CE 2.0 ANCC Contact Hours

Progressive Mobility Protocol Reduces Venous Thromboembolism Rate in Trauma Intensive Care Patients: A Quality Improvement Project

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ABSTRACT

The intensive care unit (ICU) trauma population is at high risk for complications associated with immobility. The purpose of this project was to compare ICU trauma patient outcomes before and after implementation of a structured progressive mobility (PM) protocol. Outcomes included hospital and ICU stays, ventilator days, falls, respiratory failure, pneumonia, or venous thromboembolism (VTE). In the preintervention cohort, physical therapy (PT) consults were placed 53% of the time. This rose to more than 90% during the postintervention period. PT consults seen within 24 hr rose from a baseline 23% pre- to 74%–94% in the 2 highest compliance postintervention months. On average, 40% of patients were daily determined to be too unstable for mobility per protocol guidelines—most often owing to elevated intracranial pressure. During PM sessions, there were no adverse events (i.e., extubation, hypoxia, fall). There were no significant differences in clinical outcomes between the 2 cohorts regarding hospital and ICU stays, average ventilator days, mortality, falls, respiratory failure, or pneumonia overall or within ventilated patients specifically. There was, however, a difference in the incidence of VTE between the preintervention cohort (21%) and postintervention cohort (7.5%) ($p = .0004$). A PM protocol for ICU trauma patients is safe and may reduce patient deconditioning and VTE complications in this high-risk population. Multidisciplinary commitment, daily protocol reinforcement, and active engagement of patients/families are the cornerstones to success in this ICU PM program.

Key Words

Intensive care, Mobility, Trauma, Venous thromboembolism

Deconditioning occurs rapidly, worsens in severity with bed rest, and places hospitalized patients at increased risk of the poor outcomes associated with immobility. This is clearly seen in the intensive care unit (ICU) patient, as they are most often immobilized as a result of their complex care, depth of sedation, and physiologic instability (Kress & Hall, 2014). Recent studies challenging the traditional practice of immobilization of the critically ill have led to a surge in ICU-focused and hospital-wide multidisciplinary mobility protocols designed to mitigate the sequelae of ICU-acquired weakness and to increase patient functional dependence at discharge (Banerjee, Girard, & Pandharipande, 2011; Drolet et al., 2013; Perme & Chandrashekar, 2009). Progressive mobility studies in the ICU setting have demonstrated improvements in hospital length of stay (HLOS), ICU length of stay, ventilator days, pulmonary infections, delirium, and restraint days (Klein, Mulkey, Bena, & Albert, 2015; Needham et al., 2010;Schweickert et al., 2009; Titsworth et al., 2012).

While many of these studies have focused on medical and neurologic ICU patients, few studies have been conducted in trauma and neurotrauma ICUs. Variation exists in implementing and carrying out the tasks of progressive mobility for ICU trauma patients due to complex injuries that extend throughout the expertise of several different surgical specialties (Engel, Needham, Morris, & Gropper, 2013). Trauma patients often have extensive orthopedic and neurosurgical injuries, creating additional barriers to mobility (Saunders, 2015). It is difficult to mobilize many of these patients, requiring a clear understanding of their various injuries, documented limb weight-bearing statuses, specialized equipment, and dedicated staff members. Mobilization for ICU trauma patients is frequently beyond the ability of a single therapist, even in the absence of mechanical ventilation.

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The authors declare no conflicts of interest.

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DOI: 10.1097/JTN.0000000000000234

While challenging, a limited number of studies suggest that mobilizing the ICU trauma patient is possible, safe, and efficacious. Clark, Lowman, Griffin, Matthews, and Reiff (2013) demonstrated the safety of a mobility protocol in a trauma and burn ICU and, additionally, showed a decrease in airway, pulmonary, and vascular complications (including deep vein thrombosis [DVT]). Gillick, Marshall, Rheault, and Stoecker (2011) demonstrated improved functional performance in trauma ICU patients with a structured mobility program.

For the same reasons the ICU trauma population poses challenges to mobility, it stands to reason that they should also benefit from a focused mobility program early in the critical phase of their injury. The primary purpose of this quality improvement project was to compare trauma patient outcomes before and after implementation of a structured progressive mobility protocol with end points of venous thromboembolism (VTE), HLOS, intensive care unit length of stay (ICU-LOS), mortality, average ventilator days, falls, respiratory failure, and pneumonia.

METHODS

Design

This project was determined as quality improvement by the facility institutional review board. A pre- and postintervention design was used.

Setting

The project setting is a 12-bed neurotrauma intensive care unit (NTICU) located in a 767-bed, Level I Trauma Center, in Southwest Virginia. Originally awarded American Nurse Credentialing Center Magnet designation in 2003, the facility received a third Magnet redesignation in 2013. The unit was awarded the American Association of Critical-Care Nurses (AACN) Beacon Silver Award for Excellence in 2015.

Sample

A convenience sample of trauma patients admitted to the NTICU was used. A retrospective preintervention cohort March–August 2010 was compared with the prospective intervention cohort March–August 2013.

Quality Improvement Strategy

The Six Sigma DMAIC (i.e., Define–Measure–Analyze–Improve–Control) model for quality improvement was used to identify opportunities for improvement, to structure the intervention, and to compare trauma patient outcomes before and after progressive mobility protocol implementation. A multidisciplinary team comprising physicians, clinical nurse specialist, nurses, pharmacy, physical therapy (PT) staff, and respiratory therapy staff was formed. Strengths–Weaknesses–Opportunities–Threats (SWOT) analysis and comprehensive literature review were completed targeting initial steps including the following: determination of necessary equipment needs; support staff training needs; and development of a facility progressive mobility policy, including safe handling techniques for the trauma patient. The daily MOVE safety-screening tool and progressive mobility protocol for NTICU patients was adapted with permission from the AACN (Figure 1) and posted in each ICU patient room.

Interventions

Interventions were completed during a 6-month trial period (March–August 2013). The themed quality project was designed to mobilize patients by creating a culture change from bed rest to "Move it" with the expectation of all trauma patients receiving a daily screening for safe mobilization. Specific interventions during the implementation period included the following: formal mobility education and training of NTICU nursing, support personnel (i.e., nursing assistants), respiratory therapy and physician and resident staff; electronic health record (EHR) optimization to incorporate documentation of the progressive mobility protocol; purchasing of a platform chair; updating the trauma admission order set to include physical and occupational therapy consults on admission; and development of a patient/family progressive mobility brochure added to the NTICU admission packet.

Procedures

Daily reinforcement of the progressive mobility protocol occurred during morning multidisciplinary rounds and by using a daily morning huddle between the PT and NTICU charge nurse to determine appropriate patients based on MOVE screen criteria (protocol level 2–6 and able to participate [Richmond Agitation Sedation Score −1 to 1]), as well as to verify whether appropriate activity orders were in place. A dedicated daily 2-hr time block by PT staff provided consistent coverage for patients who were medically stable to participate in mobility progression and reinforced nursing staff confidence with scoring patients accurately and documenting in the EHR. Physical therapy determined activity level, and/or with nursing, communicated in therapy notes, on a patient room communication board and included trauma specific guidelines for safe movement progression. Support of nursing staff, as well as the respiratory therapist for mechanically ventilated patients, provided physical assistance to the therapist during the PT session, for line management and to assist with monitoring patient response and vitals. Patient mobility began at bed level activity including beach chair position, range-of-motion/strengthening exercises, and bed mobility including rolling and scooting. Mobility advanced to the next stages as the patient was able, including edge-of-bed activity, sitting balance, standing trials, and transfers

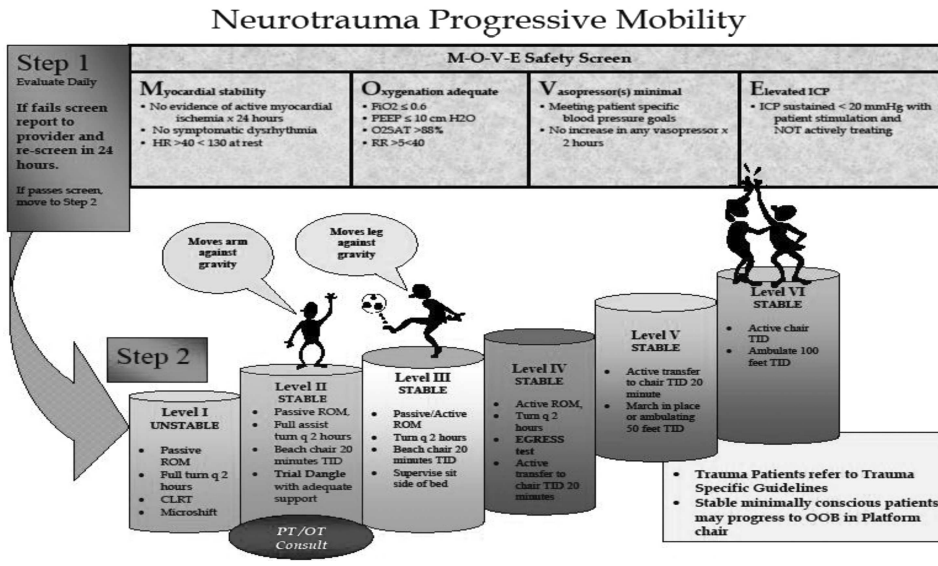

Figure 1. Neurotrauma progress mobility. This figure displays the daily M-O-V-E safety screen and progressive mobility protocol for mobilization of trauma intensive care patients. CLRT = continuous lateral rotation therapy; FiO_2 = fraction of inspired oxygen; H_2O = water; HR = heart rate; ICP = intracranial pressure; OOB = out of bed; O_2Sat = oxygen saturation; PEEP = positive end expiratory pressure; q = every; ROM = range of motion; RR = respiratory rate; TID = three times per day; x = times. American Association of Critical-Care Nurses. AACN Pearl. *Early Progressive Mobility Protocol.* http://www.aacn.org/wd/practice/docs/tool%20kits/early-progressive-mobility-protocol.pdf. Accessed September 24, 2015. Adapted with permission ©2012 by the American Association of Critical-Care Nurses.

until the patient was able to progress to walking. Registered nursing staff continued mobility progression outside of therapy session times.

DATA COLLECTION

Progressive Mobility Baseline Data

Six-week prospective data collection was conducted to determine baseline mobility characteristics in the NTICU using a convenience sample in June–July 2012, prior to the intervention period. Data elements collected included the frequency of activity, bed rest, and PT orders, and frequency bed rest was documented in the nursing EHR flow sheet for patients with out-of-bed orders.

Progressive Mobility Protocol Compliance Data

During the intervention period, data were collected prospectively by PT staff regarding patient mobility protocol level, the number of minutes spent with each patient during PT interventions, reasons for holding therapy, occurrence of adverse events (e.g., tube removal, fall, oxygen desaturation), and frequency of PT consult documented within 24 hr of order for consults.

Trauma Registry Data

Clinical outcomes data were gathered from the trauma registry for patients admitted to NTICU during the pre- and postintervention cohort periods. Trauma registry data queried included the following: age, gender, Injury Severity Score (ISS), trauma-related ISS (TRISS), diagnosis of traumatic brain injury (TBI), HLOS, ICU-LOS, average ventilator days, mortality, and complication incidence to include the following: falls, respiratory failure, pneumonia, DVT/pulmonary embolism (DVT/PE).

Analysis

Descriptive statistics such as frequencies and percentages and means for continuous variables were used to describe the demographic characteristics of the trauma registry samples and intervention compliance. Chi-square test or Fisher's exact test as appropriate was used to compare demographic differences between cohort groups. Independent-sample *t* tests, as well as Wilcoxon two-sample test, were used to compare pre- and postintervention cohorts with attention to the normality of distribution of the variables. The level for statistical significance was established as $\alpha = .05$. Analyses were conducted using SAS Version 9.3 for Windows (SAS, Inc., Cary, NC).

RESULTS

Progressive Mobility Baseline

Baseline NTICU mobility data included a convenience sample of 199 daily observations for a total of 59 unique ICU trauma patients over a 6-week preintervention period. Physical therapy was ordered for 53% of patients; 72% had

an activity order, 54% had bed rest orders, and for 52% of patients with out-of-bed orders, bed rest was documented as the activity level in the nursing EHR flow sheet.

Progressive Mobility Protocol Compliance

Physical therapy consults in the NTICU rose from 53% at baseline to more than 90% during the intervention period. Physical therapy seen within 24 hr of consult rose from a baseline of 23% (February 2013) to a range of 74%–94% in months April through May, but fell to 62% and 52% in July and August, respectively, when the project's lead PT received a leadership promotion out of the NTICU. Approximately 40% of NTICU trauma patients were Level 1 unstable for PT on any given day, with the most common reason being unstable intracranial pressure. Average length of PT patient intervention exceeded 18 min per session for protocol eligible patients, Levels 2–6. No occurrences of adverse events (e.g., tube removal, fall, oxygen desaturation) were noted during the intervention period. Anecdotally, we found that the isolated chest trauma subpopulation was most likely to ambulate while mechanically ventilated in the NTICU.

TRAUMA REGISTRY

Demographic Characteristics

Statistical differences between pre- ($n = 184$) and postintervention ($n = 159$) cohorts were not significant ($p > .05$) for age (pre *M*, 52.9 ± 21.4; post *M*, 56 ± 23.2), gender (pre-male 67%; post-male 66%), ISS (pre *M*, 20.66 ± 11.36; post *M*, 20.99 ± 10.61), and diagnosis of TBI (pre 70%; post 75%), except for TRISS (pre *M*, 0.816 ± 0.251; post *M*, 0.748 ± 0.308) ($p = .0259$).

Clinical Outcomes

There were no significant differences in pre- and postintervention cohort outcomes ($p > .05$) for HLOS (pre *M*, 13.63 ± 18.31; post- *M*, 9.85± 9.02), ICU-LOS (pre *M*, 6.52 ± 7.96; post- *M*, 5.68 ± 5.73), average ventilator days (pre *M*, 7.41 ± 9.18, $n = 100$; post *M*, 6.50 ± 6.58, $n = 82$), mortality (pre, 14.7%; post, 15.1%), and complication incidence for falls (pre, $n = 2$, 1.08%; post, $n = 4$, 2.52%), respiratory failure (pre, 39%; post, 42%), pneumonia overall (pre, 11.4%; post, 8.2%), and pneumonia in the subset of mechanically ventilated patients (pre, 19%; post, 14.6%). Incidence of DVT/PE in pre- versus postintervention cohorts (pre, 21%; post, 7.5%) reached statistical significance ($p = .0004$).

DISCUSSION

Critical care professional societies are emphasizing the importance of progressive mobility as a standard of care for acutely ill patients, including those receiving mechanical ventilation. The negative implications of immobility have been detailed in multiple muscle physiology studies conducted as early as the 1920s demonstrating decreased functional mobility, decreased lean muscle mass, and failure to return to prior to admission functional status. An understanding of the negative long-term impact of short-term bed rest in the hospitalized patient, combined with the fact that nowhere in the hospital is bed rest more common than in the ICU, provides the motivation for developing mobility strategies for the at-risk ICU population. Furthermore, mobilization of the trauma ICU population adds significant complexity to the process secondary to the nature of their injuries. Optimal mobilization strategies for the trauma ICU population have not been extensively studied. The primary purpose of this quality improvement project was to explore the impact of a structured progressive mobility protocol on ICU trauma patient outcomes before and after implementation.

Several studies have demonstrated the benefits of providing surgical and medical ICU patients with the focused therapy they need (Drolet et al., 2013; Kayambu, Boots, & Paratz, 2013). Needham et al. (2010) studied the effects of mobilizing 57 mechanically ventilated medical ICU patients and found a significant decrease in benzodiazepine use, improvement in sedation and delirium status, greater functional mobility and a decrease in HLOS, as well as ICU-LOS. In the first randomized controlled trial studying the impact of an ICU mobility program in two medical ICUs, Schweickert et al. (2009) demonstrated shorter duration of delirium, greater ventilator free days, and a greater return to independent functional status at hospital discharge. Drolet and colleagues (2013) reported that a nurse-driven mobility protocol significantly increased ambulation within 72 hr for intensive care and intermediate intensive care medical-surgical adult patients. Both Titsworth et al. (2012) and Klein et al. (2015), studying patients in neurologic ICUs, demonstrated an increase in mobility, a reduction in HLOS, and an improvement in ICU quality metrics.

However, consistent with other studies (Bassett, Vollman, Brandwene, & Murray, 2012; Clark et al., 2013; Witcher et al., 2015; Zomorodi, Topley, & McAnaw, 2012), similar improvements in ICU quality metrics were not observed in this study, despite an increase in physical therapy provided and sustainment of a culture of progressive mobility in the NTICU setting. The Clark et al. (2013) retrospective progressive mobility study is most similar to this setting, save that the NTICU does not provide burn care. Clark and colleagues (2013) demonstrated a decrease in pneumonia and DVT but interestingly failed to demonstrate a significant difference in ventilator days, HLOS, or ICU-LOS after implementation of an early mobility program, suggesting that perhaps there are enough differences between medical/neurologic and trauma ICU patients that may limit the benefit of a progressive mobility program. The outcome of this study would suggest

the same. Both Clark et al. (2013) and our project demonstrated a statistically significant difference in VTE rates after implementation of a Progressive Mobility protocol. This warrants a fuller discussion.

Venous thromboembolism is a commonly encountered diagnosis in the hospitalized patient and associated with significant health care and economic burden (Lin, Lingohr-Smith, & Kwong, 2014). A study published in Mayo Clinic Proceedings 2001 (Heit et al., 2001) quantified this entity as being diagnosed in 960.5 per 10,000 person-years of hospitalized patients, and the incidence was most notable in those older than 60 years. This was 100 times higher than among community residents at 7.1 per 10,000 person-years (Heit et al., 2001). In the subset of patients suffering major trauma, these numbers would be expected to be elevated to a greater degree. With an ever-aging trauma population, developing a successful strategy for prevention of VTE is imperative. In a prospective trial, 349 victims of major trauma were adequately screened for DVT by venography after withholding medical prophylaxis during their hospitalization. Fifty-eight percent of these patients had DVT of their lower extremities with much higher incidences in some of the injury subsets, most notably spinal cord injury and pelvic/lower extremity fractures (Geerts, Code, Jay, Chen, & Szalai, 1994). In addition, Reiff et al. (2009) found TBI to be independently associated with increased DVT risk independent of anticoagulation therapy; however, TBI frequency between the pre- and postcohorts in our project was not statistically significant. The multiply injured trauma patient is at a highly elevated risk for development of thrombosis.

For patients with an identified DVT, the traditional mode of treatment is anticoagulation and bed rest. Liu, Tao, Chen, Fan, and Li (2015) have challenged this paradigm in a recent meta-analysis. In 3,269 patients with known DVT, early ambulation was not associated with new PE, progression of DVT, or DVT-related deaths. Furthermore, early ambulation mitigated some of the acute pain experienced in the affected limb (Liu et al., 2015). When the risk for DVT is elevated in the hospitalized patient, in particular the traumatically injured patient and to the greatest degree, the critical multiple-injured trauma patient, providers must be aware of and have access to the necessary tools to decrease this risk to their patients to alleviate the added morbidity and potential mortality they portend. While a prophylactic regimen of intermittent compression devices and chemical DVT prophylaxis should be standard practice in all trauma ICUs, our data suggest an additional benefit in VTE reduction with a focused progressive mobility protocol for this patient population.

LIMITATIONS

The impact of progressive mobility on the quality outcomes of ICU trauma patient admitted to a single NTICU limits the power of this project. There was a trend toward decreased ventilator days and pneumonia incidence in ventilated patients, but these did not reach statistical significance. With a greater power, these may have reached significance. Variations in progressive mobility following discharge from the NTICU were not controlled for and may have impacted our outcomes. Because of the heterogeneous nature of trauma ICU patients, although demographic differences between the pre- and postintervention samples were not statistically significant, normal sample distribution within group pre- and postsamples were not found, limiting interpretation of our results. Changes to trauma service VTE prophylaxis guidelines did not occur between the pre- and postimplementation periods in our facility. However, secondary to the design, frequency of VTE chemoprophylaxis use, anticoagulant use prior to injury, and VTE risk stratification between pre- and postcohorts were not analyzed and is a limitation. As a quality improvement project, the findings are not generalizable but provide additional insight into the feasibility of a progressive mobility protocol for ICU trauma patients.

Maintaining momentum and compliance were difficult during the intervention period, particularly because of staffing changes. Consistent staffing may have led to better compliance, which may have led to a greater difference in VTE rates and other quality outcome measures. However, despite these staffing challenges, this project demonstrates an increase in PT time and reduced VTE rates with just 2 hr of daily dedicated PT time in our NTICU.

CONCLUSION

A progressive mobility protocol for the ICU trauma patient population is safe and can be implemented with the use of existing staff. Innovative progressive mobility initiatives may reduce patient deconditioning and VTE in the ICU trauma population. Variations in ICU patient populations and progressive mobility protocols may contribute to the inconsistent study findings reported in the literature; therefore, further studies are needed to explore the impact of ICU mobility programs on mortality and morbidity in trauma populations. Multidisciplinary commitment, daily protocol reinforcement, and active engagement of patients/families are the cornerstones to success in our NTICU progressive mobility program.

KEY POINTS

- Progressive mobility protocols significantly increase the mobilization of the at-risk intensive care trauma patient population.
- Successful development and implementation of progressive mobility protocols involve a multidisciplinary approach with input and buy-in from all key players in the intensive care setting.

- Implementation of progressive mobility protocols can be safely accomplished in the trauma intensive care population, keeping in mind certain unique risks specific to this subset of patients.
- Sustaining the implementation of progressive mobility programs can be difficult; however, the potential benefits to the patients likely far outweigh the potential costs.

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