ill patients is a well-established core component of best practice guidelines as defined by the Society of Critical Care Medicine (SCCM; Devlin et al., 2018; Evans et al., 2021). As a part of the interprofessional critical care team, occupational therapy practitioners working in this setting facilitate client participation in occupations or "activities that bring meaning and purpose to life" (AOTA, 2020c, p. 30). This statement defines the distinct role and value of occupational therapy practitioners in critical care settings across pediatric and adult populations.

Definitions

Critical care is a medical specialty involved in treating seriously ill patients who are experiencing or recovering from a *critical illness*, a life-threatening condition that generally requires treatment in a critical care unit or ICU. Surviving a critical illness often requires *invasive medical therapies* (defined below), including continuous medication infusions, artificial organ support, surgery, and frequent reassessments. The *critical care team* is a group of specially trained health care professionals who work in ICUs and can include physician intensivists; critical care nurses; occupational therapy practitioners; physical therapists; speech-language pathologists; pharmacists; registered dietitians; social workers; and advanced practice providers, such as nurse practitioners and physician assistants (SCCM, n.d.-b).

Early rehabilitation, including mobilization and early engagement, is a fundamental facet of occupational therapy intervention in critical care settings. *Early mobilization* involves assisting patients with a critical illness into upright and out-of-bed positions, often while they are connected to multiple artificial organ support systems, such as mechanical ventilators, continuous dialysis, and cardiovascular supports (Hodgson et al., 2018). *Early engagement* involves providing critically ill patients opportunities to participate in meaningful, client-centered, and goal-directed occupations in critical care settings (Margetis et al., 2021; J. Wilcox et al., 2021). Early engagement can precede early mobilization if the patient is medically unable to transition into an upright position.

Delirium is a sudden change in mental status commonly found in ICU patients that is significantly associated with increased mortality, ICU length of stay, days on mechanical ventilation, health care expenditure, and long-term physical and cognitive impairments (Kotfis et al., 2018). Prevention, routine screening, and the provision of patient-centered interventions are key aspects of a successful delirium prevention program (Devlin et al., 2018).

Invasive medical therapies encompass medications, advanced devices, and procedures that critical care providers use to stabilize and manage critically ill patients. These are numerous and can include mechanical ventilators, continuous renal replacement therapy, extracorporeal membrane oxygenation (ECMO), external ventricular drains (EVDs), central venous catheters, arterial lines, and many more. For an expanded list, see Appendix A.

Pediatric intensive care units (PICUs) provide specialized care for children up to age 21 yr (Epstein & Brill, 2005). In contrast, neonatal intensive care units provide specialized care for premature and newborn infants (AOTA, 2018).

Postintensive care syndrome (PICS) is a constellation of cognitive, physical, and emotional symptoms that persist beyond discharge from the ICU (Inoue et al., 2019). With rapid advances in critical care medicine over the past decade, patients are surviving critical illness in larger numbers, and research foci have shifted to quality of life and survivorship (Gajic et al., 2018; Inoue et al., 2019).

Importance and Significance

ICUs admit a heterogeneous population of patients who require frequent clinical assessment and higher complexity interventions to support life-threatening medical conditions. Occupational therapy practitioners work across the lifespan, playing a key role in facilitating

occupational participation during and after an ICU admission. The SCCM (n.d.-a) reports that ICUs in the United States admit more than 5 million patients annually for

- invasive or intensive monitoring;
- support of airway, breathing, or circulation;
- stabilization of acute or life-threatening medical problems;
- comprehensive management of injury and/or illness; and
- maximization of comfort for dying patients.

One in five Americans dies in an ICU, and a majority of those living today will have at least one ICU admission in their lifetime (Angus et al., 2004; Gajic et al., 2018). Overall, the mortality rate for patients admitted to the ICU ranges from 10% to 29% in adults and 2% to 6% in children (SCCM, n.d.-b). Although older adults and those with multiple chronic comorbidities are at higher risk of critical illness, the long-term sequelae of ICU admissions affect people across the lifespan (Storms et al., 2017).

Early initiation of critical care rehabilitation (including occupational therapy) has been shown to be effective in improving functional status, clinical outcomes, and lengths of stay (Costigan et al., 2019; Higgins et al., 2019; Schweickert et al., 2009). Fewer than 10% of patients on mechanical ventilation for more than 4 days return to complete functional independence after 1 yr (Harvey & Davidson, 2016). Half of critical illness survivors continue to require caregiver assistance in some capacity 1 yr after hospital discharge (Harvey & Davidson, 2016). Using their client-centered lens, occupational therapy practitioners can both assist patients in achieving their functional goals and provide individualized caregiver training to make transitioning home safer and more successful.

For ICU survivors, return to employment is associated with improved health-related quality of life and fewer depressive symptoms (Kamdar et al., 2020). Unfortunately, among previously employed ICU survivors, the prevalence of return to work is 36% at 3 mo, 60% at 12 mo, and 68% at 42 to 60 mo. For those who returned to work, up to 36% endured job loss, 66% faced a change in occupation, and 85% reported working fewer hours (Kamdar et al., 2020). To meet the needs of ICU survivors, institutions are establishing post–ICU recovery clinics, and occupational therapy practitioners have an opportunity to harness their entire scope of practice to facilitate resumption of occupations, including work (Kuehn, 2019).

Pediatric critical illness is associated with a sustained impact on survival and functional status, with new morbidity appearing to substantially increase after discharge (Pinto et al., 2017). Long-term functional outcomes were negatively associated with invasive therapies, such as mechanical ventilation, number of ventilator days, use of vasoactive medications, severity of illness, and PICU length of stay (Pinto et al., 2017). Because of the negative impact of a critical illness on a child's participation in occupational domains (see Table 1 for a comprehensive list), updated guidelines have been released that reflect emerging evidence supporting early mobilization and engagement in occupation (Choong et al., 2018). Occupational therapy practitioners working in pediatric critical care settings contribute a unique perspective and can adapt the PICU environment to facilitate successful participation in play occupations.

Contextual Factors That Influence Occupational Performance

Occupational therapy practitioners play a key role in evaluating the impact of ICU contextual factors on occupational performance and in recommending environmental modifications to facilitate patient participation. Individuals experiencing life-threatening illnesses with severely altered body systems and functions intrinsically face occupational disruption and disconnection from valued roles and routines. Critical care medicine has historically included routine sedation and immobilization of patients, unnecessarily restricting active occupational engagement and hindering recovery outcomes. The ICU's physical environment also inherently disrupts occupational participation because of its highly technical and sterile nature, designed for patient monitoring and provision of life-preserving care. Additional contextual factors, such as bright overhead lighting, disrupted sleep cycles, and restricted family visitation, prevent full patient participation, autonomy, privacy, and self-determination.

Table 1. Common Areas of Occupational Therapy Intervention in Critical Care Settings

Intervention Area	Components
Environment	▪ Identify physical and sensory aspects of the critical care environment that facilitate or impede participation (e.g., overhead lights, loud monitors, antiseptic smells, positive touch from caregivers, decreased vestibular input). ▪ Maximize natural light.
Sleep	▪ Support normal sleep–wake cycles. ▪ Promote good sleep hygiene.
Delirium	▪ Identify best practice guidelines to reduce the risk of delirium. ▪ Normalize sleep–wake cycles. ▪ Provide frequent reorientation. ▪ Minimize sedation. ▪ Encourage family visitation/contact. ▪ Implement an ICU diary. ▪ Promote use of existing corrective lenses, hearing aids, and dentures. ▪ Implement cognitive engagement activities.
Sensorimotor	▪ Address any weakness and sensory deficits, such as critical illness neuropathy or critical illness polyneuropathy, through therapeutic exercise, ADL participation, and transfer training. ▪ For children, provide the opportunity to move to improve body awareness, interoception, and self-regulation.
Neurocognitive	▪ Screen for neurocognitive changes that may limit participation and carryover of instructions. ▪ Provide temporary compensatory strategies. ▪ Initiate education on cognitive strategies. ▪ Refer for outpatient follow-up.
ADLs/IADLs	▪ Promote routine participation in ADLs. ▪ Implement compensatory or adaptive strategies for ADL participation. ▪ Encourage IADL participation, as able and appropriate. ▪ Provide education on incorporating postoperative precautions into daily routines.
Feeding/swallowing	▪ Conduct dysphagia assessment and intervention. ▪ Assess oral motor skills in children. ▪ Recommend instrumental assessment for swallowing as necessary. ▪ For infants, identify the need to change bottle/nipple flow rates for safe feeding.
Leisure/play	▪ Provide opportunities for leisure occupations and early engagement. ▪ Promote play occupations targeting developmental milestone achievements.
Social participation	▪ Encourage social interaction with providers and engagement with friends and family through in-person visitation or technology (e.g., phone calls, video calls). ▪ Incorporate family into the care plan.
Neuromuscular reeducation	▪ Use progressive activities, building trunk control and balance. ▪ Help patient progress from supported sitting positions, to unsupported sitting positions, to standing. ▪ Facilitate weight-bearing through extremities. ▪ Provide coordination training. ▪ Consider using modalities (e.g., functional electrical stim, vibration).

(*Continued*)

Table 1. Common Areas of Occupational Therapy Intervention in Critical Care Settings (*cont'd*)

Intervention Area	Components
Transfer and mobility training	▪ Promote out-of-bed transfers and functional mobility. ▪ Use lift equipment and durable medical equipment as needed to optimize mobilization.
Psychosocial/emotional	▪ Routinely screen signs or symptoms of depression, anxiety, or other mental health concerns. ▪ Monitor for difficulty coping with the critical care course. ▪ Foster coping skills throughout and following ICU admission. ▪ Refer patient to appropriate mental health providers as needed.
Musculoskeletal and skin injury prevention	▪ Recommend appropriate bed surface (e.g., low air loss mattress). ▪ Address positioning (e.g., in bed, wheelchair). ▪ Manage edema. ▪ Consider orthotics and casts for joint protection. ▪ Consider nonpharmacological pain management options.

Note. ADL/ADLs = activities of daily living; IADL = instrumental activities of daily living; ICU = intensive care unit.

For examples of environmental modifications, see Case Studies 1 through 3.

Occupational Therapy's Role in Managing ICU Sequelae

As part of an interprofessional critical care team, occupational therapy practitioners can play a distinct role in managing acute and chronic comorbidities, contributing their unique perspectives on the impact of habits and routines on overall health and wellness (AOTA, 2020c). Patients experiencing critical illness can develop a variety of acute and chronic comorbidities:

- ICU–acquired muscle weakness and limitations in cardiopulmonary endurance can occur, significantly affecting functional independence in basic ADLs (Needham et al., 2012). Muscle weakness presents in 25% to 80% of patients requiring mechanical ventilation longer than 4 days and in 50% to 70% of those with sepsis. The acute weakness can persist and become chronic, lasting years beyond hospital discharge (Harvey & Davidson, 2016). Early initiation of occupational therapy in the ICU works to mitigate the severity of muscle weakness and deconditioning (Schweickert et al., 2009).
- Delirium occurs in more than 50% of critically ill adults, with incidence and duration independently predicting long-term cognitive, psychiatric, and functional impairment; long-term disability; and discharge to long-term-care facilities (Harvey & Davidson, 2016; Ko et al., 2022; M. E. Wilcox et al., 2021). Occupational therapy practitioners have a fundamental role in evaluating cognitive performance, identifying predisposing risk factors for delirium (e.g., preexisting cognitive impairment), and monitoring for the presence of delirium in ICU patients. Occupational therapy practitioners contribute beneficial and nonpharmacological interventions to interprofessional efforts to prevent and manage delirium, including environmental modification, cognitive intervention, ADL training, and early mobilization and engagement (Álvarez et al., 2017; NIDUS Blogger, 2021). In addition, occupational therapy practitioners can lead interprofessional efforts to address cultural inequities commonly found in critical care settings by implementing programs to increase access to culturally competent care.
- Psychological sequelae, including anxiety, depression, and sleep disturbance, can persist for years after a critical illness, with up to half of patients reporting symptoms of posttraumatic stress disorder (PTSD; Harvey & Davidson, 2016). Families and caregivers of both pediatric and adult patients also report anxiety, depression, and symptoms of posttraumatic stress (Devlin et al., 2018; Fayed et al., 2020). Occupational therapy interventions that foster coping skills,

psychological resilience, and cognitive processing may help mitigate the severity of long-term consequences for survivors. ICU diaries, co-created by patients, families, and health care providers, are tools that document clinical events throughout an illness experience and can mitigate the risk of developing PTSD (Harvey & Davidson, 2016). Occupational therapy practitioners are uniquely qualified to implement ICU diaries in the early phases of recovery as therapeutic tools to highlight recovery milestones and guide patients and families as they construct recovery narratives.

The Occupational Therapy Process

Evaluation and intervention in critical care settings involve special consideration of medical complexity, potential patient instability, and use of invasive medical therapies within the clinical reasoning and occupational therapy process.

Evaluation

The occupational therapist (OT) completes an initial evaluation to build an occupational profile to identify strengths, limitations, and occupational performance deficits (AOTA, 2021). The OT establishes the goals and the plan of care and guides the intervention process in concert with the occupational therapy assistant (OTA). Additional evaluation should focus on the relevant client factors, performance skills, performance patterns, context and environment, and activity demands that are necessary for occupational performance (AOTA, 2020c). Occupational therapy practitioners should use standardized and nonstandardized assessment tools, in addition to subjective and narrative reports, to objectively capture the patient's performance barriers (Tsai & Peterson, 2019).

Intervention

Occupational therapy interventions in critical care settings should also address patients' goals and barriers to occupational performance identified during the evaluation and subsequent sessions. An in-depth review of specific occupational therapy interventions used in ICUs is beyond the scope of this Position Statement; see Table 1 for an overview of common ICU intervention areas. A growing body of literature links early rehabilitation of critically ill patients with improved medical, functional, and quality-of-life outcomes (Costigan et al., 2019; Devlin et al., 2018; Margetis et al., 2021; Wang et al., 2022). Occupational therapy practitioners contribute a unique lens to the critical care team, blending early engagement in occupation with early mobilization.

In most facilities, intervention frequency and duration are set by the evaluating therapist and may be revised frequently. Occupational therapy practitioners must communicate any environmental modifications made as a part of an occupational therapy care plan to the interprofessional critical care team to ensure carryover and increase the unit's awareness of occupational therapy's role in critical care settings. Common frames of reference include biomedical, rehabilitative, adaptive, and compensatory, with clinicians often blending their approach as patients progress. Occupational therapy practitioners working in critical care settings should closely monitor patients during interventions, looking for signs of intolerance or impending medical instability.

Care Transitions

Occupational therapy practitioners play a key role in care transitions to ensure carryover of the occupational therapy plan of care on non–ICU floors. Most ICU patients deemed medically stable and no longer at risk of imminent decompensation will transition to a step-down or telemetry floor for continued monitoring and medical care. Similar to the physician intensivists providing a medical hand-off summary to the next care provider, occupational therapy practitioners should provide a summary to the practitioner responsible for carrying forward the plan of care. In facilities where the same rehabilitation clinicians follow patients throughout their hospital admission, the occupational therapy practitioner can communicate with nursing staff to ensure ongoing carryover of the strategies and interventions initiated in critical care.

A small percentage of critical care patients will be discharged directly to the community, and occupational therapy practitioners will also play a key role in providing appropriate discharge recommendations for disposition

(e.g., home, skilled nursing facility), durable medical equipment, caregiver training, and follow-up care (e.g., home health, outpatient rehabilitation).

Interprofessional Considerations

Delivering occupational therapy services in critical care settings requires practitioners to collaborate closely with the entire interprofessional care team. It is important to note that occupational therapy practitioners must develop strong clinical reasoning and communication skills to understand when the assistance of another discipline (nursing, respiratory therapy, physical therapy, medicine, etc.) is needed to facilitate successful and safe occupational performance. An understanding of the distinct goals of each member of the interprofessional care team and their impact on patient stability and capacity to participate in therapy is a necessary part of interprofessional collaboration (Zwarenstein et al., 2009).

Clear and well-established channels of communication should exist among all members of the critical care team, the patient, and the patient's representatives. Integrating children's families and caregivers within the PICU care team has demonstrated positive impacts on short- and long-term pediatric critical illness outcomes (Richards et al., 2017). Occupational therapy practitioners should collaborate with the critical care team to determine a patient's readiness for occupational therapy intervention, including out-of-bed mobility and occupational engagement. Occupational therapy practitioners should actively participate in interprofessional rounds when feasible.

Supervision of Occupational Therapy Assistants

Occupational therapy assistants are responsible for understanding and supporting the occupational therapy goals, implementing the care plan, modifying interventions on the basis of patient response, collaborating with OTs for reassessments over time, documenting intervention outcomes, and contributing to transition plans (AOTA, 2020b). Supervision is viewed as a cooperative process between both the OT and the OTA to ensure the safe and effective delivery of occupational therapy services (AOTA, 2020b). The relationship between the OT and OTA should be collaborative and consider both the current and evolving levels of clinical competence and skills of both individuals. The supervisory process contributes to effective resource utilization for service provision. Frequency of supervision will vary and is influenced by patient complexity, practice setting, practitioner competency, and diverse patient needs (AOTA, 2020b). Because of the inherently complex nature of critical care and the need for frequent reassessment, OTA supervision is anticipated to be higher than in other practice settings and could include

- the OT providing supervision during higher risk maneuvers, such as first-time mobilization sessions with invasive medical therapies;
- the OT and OTA collaborating before and after sessions to address any medical changes that may affect readiness for intervention; and
- the OT and OTA collaborating on goal changes on the basis of the patient's response to therapy intervention and changes in medical stability.

Ethical, Legal, and Regulatory Considerations

Occupational therapy practitioners have an ethical and professional responsibility to provide services within their level of competence and scope of practice (AOTA, 2020a, 2020b). AOTA's (2020a) *Occupational Therapy Code of Ethics* outlines and defines the necessary principles for safe and competent practice and is applicable to acute and critical care settings. Practitioners must also comply with all federal, state, local, and institution-specific regulatory requirements.

Patients in critical care settings are often medically fragile, and occupational therapy practitioners must ensure that the goals of therapy intervention align with the medical goals of care. For example, if a patient and their representatives have elected for comfort-focused care[3] in the ICU, occupational therapy practitioners will likely

[3]A care plan focused on symptom control, pain relief, and quality of life.

replace high-intensity rehabilitation and restorative interventions with interventions focused on quality of life and the alleviation of discomfort.

Prior to any therapy session in the critical care setting, the practitioner should consider the risks of intervening and weigh those risks against the potential benefits. When the risks associated with occupational therapy evaluation or intervention may exceed the potential benefits, the clinician should consider deferring the session and communicate with the referring provider. In addition, occupational therapy practitioners should strongly consider providing intervention when there are risks of immobility-associated complications, such as ICU–acquired weakness, delirium, and ventilator-associated pneumonia.

Education and Training

Occupational therapy practitioners must obtain the clinical experience, mentorship, and continuing education appropriate for their practice to safely deliver interventions in the complex and constantly evolving critical care environment. Advanced clinical training opportunities for critical care rehabilitation are available through AOTA's (2022) fellowship programs in acute care, critical care, and physical rehabilitation. Practitioners typically obtain the majority of training and mentorship to work in critical care settings from advanced occupational therapy practitioners and other members of the interdisciplinary critical care team.

Funding and Reimbursement

Occupational therapy services provided during inpatient hospital admissions, including critical care rehabilitation, are not billed separately to the patient or payer. Reimbursement for all hospital care is set through an inpatient prospective payment system, with reimbursements based on diagnosis-related groups that consider the average costs associated with a specific condition. Billing for occupational therapy services provided during an ICU admission is used to track hospital spending and care delivery. Over the past decade, the Patient Protection and Affordable Care Act of 2010 (Pub. L. 111-148) has shifted the focus of health care delivery to incentivize cost-effectiveness, quality outcomes, and consumer experience. Hospitals now face payment penalties for hospital readmissions within 30 days and preventable hospital-acquired conditions, such as falls, infections, and pressure injuries (Pritchard et al., 2019). Occupational therapy services have the potential to reduce overall hospital costs by effectively preventing these conditions and reducing hospital readmission risk through discharge planning and predischarge interventions that facilitate successful transitions home (Pritchard et al., 2019).

Conclusion and Future Directions

Occupational therapy practitioners are integral members of the interprofessional critical care team. With longer life expectancies, an aging population, and advances in critical care medicine increasing demand for ICU service delivery, the profession has the opportunity to further solidify its distinct contributions to critical care rehabilitation. Investment in translational research can improve efforts to objectively measure and demonstrate the impact of critical care occupational therapy on patient-centered outcomes. Training programs and communities of practice for clinicians could improve knowledge mobilization within the profession and establish guidelines for advanced critical care practice. To prepare students for careers in critical care rehabilitation across the care continuum and lifespan, occupational therapy education should include content on adult and pediatric critical care, PICS, and their impacts on participation. Joint ventures among educators, clinicians, translational researchers, and professional leaders are needed to develop a robust occupational therapy workforce specialized to work in critical care rehabilitation (Margetis et al., 2021).

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Case Study 1. Infant With Pneumonia and Respiratory Failure

Occupational Therapy Process	Clinician's Findings
Client description	Arlo is an 8-wk and 3-day-old male infant who was born at 40 wk and 1 day of gestation via vaginal delivery to his 20-yr-old mother and father. His mother had an uncomplicated pregnancy and delivery and received intermittent prenatal care. He lives with his mother and his grandparents. His grandparents and father provide child care in the home when Arlo's mother works. Arlo has no siblings and is bottle fed. Arlo's mother was able to supply expressed breast milk for the first 6 wk of his life. She then developed mastitis and a significant drop in her breast milk supply, necessitating the introduction and eventual transition to infant formula. She was using a bottle that she purchased at the drugstore that came with a slow-flow nipple. Arlo was admitted to the PICU with acute respiratory distress secondary to bronchiolitis and possible aspiration pneumonia. In the emergency department, Arlo was unable to maintain his SpO_2 above 80% without supplemental O_2, necessitating bilevel positive airway pressure, which improved his SpO_2 to >90%. Persistent tachypnea and the increased work of breathing led to the medical team intubating and sedating Arlo and admitting him to the PICU, where occupational therapy was consulted for evaluation and treatment.
Evaluation and goal setting	Arlo was evaluated within 24 hr of PICU admission. The evaluation consisted of ▪ Occupational profile development via interview with his mother at the bedside ▪ RASS administration ▪ Range of motion assessment ▪ Assessment of tolerance to handling Arlo's mother reported the following during the interview: ▪ Arlo hates tummy time, but he would hold his head up when she held him on her shoulder. ▪ He had been feeding well, eating 2–3 oz formula every 3 hr. ▪ He was very messy and occasionally coughed, appearing to choke at least once during every bottle. ▪ He would calm when caregivers picked him up and appeared to watch his family as they moved about the room. ▪ He woke up 1–2 times/night to feed and napped 1–2 times per day. Arlo's initial RASS score was –5. ▪ He was unable to be aroused to an alert state. ▪ He did not demonstrate an active rooting reflex or grasp reflex on evaluation. ▪ He did not rest in physiological flexion, instead lying with his upper extremities fully extended and his lower extremities in hip external rotation and knee flexion. ▪ Attempts at handling resulted in Arlo's SpO_2 decreasing to 87% and his heart rate increasing to over 170 beats per minute. ▪ His hemodynamics calmed only with containment strategies, such as swaddling. Arlo's mother's goal: ▪ See Arlo get better and not fall behind in meeting his developmental milestones OT goals: ▪ Arlo's tolerance of handling in preparation for getting up to his mother's arms will increase, as evidenced by his heart rate and O_2 saturation remaining stable, within 1 wk. ▪ Arlo's mother will actively participate in 75% of Arlo's care to further facilitate mother–infant bonding within 1 wk. ▪ Arlo will tolerate oral–motor skill assessment as soon as medically appropriate.
Occupational therapy interventions	OT intervention initially included: ▪ Facilitating care with his mother while the nurse assisted with managing his IV line, temperature probe, A-line, cardiac leads, and SpO_2 monitor

(*Continued*)

Case Study 1. Infant With Pneumonia and Respiratory Failure (*cont'd*)

Occupational Therapy Process	Clinician's Findings
	▪ Family education and training on containment strategies to manage agitation during care beyond swaddling ▪ Environmental modifications in collaboration with nursing and respiratory therapy to maintain Arlo's airway to allow his mother to engage in skin-to-skin contact one time per day After 4 days, Arlo was extubated, requiring 3 LPM of supplemental O_2 via a nasal cannula. The medical team cleared Arlo to begin oral feeding trials with OT only. OT reassessment, including oral–motor assessment results, indicated the following: ▪ RASS score: +1 ▪ Normal oral structures ▪ Initiation of rooting, including active head turning with tactile input to his cheeks and corners of his mouth ▪ Opening mouth with tactile input of the pacifier ▪ Unable to drop and cup his tongue to receive the nipple of the pacifier or bottle ▪ Unable to maintain an active latch on the pacifier ▪ Unable to coordinate sucking bursts longer than 2–3 sucks at a time The OT added an oral–motor goal to the care plan. ▪ Goal: Arlo will take up to 30 mL of expressed breast milk or formula from a bottle while maintaining physiological stability within 3 days. Nonnutritive oral–motor interventions included ▪ Trying a different bottle system with a slower nipple flow rate to replace the store-bought bottle system in use at admission ▪ Using a pacifier dipped in sterile water or formula to encourage active latch and generate longer sucking bursts in preparation for feeding ▪ Sensory and environmental modifications (e.g., dimming the lights and playing white noise) to support sleep hygiene ▪ Postural strengthening by reintroducing tummy time and supported sitting As sedation and O_2 supports were weaned, Arlo began feeding more effectively. As his oral intake increased, the care team noted that his congestion would increase after feeding. The OT recommended that he undergo a VSS to rule out aspiration. The VSS revealed that Arlo was aspirating on thin liquids (IDDSI Level 0). He was deemed safe for mildly thick (IDDSI Level 2) liquids.
Occupational therapy outcomes	When Arlo was transferred out of the PICU, the following were noted: ▪ RASS score: 0 ▪ Arlo tolerated all diaper changes and care consistently without agitation. ▪ He took 1/2 to 3/4 of his expected volume of formula by mouth at each feeding. ▪ He visually fixated on his mother and tracked her around the room. ▪ He maintained a calm, alert state with minimal support. ▪ He maintained oxygenation on room air while awake and required only 0.1 LPM of supplemental O_2 when sleeping. His mother completed training to thicken his formula to a mildly thick (IDDSI Level 2) consistency and verified via the 10-s flow test (Cichero et al., 2017; Stevens et al., 2022). When Arlo transferred out of the PICU, the OT decreased his frequency from 5×/wk to 3×/wk because his mother and grandmother were at his bedside and engaging him in developmental play. Arlo was discharged home with outpatient OT when he no longer required supplemental O_2 to expedite his access to care.

Note. IDDSI = International Dysphagia Diet Standardisation Initiative (Stevens et al., 2022); LPM = liters per minute; OT = occupational therapy/therapist; PICU= pediatric intensive care unit; RASS = Richmond Agitation–Sedation Scale (Sessler et al., 2002); SpO_2 = oxygen saturation; VSS = video swallow study.

Research Evidence and Related Resources Guiding Practice

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Case Study 2: Boy With Duchenne Muscular Dystrophy and Cardiomyopathy

Occupational Therapy Process	Clinician's Findings
Client description	George (he/him) is a 9-yr-old male with Duchenne muscular dystrophy and resultant cardiomyopathy. He ambulates household and school distances but reports falling several times a day. He attempts to ambulate community distances but needs frequent rest breaks or will use the motorized scooters, if available, in stores. George reported worsening fatigue and shortness of breath during physical exertion. His cardiologist performed a routine echocardiogram and found significant change in his cardiac function, resulting in admission to the CTICU. Given George's worsening heart failure, the medical team recommended an LVAD while awaiting evaluation for a heart transplant. 48 hr after being admitted to the CTICU, George underwent successful LVAD placement. 24 hr postoperatively, George was extubated to 3 LPM of supplemental O_2 via nasal cannula, and OT was consulted for evaluation and treatment.
Evaluation and goal setting	At evaluation, George was cleared for mobilization to the edge of the bed. ▪ RASS: 0 ▪ Pain severity: 7/10 ▪ Bilateral ROM ▫ Shoulder flexion was limited to 0°–100° ▫ Elbow flexion was within functional limits ▫ Wrist extension was limited to 0°–35° ▫ Wrist flexion was limited to 0°–25° Manual muscle testing (Siu et al., 2015): ▪ Right UE ▫ Shoulder flexion: 2 ▫ Shoulder extension: 2+ ▫ Elbow flexion: 3 ▫ Elbow extension: 3

(*Continued*)

Case Study 2: Boy With Duchenne Muscular Dystrophy and Cardiomyopathy (*cont'd*)

Occupational Therapy Process	Clinician's Findings
	▫ Wrist extension: 2– ▫ Wrist flexion: 2– ▪ Left UE ▫ Shoulder flexion: 2 ▫ Shoulder extension: 2– ▫ Elbow flexion: 3 ▫ Elbow extension: 3 ▫ Wrist extension: 2 ▫ Wrist flexion 2– ▪ AM-PAC®: 6/24, indicating total assistance for all ADLs. ▪ The COPM identified George's level of participation prior to hospital admission and aligned medical goals with long-term goals for future recovery: ▫ Upper body and lower body dressing: Performance = 1, Satisfaction = 1 ▫ Getting onto and off of the toilet: Performance = 1, Satisfaction = 1 ▫ Walking the hallway at school: Performance = 2, Satisfaction = 1 ▫ Going to the store with his mom: Performance = 2, Satisfaction = 1 ▫ Playing video games: Performance = 5, Satisfaction = 3 ▫ Performance score = 9/5 (1.8) ▫ Satisfaction score = 7/5 (1.4) ▪ During the evaluation, when he transitioned from supine to sitting at the edge of the bed, George needed moderate assistance from 2 people. Once at the edge of the bed, his RT increased his O_2 support to maintain his SpO_2 >90%. He was able to wash his face using an anterior support surface for sitting balance and to support his UE to reach his face. Goals established at the evaluation: ▪ George will complete face washing and UE dressing with minimal assistance in sitting, within 1 wk. ▪ George will complete bed mobility with minimal assistance and safely maintain his drive line during mobility, within 3 wk. ▪ George will transfer to a bedside commode with moderate assistance, within 4 wk.
Occupational therapy interventions	The OTA provided interventions for George in collaboration with the OT and the PICU team. Sessions initially were cotreatments with George 2×/day to maximize his participation and accommodate his level of endurance. Interventions initially focused on ▪ Establishing what equipment George needed and was willing to use for toileting to avoid bedpan use. The bedside commode was adjusted for George's height. ▪ Providing education on integrating LVAD management during functional mobility and occupational performance ▪ Setting up the environment, including line management, to prevent soiling the drive line during toileting ▪ Recommending positioning (e.g., using a step stool) to help relax George's pelvic floor muscles during bowel movements to prevent straining ▪ Recommending assistive devices, such as toilet tongs, for peri-care After his functional mobility and endurance improved, the OT and PT split their sessions to maximize progress. During caregiver training on LVAD management, the OTA noticed George's mother was having difficulty switching to a battery power source because of decreased grip strength. To address his mother's difficulty with recalling the sequence, the OTA collaborated with the OT and the mechanical circulatory support team to adapt the

(*Continued*)

Case Study 2: Boy With Duchenne Muscular Dystrophy and Cardiomyopathy (*cont'd*)

Occupational Therapy Process	Clinician's Findings
	plugs and created a color-coded instructional guide with pictures for George's mother to facilitate independence in caring for her child. The OT established a new caregiver goal: ▪ George's mother will independently incorporate educational supports and adapted plugs to successfully transition George to a battery power source to facilitate occupational performance and mobility, by discharge.
Occupational therapy outcomes	When George was ready to transition to the step-down unit, his AM-PAC score was 17/24, indicating he needed moderate assistance with completing ADLs. George continued to work with OT services 5×/week. His goals were continued, and one additional goal was added: ▪ George will independently use adaptive equipment during ADLs and mobility to facilitate safe discharge home while waiting for his heart transplant. Within 3 wk of transfer to the step-down unit, George was discharged home and used a wheelchair only for community distances. He was also referred to a cardiopulmonary rehabilitation program in preparation for his heart transplant. At the time of discharge from the hospital, the COPM identified the following: ▪ Upper body and lower body dressing: Performance = 7, Satisfaction = 8 ▪ Getting onto and off of the toilet: Performance = 8, Satisfaction = 8 ▪ Walking the hallways at school: Performance = 6, Satisfaction = 5 ▪ Going to the store with his mom: Performance = 4, Satisfaction = 5 ▪ Playing video games: Performance = 10, Satisfaction = 10 ▪ Performance score = 35/5 (7) ▪ Satisfaction score= 36/5 (7.2) After 3 mo, George received his heart transplant.

Note. ADLs = activities of daily living; AM-PAC® = Boston University Activity Measure for Post-Acute Care (2022); CTICU = cardiac intensive care unit; COPM = Canadian Occupational Performance Measure (Law et al., 2019); LPM = liters per minute; LVAD = left ventricular assist device; OT = occupational therapy/occupational therapist; OTA = occupational therapy assistant; PT = physical therapist; RASS = Richmond Agitation–Sedation Scale (Sessler et al., 2002); RT = respiratory therapist; SpO_2 = oxygen saturation; UE = upper extremity.

Research Evidence and Related Resources Guiding Practice

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Case Study 3: Woman With Pneumonia and Sepsis

Occupational Therapy Process	Clinician's Findings
Client description	Jackie (she/her) is a 62-yr-old woman with hypertension, osteoarthritis, and a history of colon cancer now in remission. She lives with her husband and is independent with ADLs within her home and community. She works full time as a middle school math teacher and cares for her granddaughter after school. She enjoys spending time with her family, gardening with her husband, reading, and participating in a weekly book club with friends. Jackie called out sick from school and endured 3 days of chills, fever, nausea, vomiting, fatigue, dehydration, and poor oral intake. Her husband brought her to the ED after she became confused and lethargic, and had a near-syncopal episode while in the bathroom. In the ED, Jackie was severely dehydrated, hypotensive (BP: 70/44), tachycardic (HR: 130s), hypoxic (SpO_2: 86%), and disoriented to the events leading up to her visit. A code sepsis was initiated and Jackie was admitted directly to the ICU. The critical care team worked quickly to identify the source of Jackie's infection while also beginning fluid resuscitation, broad-spectrum antibiotics, vasoactive medications to support her blood pressure, and high-flow nasal cannula O_2 therapy. Jackie was diagnosed with septic shock due to influenza A and viral pneumonia. Over the next 24 hr, Jackie developed an acute kidney injury, volume overload, and acute respiratory failure, requiring continuous renal replacement therapy and mechanical ventilation. She was sedated to synchronize her breathing with the ventilator. Her sedative infusion was titrated to achieve moderate sedation: a RASS score of –3, defined as movement or eye opening to voice. OT was consulted for evaluation and treatment on Hospital Day 3. Prior to the occupational therapy evaluation, the OT reviewed the medical chart and discussed Jackie's care with her RN and RT. At the bedside, Jackie's HR had improved to 110 bpm, and her rhythm was sinus tachycardia. Her BP was stable on 2 mcg/min of norepinephrine. She had failed her spontaneous breathing trial earlier in the day and now rested on full ventilator support, with an FiO_2 of 60%. The RN reported Jackie had been awake all night with agitation and disorientation; she had required higher levels of sedation and soft wrist restraints to prevent her from pulling her endotracheal tube and temporary dialysis catheter. Around 7:15 a.m., when her husband arrived at her bedside, Jackie calmed down and fell asleep. Jackie's husband was at her bedside throughout the OT evaluation. The assessment revealed a decline in all areas of occupational performance, including basic self-care and mobility tasks. The therapist identified functional limitations resulting from impaired body systems affected by Jackie's acute illness, including immunological, cardiovascular, pulmonary, neuromuscular, and neurocognitive functions. The OT assessment and care plan details are outlined below.
Evaluation and goal setting	Functional outcome measures ▪ AM-PAC® Daily Activities: 7/24 ▪ AM-PAC Applied Cognition: 9/24 Mobility: ▪ Bed mobility: Moderate assist ▪ Edge of bed, sitting balance: Minimal assist ▪ Sit to stand: Moderate assist + walker ▪ Chair transfer: Moderate assist ▪ Commode transfer: Moderate assist Neurocognitive function ▪ RASS score at start of session: –1 (drowsy) ▪ Within session: 0 (calm and alert) ▪ Postsession: 0 (calm and alert)

(*Continued*)

Case Study 3: Woman With Pneumonia and Sepsis (*cont'd*)

Occupational Therapy Process	Clinician's Findings
	CAM–ICU (delirium screen) ▪ Inattention: 4 errors Disorganized thinking: 1 error ▪ Oriented to place, self, and month/year ▪ Reoriented to the situation and day of week ▪ Emerging environmental awareness ▪ Restless and decreased safety awareness of lines and devices during mobilization Strength: MRC-SS ▪ Shoulder Flexion: R = 3, L = 3 ▪ Hip Flexion: R = 3, L = 3 ▪ Elbow Flexion: R = 4, L = 4 ▪ Knee Extension: R = 4, L = 4 ▪ Wrist Extension: R = 5, L = 5 ▪ Ankle Dorsi-Flexion: R = 5, L = 5 ▪ MRC–SS total: 48/60 Activity tolerance ▪ 15 min of bed-level cardiac chair activity ▪ 8 min of edge-of-bed sitting ▪ <30 s of standing ▪ 15 min of chair-level activity Sensation and hearing were all intact. Jackie had impaired visual acuity at baseline, with her husband reporting that she wears glasses for driving and distance. She was able to read the wall clock at a distance of ~10 ft. Vitals ▪ Supine resting: BP = 98/55 (69), HR = 110, SpO_2 = 94% ▪ Cardiac chair: BP = 88/55 (66), HR = 118, SpO_2 = 99% ▪ Edge of bed: BP = 90/55 (67), HR = 125, SpO_2 = 94% ▪ Bedside chair, postexertion: BP = 85/52 (63), HR = 140, SpO_2 = 87% ▪ Chair at rest: BP = 94/58 (70), HR = 120, SpO_2 = 97% ▪ End of session, in bed: BP = 100/60 (73), HR = 115, SpO_2 = 98% Activity parameters (per chart review) ▪ Maintain MAP ≥65 ▪ SpO_2 >90%; RT to titrate ventilator settings as needed to support successful participation ▪ RN to titrate sedation to RASS –1 to 0 to support participation in therapy ▪ HR range with activity, 90–150 bpm Goals ▪ Jackie will participate in 30 min of chair-level self-care grooming activity daily, in 1 wk, with assistance as needed. ▪ Jackie will perform bed mobility (rolling, supine to sit) with supervision and moderate cues, in 1 wk. ▪ Jackie will perform commode transfers with walker and close supervision, in 1 wk. ▪ Jackie will tolerate chair-level activity for 1 hr, 3×/day, in 1 wk. ▪ Jackie will improve upper body strength and coordination for her grooming routine, as evidenced by an increase in upper extremity MRC-SS to 30/30, in 2 wk. ▪ Jackie will improve functional cognitive performance, as evidenced by improved AM-PAC® Applied Cognition score by 6 points, in 2 wk.

(*Continued*)

Case Study 3: Woman With Pneumonia and Sepsis (*cont'd*)

Occupational Therapy Process	Clinician's Findings
Occupational therapy interventions	Early mobilization facilitated therapy activities in upright body positions at the edge of bed and out of bed onto the bedside commode and a chair. Mobilization improved Jackie's cardiovascular tolerance, with careful monitoring of her BP and HR to ensure appropriate hemodynamics. Out-of-bed mobilization was initiated early, while Jackie was on mechanical ventilation, which prevented further loss of muscle strength and improved her overall cognitive awareness of her body and environment. Early mobilization was a critical intervention to support her successful weaning from the ventilator, improving FiO_2 and SpO_2. She was extubated on Hospital Day 6 after 4 OT sessions. Early mobilization interventions were supported by multiple members of the interprofessional team, including nursing, respiratory therapy, and physical therapy, allowing Jackie to transfer to the bedside chair 3×/day. Early engagement and ADL training was facilitated in each OT session, in conjunction with mobilization activities. Jackie grew more comfortable and independent, mobilizing within the constraints of her invasive lines and medical devices, and began to use the bedside commode each day with minimal assistance. OT sessions also engaged Jackie in tabletop grooming activities; dynamic reaching; postural control activities, such as balloon volleyball; and simple handwriting tasks, such as writing a letter to her granddaughter, who was unable to visit because of age-related visitor restrictions. Initially, Jackie required proximal support of her upper extremities at the elbow to reach her face during ADL training because of shoulder weakness. Within the first week, Jackie had generalized this strategy to support participation within and outside of OT sessions. Delirium management and prevention strategies were incorporated within all of Jackie's OT sessions. Jackie's arousal, attention, and thinking were assessed formally at each session using the RASS and the CAM–ICU, in addition to informal assessment during functional performance. The OT requested Jackie's husband bring her glasses for her to wear during waking hours, as well as a few personal photos and a blanket from home to improve the familiarity of the ICU environment. The OT practitioners emphasized the importance of structured daily routines to support Jackie's sleep–wake cycle and orientation. They encouraged the following: ▪ Earplug use at night to drown out noisy alarms and staff ▪ Visibility of the wall clock ▪ Guided meditation recordings to self-regulate arousal prior to sleep ▪ Natural light during the day and raising the window shades to see outside ▪ Positioning Jackie's bedside chair next to the window, reorienting her circadian rhythms While Jackie was on the ventilator and unable to speak, the therapists provided her with communication strategies, including: ▪ a communication whiteboard and pen to express herself; ▪ nonverbal communication strategies, such as nodding her head yes and no; and ▪ easy access to her call light to contact the care team for assistance. The OT initiated the use of an ICU diary to document key events of progress during Jackie's recovery. The ICU diary was recorded in a simple spiral-bound notebook and included printed photographs (taken with consent) of Jackie participating in therapy activities (e.g., a photograph captured by Jackie's husband of her sitting at the edge of the bed while on the ventilator during her initial OT evaluation, a photograph captured by the RN of Jackie walking while on the ventilator for the first time during PT). These photographs helped capture Jackie's progress over the course of her recovery in the critical-care unit and helped structure her recovery narrative and timeline to support her long-term recall. The OT practitioners collaborated with the interprofessional team throughout Jackie's ICU admission.

(*Continued*)

Case Study 3: Woman With Pneumonia and Sepsis (*cont'd*)

Occupational Therapy Process	Clinician's Findings
Occupational therapy outcomes	Jackie progressed well in OT while receiving supportive medical therapies under the care of the interprofessional critical-care team. She was transferred out of the ICU on Hospital Day 8, after her hemodynamics had stabilized. Jackie experienced intermittent bouts of delirium throughout her ICU admission, although the severity of delirium dramatically improved after she was able to participate in a structured early rehabilitation program. Upon transferring out of the ICU, Jackie had been delirium free for 48 hr. On her final day in the ICU, Jackie had markedly improved in her activity tolerance, spending more than 6 hr in the bedside chair, routinely transferring to the bedside commode with nursing assistance, and visiting with her granddaughter virtually. OT reassessment in the step-down unit revealed that Jackie had achieved 5 out of 6 of the initial goals set at evaluation. Functional outcome measures revealed an improvement in all areas of self-care, mobility, and cognitive-related task performance. Functional outcome measures ▪ AM-PAC Daily Activities: 17/24 ▪ AM-PAC Applied Cognition: 18/24 Strength: MRC-SS ▪ Shoulder Flexion: R = 4, L = 4 ▪ Hip Flexion: R = 4, L = 4 ▪ Elbow Flexion: R = 5, L = 5 ▪ Knee Extension: R = 5, L = 5 ▪ Wrist Extension: R = 5, L = 5 ▪ Ankle Dorsi-Flexion: R = 5, L = 5 ▪ MRC-SS total: 56/60 After an additional 3 days on the step-down unit, Jackie was discharged home with home health nursing, OT, and PT, along with the support of her husband and daughter.

Note. ADLs = activities of daily living; AM-PAC® = Boston University Activity Measure for Post-Acute Care; BP = blood pressure; bpm = beats per minute; CAM–ICU = Confusion Assessment Method for the Intensive Care Unit; ED = emergency department; FiO_2 = fraction of inspired oxygen; HR = heart rate; ICU = intensive care unit; L = left; MAP = mean arterial pressure; MRC-SS = Medical Research Council Sum Score; OT = occupational therapy/therapist; PT = physical therapy/physical therapist; R = right; RASS = Richmond Agitation–Sedation Scale (Sessler et al., 2002); RN = registered nurse; RT = reaction time; SpO_2 = oxygen saturation.

Research Evidence and Related Resources Guiding Practice

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Case Study 4: Man With Myocardial Infarction and Subarachnoid Hemorrhage

Occupational Therapy Process	Clinician's Findings
Client description	Jose (he/him) is a 48-yr-old male with an unclear past medical history who has not seen a physician in more than 5 yr. He lives at home with his wife and two children in a two-story home with 15 steps to reach his second-floor bedroom and bathroom. He works full time as a project manager and exercises sporadically. He enjoys an evening cigar and several glasses of wine or scotch per night. He presented to the ED via ambulance after collapsing in the kitchen after an afternoon watching his son's football game. The emergency response team found him unresponsive and initiated CPR in the field with return of spontaneous circulation. Upon arrival to the ED, Jose was rushed to the CCL, where he was diagnosed with an MI, severe three-vessel CAD, and cardiogenic shock. Jose underwent high-risk PCI of his three-vessel CAD, and an IABP was placed through his left femoral artery to support cardiac perfusion and output in the immediate perioperative recovery period. After surgery, Jose was transferred back to the ICU, sedated on a mechanical ventilator with the IABP; radial arterial line, urinary catheter, endotracheal tube connected to the mechanical ventilator; and pulmonary artery catheter inserted through the right internal jugular vein. The medical team cleared Jose to actively participate in early mobility with OT and PT on Day 2 after the PCI. Jose participated in 5 days of successful OT sessions without adverse events related to the femoral IABP, including out-of-bed mobilization, standing ADLs at the sink, and ambulation. The medical team's main activity parameter was no hip left flexion, to reduce the risk of dislodging the IABP. When the OT practitioner noticed Jose had developed acute right hemiparesis, depressed mental status, and aphasia at the beginning of the 6th session, they notified the critical-care team. Emergent neuroimaging revealed diffuse SAH from a ruptured left middle cerebral artery aneurysm.

(*Continued*)

Case Study 4: Man With Myocardial Infarction and Subarachnoid Hemorrhage (*cont'd*)

Occupational Therapy Process	Clinician's Findings
	The neurocritical care team placed an EVD, recommended strict BP control, and intubated him for airway protection. The neurosurgical team took Jose to the neurointerventional angiography suite for endovascular coil embolization to treat the ruptured aneurysm. Jose was kept intubated postoperatively and transferred back to the neuro ICU. OT was reconsulted on Postoperative Day 2, and Jose's evaluation revealed deficits in a wide variety of client factors (including neurocognitive, linguistic, sensory, motor, cardiovascular, and respiratory) and performance skills (including motor, processing, and social), outlined below.
Evaluation and goal setting	Jose's evaluation on Postoperative Day 1 after the endovascular coil embolization revealed the following: Neurocognitive function ▪ AM-PAC® "6 Clicks" Applied Cognition: 6/24 ▪ CAM–ICU was deferred because of aphasia/apraxia ▪ Poor level of alertness ▪ Poor sustained attention ▪ Oriented only to self ▪ Restless behavior ▪ Inability to follow basic commands ▪ Ideomotor and ideational apraxia ▪ Broca's aphasia ▪ Executive dysfunction ▪ Impairments in working memory Vision ▪ Dysconjugate gaze with complaints of diplopia ▪ L gaze preference but can cross the midline with significant cueing ▪ Hypometric saccades ▪ Full visual fields Upper and lower extremities ▪ MRC-SS: 37/60 ▪ R hemiparesis with decreased tone ▪ R hemisensory loss ▪ R gross and fine motor coordination deficits ▪ L sided strength/sensation preserved ADLs/mobility/trunk control ▪ AM-PAC "6 Clicks" Daily Activities: 6/24 ▪ ADLs: Total assistance for all ▪ Mobility: Total assistance ▪ Trunk control: Fluctuates between maximum and total assistance Vitals ▪ BP: 159/83 on continuous antihypertensive medication ▪ MAP: 86–94 with activity ▪ HR: 89–100 bpm with activity ▪ ICP: 14–18 during activity ▪ SpO_2 >98% on mechanical ventilator Activity parameters (per chart review) ▪ SBP <160 ▪ MAP >65 ▪ ICP <20 ▪ EVD must be clamped for all mobility ▪ No L hip flexion per interventional cardiology

(*Continued*)

Case Study 4: Man With Myocardial Infarction and Subarachnoid Hemorrhage (*cont'd*)

Occupational Therapy Process	Clinician's Findings
	Goals: ▪ Jose will improve all ADL functions by 1 assist level, in 1 wk. ▪ Jose will incorporate RUE into ADL tasks with moderate cues, in 1 wk. ▪ Jose will improve his trunk control to sit on the edge of the bed with minimal assist for a 5-min ADL or social activity, in 2 wk. ▪ Jose will improve chair transfer capacity by 1 assist level and improve activation of RLE, in 2 wk. ▪ Jose will increase time out of bed to 1 hr/day, in 2 wk. ▪ Jose will participate in a family visitation session, within 2 wk.
Occupational therapy interventions	▪ Tolerance to upright positioning ▪ Edge-of-bed trunk control (after IABP was removed) ▪ Transfers ▪ Participation in standing ADLs (because of IABP) ▪ Participation in seated ADLs (after IABP removed) ▪ Cognitive rehabilitation ▪ Visual skill retraining ▪ Neuromuscular reeducation Initially, the OT used the hospital bed's tilt-table function to mobilize Jose while avoiding LLE flexion, per interventional cardiology's order. Jose participated in static standing activities to facilitate upright positioning, increased level of arousal, midline orientation, loading and weightbearing on all extremities, and ADL tasks completed with hand-over-hand facilitation. On Postoperative Day 5, cardiology confirmed that Jose's cardiac function had improved enough to no longer require IABP support. On Postoperative Day 6, Jose was extubated to 3 LPM via nasal cannula. OT practitioners were limited during some ICU sessions by Jose's inability to tolerate clamping of the EVD, as evidenced by immediate increase in ICP above the activity parameter. On these days, the OT practitioners modified the intervention plan to include in-bed cardiac chair (i.e., upright) activities, including ADL participation, initiation of cognitive rehabilitation, and visual scanning activities to promote tracking to the right (Burke et al., 2021; Yataco et al., 2019). Because of profound ideomotor and ideational apraxia, Jose needed hand-over-hand guidance with multimodal cue provision to retrain in basic ADLs. Activities were initially performed with Jose's nondominant LUE, with the OT practitioner facilitating weightbearing, and closed-chain activation for his RUE, promoting sensorimotor recovery. The OT practitioners recommended environmental modifications, including turning the bed so Jose was forced to visually track to the right to watch TV. In addition, family members were encouraged to interact with Jose from the right side of the bed, improving visual tracking to the right and providing cognitive stimulation and social participation (Devlin et al., 2018). Sessions were initially conducted at the edge of the bed by an OT assisted by a therapy aide who stabilized Jose's trunk, but as Jose's tolerance improved and medical stability increased the OT collaborated with the OTA to facilitate sensorimotor recovery and increase ADL participation (Abrams et al., 2019; Marhong et al., 2017; Olkowski et al., 2015; Yataco et al., 2019). The OT practitioners collaborated with the interprofessional team routinely in a variety of ways: ▪ Nursing: Managed EVD and IABP, titrated BP medications to control fluctuations in BP, decreased/paused sedation medications to optimize participation ▪ Respiratory therapy: Adjusted ventilatory support to optimize participation ▪ Physical therapy: Provided input on how to carry over the PT plan of care within ADLs and OT-driven functional mobility ▪ Dietitian: Optimized nutrition to promote recovery and participation ▪ Social work: Provided psychosocial support and community resources to Jose and his family ▪ Environmental services: Ensured availability of clean equipment and work surfaces

(*Continued*)

Case Study 4: Man With Myocardial Infarction and Subarachnoid Hemorrhage (*cont'd*)

Occupational Therapy Process	Clinician's Findings
	▪ MD/DO/NP/PA: Set medical parameters for therapy participation Sessions were typically conducted separately from PT sessions to give Jose more opportunities to mobilize throughout the day. On Postoperative Day 15, the neurocritical care team successfully removed the EVD.
Occupational therapy outcomes	Jose progressed well within the OT plan of care. During his weeks-long ICU stay, Jose progressed toward his functional goals, participating initially in "verticalization" because of the IABP, progressing to unsupported seated ADLs after the IABP was removed to improve trunk control, and eventually transferring out of bed daily for 2 to 3 hr at a time with nursing assistance. He followed commands with 80% consistency and accuracy and spontaneously tracked to the right by the time he was transferred out of the ICU. On Postoperative Day 17, Jose was deemed medically stable for transfer to the step-down floor. He continued receiving OT interventions and was ultimately transferred to an inpatient rehabilitation facility to continue his neurorehabilitation in preparation for transitioning home.

Note. ADLs = activities of daily living; AM-PAC® "6 Clicks" = Boston University Activity Measure for Post-Acute Care "6 Clicks" functional assessment (Boston University, School of Public Health, Health and Disability Research Institute, 2019); BP = blood pressure; bpm = beats per minute; CAM–ICU = Confusion Assessment Method for the Intensive Care Unit; CAD = coronary artery disease; CCL = cardiac catheterization laboratory; CPR = cardiopulmonary resuscitation; DO = doctor of osteopathic medicine; ED = emergency department; EVD = external ventricular drain; HR = heart rate; IABP = intra-aortic balloon pump; ICP = intracranial pressure; ICU = intensive care unit; L = left; LLE = lower left extremity; LPM = liters per minute; LUE = left upper extremity; MAP = mean arterial pressure; MD = medical doctor; MI = myocardial infarct; MRC-SS = Medical Research Council Sum Score; NP = nurse practitioner; OT = occupational therapy/therapist; OTA = occupational therapy assistant; PA = physician assistant; PCI = percutaneous coronary intervention; PT = physical therapy/physical therapist; R = right; RLE = right lower extremity; RT = respiratory therapy/therapist; RUE = right upper extremity; SAH = subarachnoid hemorrhage; SBP = systolic blood pressure; SpO_2 = oxygen saturation.

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Appendix

Table A.1. Invasive Medical Therapies Used in Critical Care Settings

Therapy/device	Description
Arterial line	Thin, flexible tube placed into an artery (commonly in the wrist or groin) to monitor arterial blood pressure and draw blood samples.
Central venous catheter	Large-bore device placed into a large vein to deliver larger volumes of medications and monitor central venous pressure.
Continuous renal replacement therapy	Provides continuous hemodialysis at a constant though low rate. Commonly used in critically ill patients who cannot tolerate the large fluid shifts associated with standard hemodialysis.
Drains	Devices used in postoperative settings to collect bodily fluids from surgical sites. Common examples include bulb drains (Jackson–Pratt) and chest tubes.
External ventricular drain (EVD)	Device inserted through the skull and brain parenchyma into the ventricle in the brain. Used to monitor intracranial pressure (ICP), alleviate elevated ICP through cerebrospinal fluid diversion, and as a medication delivery system.
Intracranial pressure monitors	Devices used to monitor ICP. Examples include subdural or epidural bolts, EVDs, and intraparenchymal monitors.
Medications	Many different classes of medications exist for different purposes, including vasoactive (increase blood pressure), antihypertensive (lower blood pressure), sedation, analgesics (pain), and anti-arrhythmics.
Mechanical circulatory support devices	Invasive medical devices that support the cardiovascular and circulatory systems. Examples include ventricular assist devices; percutaneous heart pumps, such as Impella® devices; and extracorporeal membrane oxygenation.
Mechanical ventilation	Invasive method of providing ventilatory support. Commonly delivered via endotracheal tube, nasotracheal tube, or tracheostomy.
Noninvasive positive pressure ventilation	Methods of providing ventilatory support using external face masks and nasal cannulas. Examples include continuous positive airway pressure and bilevel positive airway pressure.
Pulmonary artery catheter	Catheter placed into the pulmonary artery to measure pulmonary artery pressures.
Rectal tube	A flexible tube placed into the rectum to collect loose stool. Commonly used in cases of prolonged diarrhea.
Temporary hemodialysis catheter	A catheter used for urgent/emergent hemodialysis when patients lack a working arteriovenous fistula. Commonly placed in the jugular or femoral vein and often referred to as a *Vas-Cath*®.
Urinary catheter (indwelling)	A flexible tube inserted into the bladder through the urethra to collect urine. Can also be used to measure bladder pressures, and often referred to as a *Foley*.
Vacuum-assisted closure device	Negative-pressure wound therapy is a therapeutic technique where a suction pump, with tubing connected to a sealed dressing, removes excess exudate and promotes healing in acute or chronic wounds. Often referred to as a *wound VAC*.