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Alice Atcher RN BSN CCAN CRNI

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Nestlé Health Science
Restoring Speech to Tracheostomy Patients

Linda L. Morris, Ana M. Bedon, Erik McIntosh, and Andrea Whitmer

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As you gather with family and friends to share another holiday season, consider a gift that you could give those you love and care about: the gift of a life lived to its fullest duration instead of one cut short by health problems. This gift has some unique attributes: it can be life-extending, its benefits can be shared without limitations, and, despite its capacity for unlimited sharing, it is intrinsically tailored to the benefits that each individual most needs. The gift I am referring to is the ability to determine one’s “heart age” and to identify factors in one’s personal health history that are affecting the risk of incurring a major cardiovascular event. Because cardiovascular disease (CVD) remains the primary source of morbidity and mortality in the United States, anything we can do to mitigate its toll on those we care for in critical care as well as those we care about at home is worthwhile. Determining heart age affords a means of going beyond merely discussing risk factors for CVD to calculating the impact of one’s personal set of determinants on the risk of experiencing a potentially lethal cardiovascular outcome. In the interactive versions of these calculations, users can immediately see quantitative ramifications of modifying risk factors on the likelihood of that outcome.

The Concept of “Heart Age”

Heart age is defined as “the predicted age of a person’s vascular system based on their cardiovascular risk factor profile.” The concept was introduced in 2008 with publication of the Framingham Heart Study as an alternative to the 10-year risk score then used to describe cardiovascular health risk. The comparison of calculated heart age to one’s actual chronological age can characterize a person’s risk for incurring a CVD event. In this context, a CVD event includes development of any of the following disorders: coronary heart disease (angina, coronary insufficiency, myocardial infarction, coronary death), heart failure, cerebrovascular disease (transient ischemic attack, ischemic stroke, hemorrhagic stroke), or peripheral artery disease (intermittent claudication). The hope is that this metric will translate into more meaningful and motivating terms that transform high-risk into heart-healthy behaviors associated with longevity free of major negative CVD outcomes.

When heart age is compared to chronological age, one of 3 possible findings will be observed: (1) Heart age is equal to chronological age, representing a normal risk for CVD events for someone that age; (2) heart age is less than chronological age, reflecting a lower risk; or (3) heart age is greater than chronological age, signifying a higher risk for those events for someone that age.
additional term, excess heart age, has also been coined to describe the magnitude of the spread or difference between the heart age and chronological age.4

From these 3 possible associations between heart age and chronological age, we can formulate the health goal related to each:

- When heart age equates to chronological age, the goal is to continue the behaviors that have kept cardiovascular risk factors in check and prevented increased risk. Because advancing age will continue to raise risk, however, it would be best to seek means to offset that risk by improving upon factors such as exercise or diet.
- When heart age is less than chronological age, the goal is to continue to optimize the heart-healthy behaviors that reduce risk of CVD events.
- When heart age exceeds chronological age, the goal is to identify all contributing factors and follow a plan targeted to significantly diminish their influence in heightening CVD risk.

Components of Heart Age

In the Centers for Disease Control and Prevention (CDC) study reported in September 2015,1 the research team predicted heart age by employing the Framingham Risk Score (FRS) first described 7 years earlier in the Framingham Heart Study.2 The FRS incorporates the following self-reported risk factors:

- chronological age
- current smoking status
- use of antihypertensive medication
- diabetes mellitus status
- body mass index (BMI)

In addition to these self-reported variables, the CDC study included an estimate of systolic blood pressure via an algorithm described by the senior author.3

Other means of predicting heart age include measured laboratory values for total cholesterol and high-density lipoprotein cholesterol.5 In addition to these 6 variables, my local hospital’s heart age calculator7 solicits many others, including exercise, stress, family history, CVD history and procedures, and having a primary care physician. As you might expect, using different heart age calculators that employ different attributes or numbers of attributes can produce different results.

As the Table indicates, when I used the CDC’s calculator that includes BMI,8 it predicted a heart age considerably lower and a 10-year risk higher than the CDC calculator that uses lipids rather than BMI.6 The local hospital’s calculator8 estimated my heart age to be 3 times lower than the CDC’s BMI version with a 10-year risk of CVD comparable to the CDC’s lipids version. The lesson here is that the absolute numbers generated for heart age and risk of CVD may be closely tied to the calculator and to the individual’s specific risk factor values.

Clinical Relevance of Heart Age

This recently published CDC study1 has received considerable attention since its release because it represents the first national study to determine heart age for adults aged 30 to 74 years in the United States. In addition, the sample of 236 101 men and 342 424 women, each gender with a mean chronological age of 48 years, has afforded a wealth of data related to heart age and identified a number of statistically significant disparities in heart age related to gender, race, geographic location, and other demographic attributes. A brief synopsis of those findings follows.

General Findings

- Overall, US adults have heart ages 7 years older than their chronological age.

<table>
<thead>
<tr>
<th>Heart age calculator</th>
<th>Predicted heart/vascular age</th>
<th>10 year risk of CVD</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC: Heart Age Predictor Using BMI8</td>
<td>6 years less than chronological</td>
<td>7.3% (9.2% normal for my age)</td>
</tr>
<tr>
<td>CDC: Heart Age Predictor Using Lipidsa6</td>
<td>10 years less than chronological</td>
<td>5.7% (8.2% normal for my age)</td>
</tr>
<tr>
<td>Local hospital’s Heart Health Profiler7</td>
<td>19 years less than chronological</td>
<td>5.9% (low for my age)</td>
</tr>
<tr>
<td>Average</td>
<td>11.66 years less than chronological</td>
<td>6.3%</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index; CDC, Centers for Disease Control and Prevention.

---

8 Replaces BMI with high-density lipoprotein and total cholesterol values.
A substantial majority (nearly 70%) of Americans have a predicted heart age older than their current age.

Heart Age and Gender
- One in 2 men and 2 in 5 women have heart ages 5 or more years older than their actual age.
- For men, the mean heart age was 7.8 years older and for women, 5.4 years older.

Heart Age and Race/Ethnic Group
- Although heart age exceeds chronological age for all racial/ethnic groups, it is highest among black men and women (mean, 11 years older for both).
- Black men had heart ages 3 to 4 years older than Hispanic and white men; black women had heart ages 5 to 7 years older than white and Hispanic women.

Heart Age and Excess Heart Age
- More than 69 million (43.7%) US adults aged 30 to 74 years had excess heart age of greater than or equal to 5 years.
- Prevalence of excess heart age greater than or equal to 5 years was 48.8% among men and 38.5% among women. For both genders, prevalence was higher among blacks, increased with age, and decreased with higher education and income.

Heart Age and Geographic Location
- Average heart age differed geographically with higher heart ages in southern US states.
- Excess heart age was lowest in Utah for both men (5.8 years) and women (2.8 years) and highest in Mississippi for both men (10.1 years) and women (9.1 years).
- Five states with the highest percentage of adults with heart ages 5 or more years older than their actual age were Mississippi, West Virginia, Louisiana, Kentucky, and Alabama.
- Five states with the lowest percentage of adults with heart ages 5 or more years older than their actual age were Utah, Colorado, California, Massachusetts, and Hawaii.

Heart Age and Education and Income Level
- For both genders, excess heart age increased with age and decreased with higher education and household income levels.

Heart Age and Systolic Blood Pressure
A systolic blood pressure (SBP) less than 120 mm Hg has a dramatic beneficial effect on excess heart age for both genders:
- For men, an SBP less than 120 mm Hg was associated with a mean excess heart age of 1.8 years; an SBP of 120 to 139 mm Hg was associated with a mean excess heart age of 10.5 years; an SBP greater than or equal to 140 mm Hg was associated with a mean excess heart age of 20.6 years.
- For women, an SBP less than 120 mm Hg was associated with a mean excess heart age of -1.2 years; an SBP of 120 to 139 mm Hg was associated with a mean excess heart age of 12.2 years; an SBP greater than or equal to 140 mm Hg was associated with a mean excess heart age of 18.8 years.

Implications and Applications for Critical Care Nurses
The CDC recommends that health care providers help disseminate the value of this new parameter by determining, documenting, and counseling all patients aged 30 to 74 about heart age and demonstrating the effects of risk factors on premature aging of their heart; assisting patients to select 1 or 2 risk factors to improve first; identifying community resources such as smoking cessation classes or diabetes support groups to support necessary lifestyle changes; and ensuring they take medications as prescribed.

Conclusion
As the CDC study data confirm, there has been limited success in convincing Americans to modify their lifestyles to diminish their risk of major CVD events. The concept of heart age was designed to simplify and facilitate understanding of CVD risk factors in a manner that would motivate the public to make those changes. Although it may not be fruitful to introduce your family and friends to the benefits of optimizing their heart age as you share your bountiful holiday meals together, when the conversation moves on to the approaching new year and resolutions that need to be made, that may be an opportunity to share the powerful possibilities that learning how to calculate and apply the notion of heart age can provide. Take the time to explain what heart age is, how to determine it, and the striking effect of reducing one or more risk factors on premature aging.
of the human heart. I don’t know what your holiday gift list will include, but I can pretty much guarantee that nothing on that list conveys the promise of helping to ensure that all those who you most want to share next year’s holidays with will still be able to do so. Give them this means to improve their health and extend their life so they can be there for you for many years to come.

JoAnn Grif Alspach, RN, MSN, EdD
Editor

References
Corrections

In the June article by Haut and Madden, “Hiring Appropriate Providers for Different Populations: Acute Care Nurse Practitioners” (Crit Care Nurse. 2015;35[3]:e1-e8), there were errors in Table 1 on page e3. The corrected Table 1 is shown below.

<table>
<thead>
<tr>
<th>Patient population</th>
<th>Education</th>
<th>Certification/credential</th>
<th>Previous nursing experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonates and critically ill neonates (birth to 28 days of life)</td>
<td>Neonatal nurse practitioner (NP) program</td>
<td>National Certification Corporation/NNP-BC</td>
<td>Neonatal nursing</td>
</tr>
<tr>
<td>Healthy newborns (first few days of life)</td>
<td>Neonatal NP program Primary care pediatric NP program</td>
<td>National Certification Corporation/NNP-BC Pediatric Nursing Certification Board, Primary Care/CPNP-PC American Nurses Credentialing Corporation, Primary Care/PPNP-BC</td>
<td>Maternal child nursing Newborn nursing</td>
</tr>
<tr>
<td>Critically ill children (newborn to age 21; older patients with pediatric diagnoses can be included)</td>
<td>Acute care pediatric NP program</td>
<td>Pediatric Nursing Certification Board/CPNP-AC</td>
<td>Pediatric intensive care unit Medical, surgical, trauma, or cardiac-specific intensive care units if designated as such</td>
</tr>
<tr>
<td>Children admitted to general pediatric inpatient unit (newborn to age 21)</td>
<td>Acute care pediatric NP program</td>
<td>Pediatric Nursing Certification Board/CPNP-AC</td>
<td>General pediatric inpatient unit</td>
</tr>
<tr>
<td>Acutely/chronically ill adults/elderly admitted to inpatient general medical or surgical units</td>
<td>Adult acute care NP program through 2015</td>
<td>American Association of Critical-Care Nurses Certification Corporation/ACNPC American Nurses Credentialing Corporation/ACNP-BC</td>
<td>General medical or surgical nursing Intensive care nursing</td>
</tr>
<tr>
<td>Acutely ill adults/elderly admitted to inpatient general medical or surgical units Critically ill adults/elderly in a variety of units: medical, surgical, cardiovascular, trauma, or emergency department</td>
<td>Adult-gerontology acute care NP program</td>
<td>American Association of Critical-Care Nurses Certification Corporation/ACNPC-AG American Nurses Credentialing Corporation/AGACNP-BC</td>
<td>General medical or surgical nursing Intensive care nursing</td>
</tr>
</tbody>
</table>

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Table 1 Matching education, certification, patient population, and “ideal” nursing experience

- Author interpretation as helpful, based on Consensus Model, parallel nursing experience is not required for nurse practitioner practice.
- National Consensus Model.
Restoring Speech to Tracheostomy Patients

Linda L. Morris, PhD, APN, CCNS
Ana M. Bedon, MSN, APN, AGCNS-BC, CWON
Erik McIntosh, RN, MSN, ACNP-BC
Andrea Whitmer, RN, MSN, ACNP-BC

Tracheostomies may be established as part of an acute or chronic illness, and intensive care nurses can take an active role in helping restore speech in patients with tracheostomies, with focused nursing assessments and interventions. Several different methods are used to restore speech, whether a patient is spontaneously breathing, ventilator dependent, or using intermittent mechanical ventilation. Restoring vocal communication allows patients to fully express themselves and their needs, enhancing patient satisfaction and quality of life. (Critical Care Nurse. 2015;35[6]:13-28)

Tracheostomy is one of the most common procedures performed in critically ill patients and is becoming more commonplace in the intensive care unit (ICU). Indications for tracheostomy include prolonged intubation with unsuccessful weaning, management of bronchial hygiene, obstruction of the upper airway, and airway protection. Patients with head and neck trauma and/or surgery or those who have airways that cannot be managed via endotracheal intubation may also require a tracheostomy. When the tracheostomy tube is initially placed, the cuff at the distal end of the tube is inflated to protect the airway and provide effective ventilation. Because inflation of the cuff does not permit the passage of air up through the larynx, the patient cannot phonate (ie, produce speech sounds). The inability to communicate via speech places a great amount of stress on an already critically ill patient. Patients with tracheostomies report feelings of frustration, fear, anxiety, and powerlessness related to the loss of voice. Donnelly and Wiechula have described how patients experience the loss of voice as a form of torture, more so than the physical discomfort the patients feel from the tracheostomy or other procedures performed in the ICU.

This article has been designated for CE credit. A closed-book, multiple-choice examination follows this article, which tests your knowledge of the following objectives:

1. Identify the potential effects of the inability to communicate for a patient with a tracheostomy
2. Examine methods to restore phonation for patients with a tracheostomy
3. Discuss the role of critical care nurses in restoring phonation

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For patients in the ICU, the inability to express themselves and to actively participate in their plan of care can lead to depression, disengagement in their recovery, and nonadherence with their therapeutic plan. A tracheostomy tube, however, does not prevent phonation. Phonation can enhance the ability of patients with a tracheostomy to express their needs and wishes fully and effectively, allowing the patients to participate in their plan of care and converse with their loved ones. Critical care nurses are in an ideal position to coach and guide tracheostomy patients to phonate, but nurses may not be aware of all the options available. In this article, we provide information that will enable nurses to take an active role in restoring phonation in these patients. We review the different approaches to restore phonation in patients with a tracheostomy, including patients who are spontaneously breathing, are being treated with intermittent mechanical ventilation, or are ventilator dependent. An essential component of successful communication is to determine what option or options are most appropriate for a particular patient.

Methods to Restore Phonation for Patients With a Tracheostomy

Sound is produced as air passes through the vocal cords, causing the cords to vibrate. Medical complications of the pharyngeal, laryngeal, and tracheal structures, including glottic or subglottic edema, ulceration of the vocal fold, vocal cord paralysis, tracheal stenosis, and tracheomalacia, can affect the ability to create sound. The tracheostomy tube itself can markedly obstruct the trachea, causing poor airflow, increased airway resistance, and increased work of breathing and can lead to an inability to produce speech. Therefore, the ability to create sound with a tracheostomy tube depends on having an adequate supply of air reach the vocal cords with a minimum of resistance. The diameter, length, and type of tracheostomy tube play important roles in avoiding complications and leading to greater success in phonation. Changing one or all of these components of the tracheostomy tube can lead to less airway resistance and prevent respiratory distress and unsuccessful phonation trials. Methods to restore phonation for a patient with a tracheostomy will also vary, depending on whether or not the patient is ventilator dependent, and, if so, whether the patient is fully or partially dependent on ventilator support. Methods of restoring phonation for patients who are spontaneously breathing, are being treated with intermittent mechanical ventilation, or are fully ventilator dependent are summarized in Table 1.

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### Table 1  Methods of phonation

<table>
<thead>
<tr>
<th>Technique</th>
<th>Pros</th>
<th>Cons</th>
<th>Special considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuff deflation with digital occlusion</td>
<td>Used for assessment of the patient's ability to tolerate capping or use of a speaking valve</td>
<td>Bulkiness of the deflated cuff may cause marked airway obstruction and resistance</td>
<td>Before the cuff is deflated, subglottic suctioning should be performed to prevent aspiration of secretions from above the cuff. Cuff must be completely deflated before digital occlusion. Thorough suctioning before and after cuff deflation can help prevent aspiration, coughing, respiratory distress, which may lead to an unsuccessful digital occlusion trial. Ideally, heated aerosol via tracheostomy collar should be used if supplemental oxygen is needed.</td>
</tr>
<tr>
<td>Capping trials</td>
<td>Capping the tracheostomy tube allows air to be inhaled and exhaled through the natural airway</td>
<td>Possible airway obstruction, with mucus buildup around or within the tube; therefore, frequent monitoring is essential</td>
<td>Capping should be attempted only with a cuffless tube or tight-to-shaft (TTS) tracheostomy tube of appropriate size; external tube diameter should be minimized as appropriate. Nasal cannula or face mask should be used if supplemental oxygen is needed while cap is in place. Thorough suctioning before and after capping trials can help prevent aspiration, coughing, respiratory distress, which may lead to an unsuccessful capping trial. Anxiety may be a factor in unsuccessful capping trials: the unfamiliar feeling of air moving through the upper part of the airway may lead to tachypnea.</td>
</tr>
<tr>
<td>Speaking valve</td>
<td>Can be used with fully deflated cuff or cuffless tube</td>
<td>See Table 2 for full list of contraindications</td>
<td>Ideally, heated aerosol via tracheostomy collar should be used if supplemental oxygen is needed. Cuff must be completely deflated when speaking valve is used. Thorough suctioning before cuff deflation can help prevent aspiration, coughing, and respiratory distress, which may lead to an unsuccessful trial of the speaking valve.</td>
</tr>
<tr>
<td>Tracheostomy button</td>
<td>Fits within the stoma and does not require tracheostomy ties</td>
<td>If patients need positive pressure ventilation and/or need suctioning, button should be replaced with a standard tracheostomy tube</td>
<td>Not usually used in critical care but may be an option for patients after discharge.</td>
</tr>
<tr>
<td>Cuffless fenestrated tracheostomy tube</td>
<td>A fenestrated tracheostomy tube allows air to travel through the fenestration, which decreases airway resistance, improves airflow in the trachea, and facilitates speech</td>
<td>If tube does not fit properly, granulation tissue may grow within the fenestration, making removal a surgical problem</td>
<td>Requires an evaluation by a specialist to fit the tube to ensure that the fenestration lies centrally within the trachea; otherwise, granulation tissue may grow into the fenestration. Secretions can also collect in the fenestration, so the patient should have optimal humidification with heated aerosol.</td>
</tr>
</tbody>
</table>

Continued
Table 1

<table>
<thead>
<tr>
<th>Technique</th>
<th>Pros</th>
<th>Cons</th>
<th>Special considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneously breathing patient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speak EZ tracheal cannula</td>
<td>Low profile, does not require tracheostomy ties</td>
<td>If patients need positive pressure ventilation and/or need suctioning, cannula should be replaced with a standard tracheostomy tube</td>
<td>Most often used for patients who initially received a tracheostomy for vocal cord paralysis or sleep apnea. Not commonly used in critical care, but may be an option for patients after discharge.</td>
</tr>
<tr>
<td></td>
<td>Fits only within the stoma, thereby providing no tracheal irritation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermittently ventilator dependent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermittent phonation</td>
<td>Because the cuff essentially disappears on deflation, the TTS tube can be safely capped When capped, the natural function of the glottis is restored, and this return to natural function often allows patients to remain free from the ventilator Bivona TTS cuff can be inflated to deliver positive pressure ventilation and then deflated for capping</td>
<td>These TTS tubes are single-cannula tubes and may become clogged with secretions</td>
<td>Cuff must be completely deflated when providing intermittent phonation Only sterile water should be used to inflate the Bivona TTS cuff; saline should NOT be used because it damages the cuff; air should not be used because it diffuses through the cuff, causing cuff deflation over time Thorough suctioning before and after cuff deflation can help prevent aspiration, coughing, and respiratory distress, which may lead to an unsuccessful trial Supplemental oxygen should be provided if needed, via nasal cannula when the tube is capped When cuff is inflated, minimal leak technique should be used to prevent complications associated with the high-pressure TTS cuffs</td>
</tr>
<tr>
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<td>Ventilator dependent</td>
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<td>Leak speech</td>
<td>Allows speech even though patient cannot be liberated from mechanical ventilation</td>
<td>Patient must be coached to speak on inspiration and may require practice in timing vocalization</td>
<td>Leak speech can be used in a patient who can tolerate cuff deflation Ventilator settings can be adjusted to compensate for tidal volume loss and to improve speech quality Thorough suctioning before and after cuff deflation can help prevent aspiration, coughing, respiratory distress, which may lead to an unsuccessful leak speech trial</td>
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<td>Talking tracheostomy tubes</td>
<td>Used for patients who require continuous cuff inflation The air used for speech is completely separate from the air used for breathing Does not require adjustment of ventilator settings; tidal volume is constant</td>
<td>Speech depends on having patient or caregiver occlude the port Accumulation of secretions above the cuff can clog the air supply line, resulting in no airflow for speech Discomfort and drying of mucous membranes can occur with high airflow</td>
<td>Tube has a port attached to an air source located above the cuff Secretions may pool above cuff; suctioning of secretions from air port should be done as needed to maintain patent airway and facilitate good speech quality Voice is adjusted by increasing airflow, often 5-15 L/min, to achieve optimal vocalization; humidified airflow should be provided to mitigate against discomfort with higher airflow</td>
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Continued
Phonation in Patients Who Are Breathing Spontaneously

For patients with tracheostomies who are breathing spontaneously and do not require mechanical ventilation, 3 primary methods of phonation can be used: cuff deflation with digital occlusion of the tracheostomy tube; capping; and use of a speaking valve. Before any method of phonation is started, the patient’s physical and mental condition should be assessed to determine which method would be the most appropriate. The patient must be attempting to communicate verbally and must have intact cognitive function. The ability to follow instructions and communicate any difficulty with breathing or phonation is important to success. With any of the following methods, nurses should closely monitor patients for signs and symptoms of respiratory distress, including breathing discomfort, increased respiratory rate, use of accessory muscles, inadequate chest inflation or deflation, and difficulty with air exchange. Assessing the work of breathing is a better method to determine tolerance of cuff deflation, capping, or use of a speaking valve than is measuring oxygen saturation.

Cuff Deflation. Generally, a patient must be able to tolerate cuff deflation or have a cuffless tube in order to phonate via any of the 3 primary methods. Deflation of the cuff causes airflow to be redirected around the tracheostomy tube and up through the upper part of the airway and may require a period of adjustment for the patient. Pooled secretions above the cuff and movement of the tube during cuff deflation can cause airway irritation, coughing, obstruction of secretions, increased work of breathing, and shortness of breath, which may lead to cardiorespiratory deterioration. Therefore, verifying that emergency equipment is available, including suction equipment and a manual resuscitation bag, is important.

Cuff deflation can be an anxiety-filled experience for a patient if it causes respiratory discomfort and distress. Therefore, it is essential to provide adequate assessments as well as proper coaching and preparation of the patient before, during, and after cuff deflation. The following steps can help facilitate a successful cuff deflation trial: First, explain to the patient the steps that go into cuff deflation and the feelings that might occur. Second, ensure the correct position of the patient and the tracheostomy...
Proper clearance of secretions will prevent triggers of airway irritation and cough, which can initiate bronchospasm.

tube, with the head of the bed elevated to the best level for breathing comfort and neutral position of the tracheostomy tube to prevent airway irritation, coughing, and obstruction. Third, explain to the patient the need to suction the back of the throat to clear secretions that may have pooled above the cuff. Of note, deep subglottic suctioning will not always ensure complete removal of secretions once the cuff is deflated, and suctioning of the mouth and the posterior part of the pharynx may still be required. If the patient is able, have him or her perform this step. Fourth, before the cuff is deflated, have the patient take a deep breath in to maximize air in the lungs to promote a forceful cough if needed to clear any secretions. Just after the patient takes a deep breath in, and as he or she begins to exhale, completely deflate the cuff. After the cuff is deflated, immediately suction as needed through the tracheostomy tube and/or mouth to clear the secretions that might have remained above the cuff. While the cuff is deflated, closely observe the patient for any signs or symptoms of respiratory distress. Increase the fraction of inspired oxygen as needed; cuff deflation causes admixture of room air in patients receiving oxygen therapy. Secretions and coughing also may lower oxygenation. Continually reassure the patient through this process to decrease anxiety. Proper clearance of secretions is crucial to successful cuff deflation and will prevent triggers of airway irritation and cough, which can initiate bronchospasm. A manual resuscitation bag and suction devices should be at hand to stabilize the patient’s condition if needed.

If cuff deflation is not initially tolerated, despite meticulous attention to proper procedure, another trial with slow deflation of the cuff, perhaps up to several minutes, is recommended. If respiratory distress, dyspnea, or shortness of breath occurs with cuff deflation, the cuff should be reinflated, and cuff deflation trials can be repeated at another time. Working side by side with speech language pathologists and respiratory therapists can ensure patients’ comfort, tolerability of cuff deflation trials, and quality outcomes. After successful cuff deflation, digital occlusion can be attempted for vocalization.

Digital Occlusion. Digital occlusion of the tracheostomy tube is used for patients who have a cuffless tube or a cuffed tube with a fully deflated cuff (Figure 1). When the cuff is inflated, the only exit for air from the lungs is out the tracheostomy tube. If the cuff is inflated and the tube is occluded, air cannot move in or out of the lungs. Therefore, digital occlusion should be performed only with the cuff completely deflated. A potential complication with a cuffed tube is the bulkiness of the deflated cuff, which may cause an obstruction while the patient is attempting to breathe around the tube. In this case, a smaller diameter tracheostomy tube or a cuffless tube, if appropriate, can be used to facilitate speech. After cuff deflation, a gloved finger of the caregiver or patient is placed over the opening of the tube. This procedure will redirect air to the upper part of the airway and allow the air to pass through the vocal cords. Many patients lack the dexterity that this method requires, but digital occlusion may be an option for patients who may not be completely alert and who may not tolerate capping. Before digital occlusion, a patient’s ability to inhale and exhale around the deflated cuff must be assessed. If the patient has any difficulty, teaching him or her intermittent digital occlusion during the exhalation phase can facilitate speech. If a patient is unable to speak or exhale or complains of shortness of breath or trouble breathing, digital occlusion should be stopped.

Capping. Occluding the opening of the tracheostomy tube with a cap, plug, or cork is another means of producing speech. The goal of capping is to prevent

Figure 1 Cuffed tube with deflated cuff versus cuffless tube. Note bulk of deflated cuff on left, compared with cuffless tube on right.
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air from entering and exiting through the tracheostomy itself; all the airflow is redirected around the tube and up to the vocal cords. When a tracheostomy tube is capped, the patient is not breathing through the tube at all, but completely around the tube (Figure 2). This method requires the ability to tolerate cuff deflation and necessitates maximizing airflow around the tube. With 2 exceptions, cuffed tracheostomy tubes with deflated cuffs should never be capped.8,13 The bulk of the deflated cuff on most tracheostomy tubes creates a great deal of resistance around the tube, potentially interfering with optimal ventilation. The only cuffed tracheostomy tubes that can be safely capped when deflated are a properly fit fenestrated tube or a tight-to-shaft (TTS) tracheostomy tube (Figure 3). With the TTS tube, the deflated cuff flattens completely against the shaft of the tube and mimics a cuffless tracheostomy tube.8,13 The safety implications of both types of tubes are discussed later in this article.

Ensuring that the tube is an appropriate size, one that easily allows airflow around it and through the upper part of the airway is important,8 although ease of airflow may not be obvious initially. Tubes that have a large outer diameter should be exchanged for ones with a smaller diameter to allow easy airflow around the tube. The increased resistance caused by a large tracheostomy tube in the airway or one with a bulky deflated cuff can cause anxiety and respiratory distress, which can lead to respiratory compromise.9 One serious complication of capping is obstruction, with mucus buildup around or within the tube; therefore, frequent monitoring is essential, especially during the initial capping trials.8 The strength of a patient’s cough and ability to clear the airway of secretions should be assessed before capping is used. A patient with a strong cough might not be able to fully clear the airway of secretions, especially if the secretions are thick and tenacious, because they may be “hanging up” around the tube. Assessment of respiratory rate, oxygen saturation, color, and breathing pattern during a trial are necessary. If any signs of distress or desaturation are noted, the cap should be immediately removed and the patient returned to the humidified tracheostomy collar or mask.8,13 These potential complications reinforce the need to adequately assess a patient’s cognitive status in order for the nurse to detect respiratory distress quickly.

**Speaking Valve.** Use of a speaking valve (Figure 4) is different than capping because the device is a 1-way valve that allows air to enter into the tracheostomy tube but prevents air from being exhaled through it.7,8 A speaking valve can only be used by patients who are able to tolerate total cuff deflation, or ideally have a cuffless tube. While using the valve, the patient inspires through the tube but exhales around it (Figure 5).8 Most speaking valves are flap valves that are placed over the opening to the tracheostomy tube. The flap opens during inhalation
and closes during exhalation. Closure of the flap on exhalation allows the exhaled air to be directed through the vocal cords, the upper part of the airway, and out the mouth and nose. Because of this path, any supplemental oxygen that is required should be delivered via a humidified tracheostomy collar when a speaking valve is used.8 If the tube or cuff diameter creates a marked obstruction in the trachea, the patient will be unable to exhale freely, and the inability to exhale completely can create adverse effects such as air trapping, lung hyperinflation, and respiratory distress. Speaking valves should never be placed on a tube with an inflated cuff because inflation of the cuff prevents exhalation, potentially causing barotrauma and other possibly fatal complications.1,9 A wide range of speaking valves is available, each with its own level of resistance and potential to increase work of breathing.15

Table 2 lists several contraindications8,9,16-18 to use of a speaking valve. Patients with poor pulmonary reserve and severe lung disease may not be able to completely inhale and exhale, and hypercarbia can develop; use of a valve may not be appropriate for these patients. Also, patients who have an unstable hemodynamic status, received a total laryngectomy, have an inflated cuff, or have a foam-cuffed tube are not candidates for a speaking valve.18 Patients with copious thick secretions or with obstruction of the upper part of the airway should not use a speaking valve.11 Speech language pathologists or respiratory therapists can be resources for determining when a patient may be ready for trials with a speaking valve.11 Monitoring Patients Who Have a Cap or Speaking Valve. During the initiation of use of a cap
or speaking valve, patients should be under close observation to detect signs or symptoms of respiratory distress. If respiratory distress or desaturation occurs, a nurse should immediately remove the cap or valve, suction secretions as needed, and return the patient to use of a high-humidity tracheostomy collar. The patient may need to begin with short sessions of capping or using a speaking valve (as short as 5 or 10 minutes), then gradually increase the duration, and progress toward continuous use. However, overnight use of the Passy-Muir valve is not recommended. Members of the health care team should be aware of factors that can lead to a patient’s inability to tolerate capping trials, such as inattention to optimum positioning, accumulation of secretions, failure of the valve to open freely on inspiration, and/or patient anxiety related to capping trials.

During use of a valve or a cap, promotion of effective coughing and mobility of secretions is important. Some patients do not have an effective cough because of neuromuscular disease or paralysis. With these patients, optimal positioning such as elevating the head of bed are important to maximize breathing comfort and respiratory muscle function. Nurses must be cognizant of any clinical worsening in the patient’s overall status, including during any capping periods. Any new indication of respiratory distress should lead to immediate discontinuation of a capping trial. Proper humidification with a heated aerosol may be necessary to keep secretions thinner and easier to cough out. Patients can be evaluated for use of a smaller tube or decannulation when they can tolerate continuous capping for at least 24 to 48 hours and achieve an acceptable cough strength so that they are able to cough out all their secretions.

**Alternative Methods of Phonation.** Two other methods of phonation in spontaneously breathing patients may be used by long-term tracheostomy patients in subacute care, home, or rehabilitation settings: the tracheostomy button and the Speak EZ tracheal cannula. Both of these devices eliminate the bulk of a tube within the airway and maintain the patency of the stoma. Neither of these devices requires ties to secure it; therefore, they both require custom fitting to determine the exact length of the stoma.

A tracheostomy button (Figure 6) is a device that maintains the patency of the stoma in patients who may require repeated tracheostomies or may need rehabilitation to improve overall strength and meet criteria for decannulation. The tracheostomy button is a stent that maintains patency of the stoma for a prescribed time, after which the button can be removed, allowing closure of the stoma. If frequent access to the airway is required (eg, for suctioning), the button should be replaced with a tracheostomy tube. The tracheostomy button consists of 3 parts: the tracheal cannula, the closure plug, and spacer rings (Figure 7) that are added to fit the length and width of the stoma exactly. When the closure plug is placed into the cannula, the petals at the distal end splay out to maintain secure position of the cannula within the stoma. Removing the tracheostomy button requires removing the closure plug first, releasing the tension at the distal end of the petals. Then the tracheal cannula can be easily removed.

The Speak EZ tracheal cannula (Figure 8) is another stoma maintenance device. This tracheal cannula has the added feature of a built-in speaking valve on the proximal end. The cannula is made of soft silicone and can be used for patients who have vocal cord paralysis or sleep apnea or to maintain the stoma after removal of a tracheostomy tube or T-tube (eg, the Montgomery T-tube).

Both the tracheostomy button and the Speak EZ tracheal cannula may be options for spontaneously breathing patients who wish to speak but cannot tolerate capping because of obstruction or resistance to airflow. However,
if a patient requires positive pressure ventilation or frequent suctioning, both the tracheostomy button and the tracheal cannula should be removed and replaced with a standard tracheostomy tube.

**Phonation in Patients Who Require Intermittent Mechanical Ventilation**

When a patient requires intermittent mechanical ventilation, an optimal time to begin phonation attempts is when the patient is free from mechanical ventilation. One way to accomplish this freedom is to completely deflate the cuff and use finger occlusion or a speaking valve for phonation. Most often, however, a tube change to a TTS tube is recommended to allow better airflow around the tube. As discussed in a previous article, the cuff of the TTS tube inflates to seal the airway and allow the patient to successfully return to mechanical ventilation, but when deflated, the cuff essentially disappears. With the cuff deflated, the TTS tracheostomy tube can also be safely capped, allowing air to pass through the vocal cords, producing speech. An added benefit is that when the tube is capped, the natural function of the glottis is restored, and this return to natural function may allow patients to remain free from mechanical ventilation.

When a patient is returned to mechanical ventilation, the cuff of the TTS tracheostomy tube should be inflated with sterile water, not physiological saline or air. Sterile water will distribute pressure evenly and prevent loss of cuff volume that occurs when the cuff is inflated with air, because air diffuses out of the cuff. Also, use of minimal leak technique is important when the cuff of the TTS tube is inflated because the high-pressure cuff will create elevated direct measurements of cuff pressure. Of note, the TTS tracheostomy tube is a single-cannula tube. If a patient has large amounts of thick secretions, he or she may be at risk for obstruction. Therefore, frequent pulmonary hygiene, with suctioning, methods to mobilize secretions, proper humidification, and coughing exercises, are extremely important. These methods include use of a heated aerosol, positioning the patient sitting up or with the head of the bed elevated, optimal fluids to keep secretions thin, and suctioning as needed. If difficulty inserting a suction catheter or mucus plugging occur with an TTS tube, changing to a tube with an inner cannula may be advisable.

**Phonation in Patients Who Are Ventilator Dependent**

Restoring speech in patients who are ventilator dependent can be challenging. Approaches vary according to whether or not a patient can tolerate cuff deflation. Ventilator-dependent patients who can tolerate cuff deflation can use leak speech for phonation; those who cannot protect their airway will require approaches that maintain cuff inflation. The available devices include talking tracheostomy tubes, cuffed fenestrated tracheostomy tubes, and the Blom tracheostomy tube system. With all of these methods, manipulation of ventilator parameters can facilitate speech in a patient who is ventilator dependent.
**Leak Speech.** Leak speech can be an effective aid in communication for patients who are ventilator dependent; however, it cannot be used in patients who cannot tolerate cuff deflation. 20 Leak speech is appropriate only for patients who can tolerate cuff deflation or have a cuffless tube. To provide leak speech, the cuff is deflated and the ventilator settings are adjusted to accommodate the air leak that results. Tidal volume delivery can be increased to compensate for the loss of volume during inspiration through the upper part of the airway. 20 Humans naturally speak on exhalation, but leak speech is the opposite of normal speech: it occurs on inhalation. The leak during the inspiratory phase allows for phonation, so the patient must be coached to speak on inspiration, as the breath is delivered. 19 Leak speech generally results in short phrases followed by long pauses, so increasing the inspiratory time on the ventilator can allow for more syllables per minute. 20, 21

Some patients have reported anxiety or discomfort with the use of leak speech because of an unfamiliar feeling of airflow through the upper part of the airway. These patients can be taught to push down, hold their breath, or tighten their throat to increase or decrease the volume delivered to the lungs. 22

A respiratory therapist can adjust the positive end-expiratory pressure (PEEP) to improve the quality of leak speech and allow phonation during the expiratory phase. 28, 23 The exhaled air exits through the ventilator circuit instead of the upper part of the airway if the PEEP setting is zero. 12 The addition of PEEP can direct exhaled air to pass through the upper part of the airway so that the patient can use 60% to 80% of the breathing cycle for phonation. 12 PEEP can also be added to improve voice quality and comfort. 28, 23 At the end of a leak speech trial, and before cuff reinflation, additional PEEP should be turned off to prevent lung hyperinflation and related adverse effects. Obtaining optimal voice quality is usually a matter of trial and error, so adjustments based on appropriate evaluations by a health care provider can limit or obviate interventions that can cause a patient anxiety or respiratory distress and affect future trials. Patients frequently become frustrated with this method of speech, so practice and patience are essential. 29

When the cuff is deflated, supplementing leak speech with the addition of a speaking valve can be beneficial in allowing exhaled air to pass through the upper part of the airway instead of through the ventilator circuit. 12

![Passy-Muir speaking valve](image)

**Figure 9** Photo of Officer James Mullen who uses leak speech with a ventilator. (He sustained a gunshot wound to the spinal cord in 1996, resulting in complete paralysis at the level of C1-C2.) Passy-Muir speaking valve is attached within the ventilator circuit and the cuff is deflated. Speech occurs on inspiration as the breath is delivered.

Patients who use a speaking valve during mechanical ventilation, like their spontaneously breathing counterparts, should be closely monitored. If exhalation is difficult with this method, the patient will not be able to phonate and may not be a good candidate for a speaking valve. 9 The valve should be removed immediately if the patient experiences any breathing discomfort. The patient should be assessed for evidence of air trapping, an increased respiratory rate, use of accessory muscles, and other indications of increased work of breathing. 9 The speaking valve should be removed for suctioning so that secretions do not occlude the airway during exhalation. 9

**Talking Tracheostomy Tubes.** The most challenging patients for restoration of speech are those who are ventilator dependent and who cannot tolerate cuff deflation. In these patients, one method to consider for speech restoration is the talking tracheostomy tube. A talking tracheostomy tube has an extra port that
distributes airflow above the inflated cuff (Figure 10). When this port is attached to an airflow source, the air flows through the tubing, and with occlusion of the port, air is directed toward the vocal cords, thereby producing phonation. Voice quality is adjusted by increasing airflow, usually from 5 to 15 L/min for optimal voice quality; variability depends on the individual patient's needs. Significant increases in voice quality are detectable as airflow increases from 5 L/min to 15 L/min; but even with this system, voice quality can be a whisper, at best.\textsuperscript{12,24} The advantages of this method are that the air used for speech is completely separate from the air used for breathing and that it does not require manipulation of the ventilator settings.\textsuperscript{9} Disadvantages of this method include the need for the patient or a caregiver to occlude the port for speech; accumulation of secretions above the cuff, which can clog the air supply line; poor voice quality; and discomfort and drying of mucous membranes with high airflows.\textsuperscript{8} Also, the port might not be properly fitted in the trachea and may lead to ineffectiveness of the talking tracheostomy tube. Patients also need time and practice to perfect the use of this type of speech.

**Cuffed Fenestrated Tracheostomy Tubes.**

Another method to restore speech in patients who require an inflated cuff is use of a fenestrated tracheostomy tube. A fenestration is an opening on the dorsal side of the shaft of the tube; it is usually placed one-third of the distance down the shaft. This opening allows air to move through the tube and up through the vocal cords.\textsuperscript{9} When the cuff on a fenestrated tube is inflated, inspiration and expiration occur primarily through the tube via the ventilator, but a small amount of air moves through the upper part of the airway and past the vocal cords via the fenestration (Figure 11). As with leak speech, ventilator alarms and settings must be adjusted to accommodate for the exhaled volume lost through the upper part of the airway.

An important consideration with the use of a fenestrated tracheostomy tube is that the fenestration must fit perfectly in the center of the trachea so that it does not come in contact with the tracheal wall. Blockage of the fenestration affects breathing, and granulation tissue may form at the fenestration site, causing an occlusion of the aperture and trauma on removal of the tube. Because an off-the-shelf fenestrated tube might not fit properly, fenestrated tubes may require a custom order. The anterior and posterior tracheal depths must be measured and compared with the position of the fenestration. If these measurements do not match, a custom tube should be ordered.\textsuperscript{8,25} A simple assessment of proper fit can be done by removing the inner cannula.
and shining a light into the tube to observe for an open versus a blocked fenestration. A blockage of the fenestration affects breathing, and granulation tissue may form at the fenestration site, causing occlusion of the aperture and trauma on removal of the tube. Nurses should also be mindful that secretions can occlude the fenestration and cause complications as well as impede optimal phonation.

For the fenestrated tube to work properly, the fenestrated inner cannula should be in place when the patient is attempting to phonate. This fenestrated inner cannula is usually identified in some way. For example, the 15-mm connector of the fenestrated inner cannula of the Shiley tracheostomy tube is colored green. However, if a patient with a fenestrated tube requires suctioning, the nonfenestrated inner cannula must be used so that the suction catheter does not get lodged within the fenestration.

Blom Tracheostomy Tube System. The Blom tracheostomy tube system (Figure 12) was designed for ventilator-dependent patients with no cognitive impairment who require continuous cuff inflation and who desire to speak. The system is a relatively new device that has a fenestrated outer cannula lying just above the cuff; the position is intended to prevent contact with the tracheal mucosa. A total of 4 different types of inner cannulas can be used with the Blom tube: a standard inner cannula, an inner cannula with a subglottic suctioning port, a speech cannula, and a low-profile inner cannula that can be used for patients who do not require ventilator support or who can tolerate cuff deflation. These cannulas have a unique locking mechanism that can be used only with the Blom tube system. When phonation is desired with a Blom tube for a patient receiving mechanical ventilation, the uniquely designed speech cannula should be used. This cannula has 2 valves on its soft and flexible shaft. On inhalation, air is delivered to the lungs through a flap valve that opens at the tip of the tube (Figure 13). Upon exhalation, the flap valve closes, and air passes through the fenestration and through a bubble valve along the shaft of the speech cannula. Before the speech cannula is inserted, the patient should be assessed to ensure that he or she is breathing comfortably and that the airway is clear of secretions. After the speech cannula is placed, airflow through the upper part of the airway should be assessed. If the patient has any indications of respiratory distress, the speech cannula should be immediately removed and replaced with the standard cannula. Patients with thick or copious secretions should not use this type of tube.

Another unique feature of the Blom system is the exhaled volume reservoir. This small bellows system expands and traps air during the inspiratory phase and then returns that air to the ventilator during the expiratory phase so that the air can be measured as exhaled volume. This reservoir should be used only while the speech cannula is in place; it should be removed when the speech cannula is not in use.

**Conclusion**

Many different methods can be used to restore phonation in patients who have a tracheostomy, and critical care nurses are the ideal members of the health care team to facilitate a planned and systematic approach to achieving phonation. Coordination of the interdisciplinary team, which includes critical care nurses, respiratory therapists, speech pathologists, advanced practice nurses, and physicians, is essential to the goal of voice restoration. Early involvement of this team can improve clinical outcomes and patient satisfaction by reducing the time needed for phonation.

Nurses who provide care for patients with tracheostomies need not only focus on the tasks associated with care but also acknowledge that patients with tracheostomies can struggle with loss of the voice. The team must be sensitive to this loss and explore the anger and frustration that can overwhelm patients.
facilitate a method of communication that is ideal for the patient and can be consistent in its implementation until the patient’s voice is restored. Patients need a way to communicate their feelings as well as their physical and emotional needs, and in turn, they are grateful to nurses who take the time to be patient, who are creative with methods of communication, and who provide reliable quality care.

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dotmore
To learn more about patients with a tracheostomy, read “Comparison of Respiratory Infections Before and After Percutaneous Tracheostomy” by Sole et al in the American Journal of Critical Care, November 2014;23:e80-e87. Available at www.ajcconline.org.


1. Which of the following are indications for tracheostomy placement?
   a. Confirmed ventilator-associated pneumonia
   b. Prolonged intubation with unsuccessful weaning
   c. Prolonged need for vasoactive medications
   d. Two or more self-extubations

2. Which of the following statements best describes the difference between capping a tracheostomy and using a speaking valve?
   a. For a cuffless tube, a speaking valve should not be used and only a cap is appropriate.
   b. Capping a tracheostomy should never be done on a fenestrated tube while a speaking valve can be used on any tube.
   c. A speaking valve will allow air to enter into the tracheostomy tube while capping will not.
   d. There is no difference between capping a tube and using a speaking valve.

3. Which of the following devices should be used to provide supplemental oxygen for a patient with a speaking valve?
   a. Nasal cannula
   b. High-flow nasal cannula
   c. Venturi mask
   d. Humidified tracheostomy collar

4. Which of the following statements do the authors suggest as rationale for avoiding the use of a speaking valve on an inflated cuff tube?
   a. The cuffed tube will not allow for air to escape during exhalation, which could lead to barotrauma.
   b. The rate of inhalation of air through the speaking valve may damage the cuff.
   c. The speaking valve can prevent the expectation of mucus when the cuff is inflated.
   d. The cuffed tube may prevent adequate inhalation of supplemental oxygen through the speaking valve.

5. Which of the following do the authors suggest as contraindications for the use of a speaking valve?
   a. Previous failed attempt at using a speaking valve
   b. Total laryngectomy
   c. Supplemental oxygen requirements
   d. Acute delirium

6. Advantages to using the tracheostomy button and the Speak EZ tracheal cannula include which of the following?
   a. Having the ability to custom fit the tracheostomy ties
   b. Reducing the need for mechanical ventilation
   c. Eliminating the bulk of the tube in the airway
   d. Decreasing the supplemental oxygen requirement

7. Leak speech is most appropriate for which of the following patients?
   a. Those who no longer require ventilation
   b. Those who require mechanical ventilation at night
   c. Those who can tolerate cuff deflation without signs of distress
   d. Those who have thick secretions that can be expelled easily

8. Which of the following adjustments to a mechanical ventilator can improve leak speech quality?
   a. Decreasing tidal volume
   b. Increasing positive end-expiratory pressure
   c. Decreasing inspiratory time
   d. Increasing oxygen

9. Which of the following statements describes the differences between normal speech and leak speech?
   a. Normal speech often is comprised of short phrases whereas leak speech generally has long phrases with pauses.
   b. Here is no difference in quality between normal speech and leak speech.
   c. The use of leak speech often requires supplemental oxygen while the oxygen demands do not increase with normal speech.
   d. Leak speech occurs during inhalation while normal speech occurs during exhalation.

10. The role of critical care nurses in restoring phonation in patients with a tracheostomy includes which of the following?
    a. Deferring the decisions regarding devices to a speech therapist
    b. Monitoring for complications of respiratory distress exclusively
    c. Reporting patient frustrations of inability to communicate to the health care provider
    d. Serving as a member of the interdisciplinary health care team to assist in the coordination of care

11. Proper steps involved in cuff deflation include which of the following?
    a. Prior coaching and prepping of the patient, deep oropharyngeal suctioning, cuff deflation, observe for symptoms of respiratory distress
    b. Ask patient to take deep breath, cuff deflation, deep subglottic suctioning, increase fraction of inspired oxygen
    c. Slow cuff deflation over several minutes, increase fraction of inspired oxygen, reassure patient, deep oropharyngeal suctioning
    d. Deep subglottic suctioning, cuff deflation, ask patient to take a deep breath, observe for respiratory distress

12. Considerations for safe capping of a tracheostomy tube include which of the following?
    a. Use of a standard cuffed tube with the cuff deflated
    b. Use of a cuffless, tight-to-shaft, or fenestrated tube of appropriate size
    c. Use of a Speak EZ tracheal cannula
    d. Use of humidified tracheostomy collar

Test answers: Mark only one box for your answer to each question. You may photocopy this form.

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This method of CNE is effective for this content
The level of difficulty of this test was:
Easy medium difficult
To complete this program, it took me hours/minutes.

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Prone Positioning of Patients With Acute Respiratory Distress Syndrome

Dawn M. Drahnak, RN, DNP, CCNS, CCRN
Nicole Custer, RN, MS, CCRN-CSC

Effectively treating critically ill patients with acute respiratory distress syndrome (ARDS) is a challenge for many intensive care nurses. Multiple disease processes and injuries contribute to the complexity of ARDS and often complicate therapy. As a means of supportive care for ARDS, practitioners resort to rescue therapies to improve oxygenation and salvage the patient. The pathophysiology of ARDS and the use of prone positioning to improve pulmonary ventilation and oxygenation in ARDS patients are described. Educating nursing and medical staff on the use of prone positioning allows ease of patient placement with an emphasis on safety of both patients and staff. Scrupulous assessment of patients coupled with judicious timing of prone positioning expedites weaning from ventilatory support and contributes to positive outcomes for patients. (Critical Care Nurse. 2015;35[6]:29-37)

Critical care nurses work diligently day and night to manage intensely ill patients who are in unstable condition. The added strain of watching a patient’s condition deteriorate despite constant care and intervention often leaves nurses feeling helpless. Acute respiratory distress syndrome (ARDS) is not a primary disease, but rather reflects failure of the respiratory system resulting from inflammatory processes in the body. The inflammatory process derives from a variety of pathological triggers; therefore, ARDS has no boundaries and is often observed in various acute and intensive care settings. According to the National Heart, Lung, and Blood Institute, about 190,000 Americans are affected by ARDS annually. Physical findings are often nonspecific, and diversity in signs and symptoms complicates the diagnosis of ARDS and leads to reported mortality rates varying from 20% to 40%.

In 2011, the combined efforts of the European Society of Intensive Care Medicine, the American Thoracic Society, and the Society of Critical Care Medicine produced the Berlin definition of ARDS. The objectives for this initiative were to use epidemiological, physiological, and clinical trials to address the limitations of the American European Consensus Conference definition of ARDS. Specifically addressed
were missing or poorly defined components of the American European Consensus Conference’s definition, including (a) timing of onset, (b) sensitivity of the ratio of PaO₂ to fraction of inspired oxygen (PaO₂/FIO₂ or P/F ratio) to varied ventilator settings, (c) reliability of radiographic criteria, and (d) hydrostatic edema. Under the new definition, ARDS is diagnosed if symptom onset is within 1 week of clinical injury or worsening symptoms. Three categories of ARDS were described in the Berlin definition of ARDS, based on degree of hypoxemia as evidenced by the calculated P/F ratio: mild, moderate, and severe (Table 1). The P/F ratio is a useful measure of efficiency of oxygen transfer across the lung. Lower P/F ratios indicate poor gas exchange in the lungs (Table 1).

An additional resource available as a result of the Berlin definition of ARDS work group is a chest radiograph reference set, which provides a visual aid to assist practitioners with diagnosing ARDS. With the new definition, ARDS is imperative for continued research and to support positive outcomes for patients. Costa and Amato showed that the reassessment of the criteria at 24 hours was better for predicting mortality across the 3 ARDS groups. Villar et al reported that mortality was better described by assignment of the ARDS criteria (in terms of P/F ratio) at a given positive end-expiratory pressure (PEEP) and FIO₂ at 24 hours. Hernu et al, in a prospective survey, did not find any difference in mortality between patients with mild versus moderate ARDS.

ARDS is manifested acutely and progresses rapidly. Recognition and treatment of the underlying cause with concurrent mechanical ventilatory support is the multimodal approach to combat the damaging effects of ARDS. Interventions used supportively to decrease ventilator-induced lung injury and to maximize oxygenation include lung-protective (low-tidal-volume) ventilation, use of PEEP, and fluid management to maintain cardiac output. A National Heart, Lung, and Blood Institute clinical trial reports strong evidence that low tidal volume (6 mL/kg vs 12 mL/kg) results in lower mortality than does higher tidal volume.1,13,14

Other therapies termed rescue or salvage therapies (because of when these therapies are initiated) are used in combination with the measures noted. These therapies may include inhaled pulmonary vasodilators (nitric oxide or prostacyclin), partial liquid ventilation (perfluorocarbon liquids), alternative ventilation (high-frequency oscillatory, jet, airway pressure release, or pressure control-inverse ratio), neuromuscular blocking agents, exogenous surfactant, intravascular oxygenation, extracorporeal membrane oxygenation, and prone ventilation.13,15

According to Taber’s Cyclopedic Medical Dictionary, prone is defined as “horizontal with the face downward”

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timing</strong></td>
<td>Within 1 week of injury or new/worsening respiratory symptoms</td>
</tr>
<tr>
<td><strong>Chest imaging</strong></td>
<td>Bilateral opacities</td>
</tr>
<tr>
<td><strong>Origin of edema</strong></td>
<td>Respiratory failure not fully explained by cardiac failure or fluid overload Need objective assessment to exclude hydrostatic edema, if no risk factors</td>
</tr>
<tr>
<td><strong>Oxygenation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Mild</strong></td>
<td>PaO₂/FIO₂ ≤100 mm Hg with PEEP ≥5 cm H₂O</td>
</tr>
<tr>
<td><strong>Moderate</strong></td>
<td>PaO₂/FIO₂ ≤200 mm Hg with PEEP ≥5 cm H₂O</td>
</tr>
<tr>
<td><strong>Severe</strong></td>
<td>PaO₂/FIO₂ ≤300 mm Hg with PEEP ≥5 cm H₂O</td>
</tr>
</tbody>
</table>

How to calculate the PaO₂/FIO₂ (P/F) ratio:

1. Obtain most recent PaO₂ value in mm Hg
2. Convert FIO₂ (%) value into decimal PaO₂ (%)/100% = FIO₂ decimal
3. Calculate the P/F ratio taking numbers from steps 1 and 2

Abbreviations: CPAP, continuous positive airway pressure; FIO₂, fraction of inspired oxygen; PaO₂, partial pressure of arterial oxygenation; PEEP, positive end-expiratory pressure.

*Based on information from The ARDS Definition Task Force.*

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or the opposite of supine, and pronation is defined as “the act of lying prone or face downward.” Patients are placed prone for surgery, procedures, dressing changes, and to improve pulmonary complications of ARDS. Potential benefits of prone positioning include improved oxygenation, improved lymphatic drainage and secretion removal, and reinflation of collapsed pulmonary alveoli.11,15,17,18

A variety of techniques or devices can be employed to achieve prone position; namely, manual proning maneuvers, positioning devices, and automated beds.11 The decision regarding which technique or device to use is multifactorial and should take into consideration facility resources, nurses’ education level, and equipment availability. In this article, we briefly introduce and review each approach to achieving the prone position for treatment of patients with ARDS.

**ARDS Pathophysiology Review (in Relation to Prone Positioning)**

A brief review of the pathophysiology of ARDS provides a basis for understanding the utility of prone positioning as a treatment technique to improve oxygenation and facilitate weaning of patients off of ventilatory support. ARDS develops as a result of direct (pulmonary) or indirect (extrapulmonary) lung injury11,19 (Table 2). Specifically in extrapulmonary ARDS, injury of the alveolar epithelium and pulmonary vasculature leads to increased alveolar capillary permeability, causing alveolar and interstitial edema.12,17,19 Damage of type II alveolar cells renders surfactant inactive, which contributes to atelectasis and decreased lung compliance and ultimately results in refractory hypoxia and respiratory failure.12,17,19 Furthermore, edematous alveoli compress alveoli in dependent regions and the weight of the heart and abdominal contents of the sedated, often chemically paralyzed, patient contributes to the alveolar collapse.12,21 Impairment of oxygenation ensues, and bilateral infiltrates, unrelated to cardiac cause, are seen on chest radiographs.11

**Evidence to Support Prone Positioning of Patients With ARDS**

In the 1970s, positive effects on arterial oxygenation as a result of prone positioning were hypothesized to promote dorsal lung reexpansion, oxygenation, and alveolar recruitment in patients with ARDS.2,17 Prone positioning benefits the patient by improving regional ventilation and perfusion, aiding in secretion and redistribution of extravascular lung water, and unweighting the soft tissues.15,17 Additional physiological benefits of prone position include improved lung recruitment and oxygenation.17 The prone position allows a greater percentage of open alveoli (greater recruitment) and therefore potentially causes less ventilator-induced lung injury or delays such injury by allowing a lower FIO2 and lower airway pressures to achieve adequate oxygenation.11,21 Sud et al14 reported that prone positioning during mechanical ventilation reduces mortality in ARDS patients receiving protective lung ventilation (tidal volume < 8 mL/kg of predicted body weight). The effects of PEEP, recruitment maneuvers, and prone positioning are greater in patients with ARDS that has not resulted from direct lung injury.22

Prone positioning within 72 hours of diagnosis with the patient kept prone up to 20 hours per day yield the most benefit.15,18 In a meta-analysis, Lee et al23 reported that sufficient duration of mechanical ventilation of prone patients significantly reduced overall mortality in patients with severe ARDS. In a randomized controlled trial for positioning patients with severe ARDS prone, Guerin et al24 demonstrated that early prone positioning (patient placed prone within 1 hour after randomization) reduced mortality (28 and 90 days later) and increased the rate of successful extubation. Improvement in gas exchange is often used to indicate successful prone positioning; therefore, prescribing the duration of prone positioning is patient specific.25

When the patient is prone, alveolar recruitment is hypothesized to result from the pleural gradient being

**Table 2** Causes of acute respiratory distress syndrome

<table>
<thead>
<tr>
<th>Direct</th>
<th>Indirect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia</td>
<td>Sepsis</td>
</tr>
<tr>
<td>Aspiration</td>
<td>Transfusion of blood products</td>
</tr>
<tr>
<td>Inhalation injury</td>
<td>Shock</td>
</tr>
<tr>
<td>Fat emboli</td>
<td>Burns19</td>
</tr>
<tr>
<td>High-pressure mechanical</td>
<td>Drug overdose</td>
</tr>
<tr>
<td>ventilation20</td>
<td>Cardiopulmonary bypass</td>
</tr>
<tr>
<td>Pulmonary contusion</td>
<td>Acute pancreatitis9</td>
</tr>
<tr>
<td>Near drowning</td>
<td>Severe trauma</td>
</tr>
<tr>
<td>Reperfusion pulmonary edema9</td>
<td>Head injury20</td>
</tr>
<tr>
<td></td>
<td>Disseminated intravascular coagulation20</td>
</tr>
</tbody>
</table>


smaller than when the patient is supine; the heart rests mostly on the sternum when the patient is prone, thus exerting less pressure on the pleura and lung. In addition, intra-abdominal pressure may be reduced when the patient is prone.\textsuperscript{2,25} All measures reduce the compression of the lung and enforce reopening of collapsed alveoli.\textsuperscript{25} Decreased ventilation of dependent areas with the patient supine is abolished when the patient is prone, allowing more homogeneous ventilation and perfusion, which reduces the shunt.\textsuperscript{25,26} Positive-pressure ventilation amplifies this effect while the patient is prone by directing the pulmonary blood flow to the more ventilated regions.\textsuperscript{25} Postural drainage of water and exudates and accelerated removal of secretions are also noted clinical benefits of positioning patients prone.\textsuperscript{2} Prone positioning improves oxygenation in 70% to 80% of patients with ARDS.\textsuperscript{25,27} Use of the reverse Trendelenburg position while the patient is prone may serve to decrease abdominal pressure and prevent displacement of stomach contents.\textsuperscript{2}

### Procedure for Achieving Prone Positioning

Patients may be positioned prone manually, with the use of assistive devices, or with the use of an automated bed. Manual positioning refers to placing the patient prone without the use of equipment or specialized beds to achieve the position. When positioning a patient manually, ensure that a sufficient number of staff help to turn the patient safely. Prone positioning may also be achieved with the Vollman Prone Positioner, a padded metal frame with belt buckles that secure and protect the patient’s head, chest, and abdomen during the procedure.\textsuperscript{28,29} Last, prone positioning may be achieved via use of an automated bed.

Prone positioning in life-threatening hypoxemia may prevent imminent death. Such devices assist critical care nurses by mechanically assisting the nurse in positioning the patient prone and providing lateral rotation while allowing Trendelenburg and reverse Trendelenburg positioning.\textsuperscript{25} Automated beds provide a mechanism to position the patient supine rapidly in the event of a cardiac arrest or hemodynamic instability.\textsuperscript{19,25}

Regardless of the method used to achieve the prone position, only trained teams who have completed staff education and demonstrated competency (Table 3) should be permitted to attempt this intervention. Positioning a patient prone is labor intensive and physically challenging for nursing staff. Protocols and an algorithmic approach to prone positioning should be used to meet specific needs of the unit and the population of patients.

### Indications

Research demonstrates the importance of early prone positioning and indicates that sufficient duration of prone positioning can lead to better outcomes for patients. Knowledge of the physiological benefits of prone therapy in select ARDS patients (particularly those with extrapulmonary ARDS) supports advocacy for the procedure. The basis for initiating prone positioning begins with assessment of the patient, a key activity of acute and critical care nurses.\textsuperscript{20} Well-sedated patients receiving mechanical ventilation should be placed prone with the following inclusion criteria in mind: inadequate oxygenation at greater than 50% Fi\textsubscript{O}\textsubscript{2} despite PEEP levels higher than 10 cm H\textsubscript{2}O, and the presence of bilateral infiltrates on chest radiograph.\textsuperscript{31} These criteria may differ between institutions, individual practitioners, and from patient to patient.

Risks of prone positioning are often offset by the need to provide adequate oxygenation and should be weighed on an individual basis.\textsuperscript{2,17} Table 4 lists absolute and relative contraindications for placing a patient prone. The P/F ratio can be used to guide timing for initiating prone positioning.\textsuperscript{25} Prone positioning as a rescue maneuver in cases of life-threatening hypoxemia in patients undergoing mechanical ventilation (Pa\textsubscript{O}\textsubscript{2} ≤ 55 mm Hg at Fi\textsubscript{O}\textsubscript{2} = 1.00 and PEEP ≥ 15 cm H\textsubscript{2}O) may prevent imminent death and allow time for other treatments.\textsuperscript{15,33} Patients with severe ARDS as evidenced by a P/F ratio less than 100 have shown the most benefit from prone positioning, with reduced mortality.\textsuperscript{14,18,24,31} Regardless, prone positioning should be implemented as early as possible in patients with ARDS rather than using it as rescue intervention. In the PROSEVA trial, Guérin et al\textsuperscript{24} reported decreased mortality at 28 and 90 days and demonstrated the importance of using prone positioning as a first-line intervention rather than a rescue maneuver.

### Nursing Implications

ARDS patients who are placed prone are critically ill. Critical care nurses must be vigilant when caring for such patients. Frequent assessments of all body systems
are important nursing actions. Furthermore, anticipating adverse effects is an important function of the critical care nurses caring for prone patients. Pressure ulcers, obstruction of the endotracheal tube, and dislodgement of thoracostomy tubes are particularly high-risk complications for these patients.\textsuperscript{14}

**Ensuring a Patent Airway**

Anticipation of complications must be ensured to prevent dislodgement of the airway and critical tubes or catheters in prone patients.\textsuperscript{12} Use of specialized securement devices may decrease the risk of catheter or airway loss when used in conjunction with careful monitoring.\textsuperscript{2} Additionally, having a respiratory therapist in the room for the procedure in the event of airway or ventilator complications may prove useful. Nursing or respiratory staff should securely tie and double tape the endotracheal or tracheostomy tube, as secretions may increase with the patient prone and may loosen adhesive, dislodging the tubes and causing airway compromise. A bite block may be used to prevent the patient’s tongue from protruding and becoming injured.

**Ongoing Respiratory Assessment**

Other complications may include transient oxygen desaturation and hypotension.\textsuperscript{32} Nurses caring for the

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**Table 3** Tool used to demonstrate nursing competency in prone positioning of patients

<table>
<thead>
<tr>
<th>RN Name:</th>
<th>Unit:</th>
<th>Date:</th>
<th>Performance criteria</th>
<th>Date/Initial</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. States indications for positioning patient prone</td>
<td></td>
<td>Met</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. States contraindications to positioning patient prone</td>
<td></td>
<td>Not met</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>3. Prepares the patient for prone positioning</td>
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<td></td>
<td></td>
<td></td>
<td>a. Changes ECG electrodes from anterior to posterior thorax (avoid interruption of monitoring)</td>
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<td></td>
<td></td>
<td></td>
<td>b. Provides eye care and lubrication</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>c. Ensures tongue is inside the patient’s mouth; if tongue swollen or protruding, inserts bite block</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>d. Ensures patency and security of airway</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>e. Performs wound care on anterior wounds (if appropriate)</td>
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<td></td>
<td></td>
<td></td>
<td>f. Empties ileostomy/colostomy bags (if appropriate)</td>
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<td></td>
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<td></td>
<td>g. Ensures patency of all IV accesses</td>
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<td></td>
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<td></td>
<td>h. Pads pressure points and bony prominences</td>
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<td>4. Assists patient into the prone position and ensures correct anatomical position</td>
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<td></td>
<td></td>
<td></td>
<td>5. Assesses patient’s response to prone positioning</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>a. Monitors hemodynamic status every 30 minutes</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>b. Monitors respiratory rate, $\text{SpO}_2$, $\text{Svo}_2$ (if appropriate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>c. Obtains arterial blood gases within $\frac{1}{2}$ hour of placing patient prone</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>d. Repositions patient’s head and performs ROM every 2 hours (manual or Vollman Prone Positioner only)</td>
<td></td>
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</tr>
</tbody>
</table>

Abbreviations: ECG, electrocardiographic; IV, intravenous; ROM, range-of-motion exercises.

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**Table 4** Contraindications for prone positioning\textsuperscript{a}

<table>
<thead>
<tr>
<th>Absolute</th>
<th>Relative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spine instability</td>
<td>Open abdominal wounds</td>
</tr>
<tr>
<td>Unmonitored increased intracranial pressure</td>
<td>Multiple trauma with unstabilized fractures</td>
</tr>
<tr>
<td></td>
<td>Severe hemodynamic instability</td>
</tr>
<tr>
<td></td>
<td>Pregnancy</td>
</tr>
<tr>
<td></td>
<td>High dependency on airway and vascular access</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Based on information from Gattinoni et al.\textsuperscript{32}
In-depth training and in-service training serve as a foundation for the success of prone positioning.

Patient should note ventilator settings, P/F ratio, and vital signs (including pulse oximetry) before placing the patient prone. Changes in baseline values are important to determine patients’ tolerance of prone positioning. Assessing improvements in the P/F ratio is one means of assessing the patient’s response to being positioned prone, and it is recommended that arterial blood gases be measured 30 minutes after the patient is initially positioned prone. Improvements in gas exchange during prone positioning may be caused by an increase in functional residual capacity (volume of air present in the lungs at the end of passive expiration), similar to the effects of PEEP. A Pao₂ increase of at least 10 mm Hg or an increase in P/F ratio by 20 mm Hg or more indicates a positive response to prone positioning. Additionally, improvement in oxygenation with prone therapy was described in the PROSEVA trial as a P/F ratio of at least 150 mm Hg with a PEEP of 10 cm H₂O or less and an Fio₂ of 0.6 or less.

Integumentary Concerns

Eye and skin care should be included in the plan of care to minimize complications from prone positioning. To prevent corneal drying and abrasions, nurses should cover the eyes and apply lubricant as ordered. Routine eye care should be performed to reduce the patient’s risk for ophthalmic infection. Recent recommendations suggest that polyethylene-film eye covers may be more effective than instilling drops or ointment to prevent corneal abrasions. Nurses should also ensure that padding is not causing direct pressure on the eyes once the patient is positioned prone.

Any dressings or drainage tubes present on the anterior part of the patient’s body should be changed and emptied before positioning the patient prone to reduce the risk of skin breakdown from oozing secretions. Nurses should assess and document skin condition before turning the patient prone because skin breakdown may occur with prone positioning. Once the patient is prone, considerable pressure is placed on the forehead and cheeks. Measures should be taken to prevent or minimize skin breakdown; for example, removing electrocardiography leads from the anterior chest wall and repositioning them posteriorly or toward the shoulders and sides, avoiding pressure areas. The Figure shows an example of high-risk breakdown areas that may be padded with foam dressings.

Neurological Considerations

The nurse should assess neurological status frequently, as adequate sedation is imperative for all ARDS patients being treated with prone therapy. Some patients may require sedation with the addition of neuromuscular blocking agents. Turning can be a frightening experience for a patient if he or she is not adequately sedated. Pain assessment should be performed per agency policy, and the potential need for a bolus dose of sedative before positioning the patient prone should be considered.

Gastrointestinal Considerations

In order to prevent aspiration, enteral feedings should be withheld at least 1 hour before positioning a patient prone. In 2009, Schneider et al reported that best practice guidelines for withholding enteral feeding from intubated patients before scheduled procedures need to be developed jointly by the critical care specialties. Adequate patient nutrition supports recovery and can be achieved with enteral feedings via the postpyloric or parenteral route. If the patient requires neuromuscular blocking agents to sustain prone positioning, enteral feedings should be discontinued and replaced with parenteral nutrition.
Anticipating Adverse Effects of Prone Positioning

Patient who are turned prone are at risk for many complications. These complications include, but are not limited to, adverse airway events, displacement of the endotracheal tube, selective intubation or accidental extubation, obstruction of the endotracheal tube, pressure sores or facial edema, and dislodgement of catheters or tubes. Hemodynamic instability, worsening gas exchange, patients’ intolerance owing to inadequate sedation, cardiac dysrhythmia, and inadequate enteral nutrition also may occur. Difficulty in monitoring the patient and performing cardiopulmonary resuscitation are additional complications of prone positioning. As mentioned earlier, facial, orbital, and ocular edema, peripheral nerve injuries, skin necrosis, corneal ulceration, and abdominal wound dehiscence may occur. The complications that may occur with prone positioning, coupled with the patient’s critically ill status, necessitate frequent assessment and adjustment of the nurse to patient ratio.

Education

Providing ongoing education to the patient’s family is an important function of the critical care nurse. Additionally, to ensure the patient’s safety while he or she is prone, ongoing staff education, development, and competency are all necessary.

Staff Education

Nurses are primarily responsible for placing the patient prone and for the ongoing assessment of the patient. In-depth training and in-service training serve as a foundation for the success of prone positioning. A medical skills learning center or simulation laboratory may serve as an integral component for educating and maintaining staff competency with use of prone positioning. Detailed instruction, including demonstration, followed by guided hands-on placement is important to form a solid foundation for competency. Use of simulation mannequins or peer volunteers for placement in the prone position provides a realistic environment and contributes to a nurse’s comfort level.

Nursing policy including an algorithmic approach to assessing, diagnosing, and use of prone ventilation should be clear and available to all members of the health care team. Education including return demonstration can strengthen competency and enhance comfort with positioning patients prone, especially when recent experience is lacking or absent. Patients’ complications decrease with increased experience gained by nurses with frequent use of prone positioning, regardless of the technique used.

Family Education

A patient’s family can feel helpless when a loved one is critically ill. An important component of caring for the patient involves care for the patient’s family as well. Inclusion of the family in decision making and caregiving during the course of illness can empower the family and give them hope and purpose. Family members can become overwhelmed with the complexity of equipment that monitors and supports their loved one. Concerns regarding prone positioning may include fear for their loved one’s safety. Providing a rationale for prone positioning and explaining the expected benefits may help alleviate doubts. The nurse should also prepare the patient’s family for facial edema and the possibility of skin breakdown. Educational brochures may be offered to patients and their families and may aid in alleviating fears. Allowing family members to be present while the patient is turned prone may also alleviate their fear of the patient being injured. According to the American Association of Critical-Care Nurses practice alert (from 2011), evidence shows that the unrestricted presence and participation of a support person can enhance satisfaction of both patients and their families.

Summary

As the incidence of ARDS continues to contribute to patients’ mortality, critical care nurses must understand the pathophysiology of ARDS, indications for prone positioning, and nursing interventions for patients who are positioned prone. Prone positioning of a patient with ARDS may result in a greater proportion of alveoli being aerated at equivalent delivered volumes and should be considered as an early supportive therapy rather than a rescue maneuver. Future research should focus on timing, duration, and effectiveness of prone positioning in the treatment of patients with ARDS. CCN
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30. AACP Scope and Standards for Acute and Critical Care Nursing Practice. Also Viejo, CA: American Association for Critical-Care Nursing; 2008.
Prone Positioning of Patients With Acute Respiratory Distress Syndrome

**Facts**

Acute respiratory distress syndrome (ARDS) is manifested acutely and progresses rapidly. Interventions used supportively to decrease ventilator-induced lung injury and to maximize oxygenation include lung-protective ventilation, use of positive end-expiratory pressure, and fluid management to maintain cardiac output. Other therapies used in combination with the measures noted may include inhaled pulmonary vasodilators, partial liquid ventilation, alternative ventilation, neuromuscular blocking agents, exogenous surfactant, intravascular oxygenation, extracorporeal membrane oxygenation, and prone ventilation.

- Research demonstrates the importance of early prone positioning and indicates that sufficient duration of prone positioning can lead to better outcomes for patients.
- A variety of techniques or devices can be employed to achieve prone position; namely, manual proning maneuvers, positioning devices, and automated beds. The decision regarding which technique or device to use is multifactorial and should take into consideration facility resources, nurses’ education level, and equipment availability.
- The basis for initiating prone positioning begins with assessment of the patient, a key activity of acute and critical care nurses.
- Well-sedated patients receiving mechanical ventilation should be placed prone with the following inclusion criteria in mind: inadequate oxygenation at greater than 50% Fio₂, despite positive end-expiratory pressure levels higher than 10 cm H₂O, and the presence of bilateral infiltrates on chest radiograph.
- Any dressings or drainage tubes present on the anterior part of the patient’s body should be changed and emptied before positioning the patient prone to reduce the risk of skin breakdown from oozing secretions.
- Nurses should assess skin condition before turning the patient prone because skin breakdown may occur with prone positioning. Once the patient is prone, considerable pressure is placed on the forehead and cheeks. Measures should be taken to prevent or minimize skin breakdown; for example, removing electrocardiography leads from the anterior chest wall and repositioning them posteriorly or toward the shoulders and sides, avoiding pressure areas.
- Critical care nurses must be vigilant when caring for patients who are placed prone. Frequent assessments of all body systems are important nursing actions. Pressure ulcers, obstruction of the endotracheal tube, and dislodgement of thoracostomy tubes are particularly high-risk complications for these patients. CCN

Managing Spaghetti Syndrome in Critical Care With a Novel Device: A Nursing Perspective

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Kelly Bowers, MPH
Richard Young, MD
Trudy Sanders, PhD
Karen E. Schultz, MPH

BACKGROUND Managing “spaghetti syndrome,” the tangle of therapeutic cables, tubes, and cords at patients’ bedsides, can be challenging.

OBJECTIVES To assess nurses’ perceptions of the effectiveness of a novel banding device in management of spaghetti syndrome.

METHODS A simple color-coded elastomeric banding strap with ribbed flaps was attached to bed rails of adult critical care patients to help organize therapeutic cables, tubes, wires, and cords. Nurses were surveyed before and after use of the bands and after the nursing shift to assess the burden of spaghetti syndrome and the effectiveness of using the bands.

RESULTS Use of the bands decreased the time spent untangling cords, reduced the frequency of contact of tubing with the floor, and diminished disruptions in care.

CONCLUSIONS Use of a simple flexible latex-free elastomeric band may help organize therapeutic tubing at patients’ bedsides and may promote improvements in nursing care. (Critical Care Nurse. 2015;35[6]:38-45)

Critical care patients often have numerous therapeutic connections (eg, cords, cables, and tubes) at the bedside that can easily become disorganized and tangled, leading to contamination of the connections, nurses’ confusion, a physical hazard that increases the risk for falls for both nurses and patients, and the possibility of damage of medical devices. This phenomenon, known as spaghetti syndrome, makes caring for patients challenging and difficult (Figure 1). Multiple instances of patients’ deaths, permanent injury, and life-threatening situations related to entanglement with the cords of medical devices have been reported. Ensuring the organization of cords and tubes at a patient’s bedside may reduce adverse outcomes such as entanglement of the patient, backflow in tubing, falls by both patients and health care personnel, and connection errors or damage of medical equipment.
Therapeutic tubing, cables, wires, and cords are a fundamental aspect of daily health care for delivery of medications and fluids to patients. The often disorganized tubing and cords at the bedside increase the possibility of inadvertently connecting the wrong syringes and tubing and then unintentionally delivering medication or fluids via the wrong route. In 2006, the Joint Commission issued alerts on tubing misconnections; interventions and procedures to manage and protect medical cords, tubes, and cables as a standard of care, but only a few devices are available to aid in this task.11,13,15

Few bedside devices for cord control are commercially available, and they vary in complexity and design. The purpose of this study was to test use of a novel simple, sleeved-strap banding device in the management of spaghetti syndrome in a critical care unit and to assess nurses’ responses to use of the band. Before the study, no devices or standard protocols were being used to manage the syndrome.

Methods

After a comparison of commercially available products, a novel sleeved-strap band crafted from elastomeric latex-free material (JanaBand, JMC Global Technologies) was chosen for the study. This device was selected because of its relative value, flexibility, and ease of application (Table 1, Figures 1 and 2). The color-coded sleeved banding devices were donated for the study by their creator and manufacturer, JMC Global Technologies, Keller, Texas.

In tests of the effectiveness of the device in an inpatient setting, 2 colors (red and blue) were used to distinguish between afferent tubing carrying medications or fluids into the patient and efferent tubing removing fluids from the patient or holding wires and cables (Figure 2).
The banding device is approximately 29.2 cm (11 1/2 in) long and 4.8 cm (1 7/8 in) wide. The flap sleeves allow quick release and gliding of the therapeutic connections. In addition, the banding device added structure and strength to support a wide variety of sizes and weights of therapeutic tubing. In order to ensure sanitation, once a band is removed from a patient’s bed, it cannot be reconnected and is therefore disposed of immediately. The intended use of the band is to manage spaghetti syndrome by bundling therapeutic tubing, wires, cables,

Table 1 Comparison of bedside devices

<table>
<thead>
<tr>
<th>Feature</th>
<th>Comparison devices</th>
<th>Study device (JanaBand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Variable depending on quantity</td>
<td>$5-$9 depending on quantity</td>
</tr>
<tr>
<td>Design</td>
<td>Clasp: securing holes are the same size and accommodate 3-4 tubes, cords, and/or wires, prefitted</td>
<td>Strap sleeve: larger opening allows for variety of tube sizes and numbers of tubes, cords, and wires</td>
</tr>
<tr>
<td>Material</td>
<td>Foam, rubber, and plastic</td>
<td>Latex-free elastomeric flexible strap</td>
</tr>
<tr>
<td>Attachment</td>
<td>Designed to fit on bedrail</td>
<td>Secures on multiple posts, including bedrails, and intravenous poles; can be adjusted for multiple sizes</td>
</tr>
</tbody>
</table>

Figure 2 The JanaBand strap device system (JMC Global Technologies, Keller, Texas).
A simple flexible elastomeric sleeved latex-free banding strap can be used in the intensive care unit to help organize therapeutic tubing and may promote improvements in nursing care.

During a 1-month period (October 2013), the effectiveness of the banding device was determined at a tertiary urban care hospital and academic medical center in an adult intensive care unit with 36 private patient rooms. The unit was staffed and monitored by 74 intensive care nurses; each nurse worked 12-hour shifts 3 days/week.

Several methods were used to teach the nurses how to use the banding device correctly. Nurses were introduced to the device during their rounding huddles or at meetings before the start of a shift. A member of the study team demonstrated how to attach the devices to the bed and how to remove them after each use. In addition, nurses received an e-mail with a link to an instructional video demonstrating proper use of the band. Additional educational sessions available to the nurses in the break room provided detailed pictures and directions on how to use the device and a contact number for study personnel if a nurse had questions about the band.

Of the 36 patient rooms 18 (50%) were selected for use of the banding device; the other 18 patient rooms served as control rooms, with no use of the device. Once the study rooms were identified, 2 sealed packages of the bands were placed by medical technicians at the patient’s bedside before a new patient was admitted. In order to ensure consistency, nurses were instructed to place the banding device on the patient’s bed rails, securing appropriate tubing, cords, and cables. This particular location for the banding device was chosen because of proximity to medical equipment and to avoid interfering with movement of the bed rails and the patient’s mobility. The location was tested before the study to ensure consistency and to determine the ideal place for the bands.

Surveys

A voluntary survey consisting of 10 questions was administered before and after use of the bands. The purpose of the survey administered before use of the bands was to determine nurses’ perceptions of the burden of the spaghetti syndrome in the critical care unit before the study took place. The survey given after use of the bands was used to measure nurses’ perceptions of the effectiveness of the banding device.

Surveys after each nursing shift were completed voluntarily by nurses for each of the patient rooms monitored during their shift. Complete surveys were returned to a locked ballot box. This survey consisted of 3 multiple-choice questions on the nurses’ perceptions of the frequency that therapeutic tubing and wires were tangled, disorganized, or damaged severely enough to disrupt care; the frequency that the tubing, wires, and cables were in contact with the floor; and the amount of time required to reorganize or untangle therapeutic cords, cables, and tubing to administer necessary care to the patient during the shift. On each survey, the respondent indicated if the banding device was used with the patient the nurse was describing and provided the room number for verification.

Statistical Methods

The data were analyzed by using SAS, version 9.2, software (SAS Institute Inc). Findings were considered significant at \( \alpha = .05 \). Survey items were summarized using descriptive statistics. A sample-size calculation was performed before the study to ensure that an adequate number of surveys were collected to achieve a statistical power of 80% during the 1-month study period. The responses from the survey given after the nurses’ shifts were dichotomized, and \( \chi^2 \) analysis with odds ratios was done to determine the differences in the number of disruptions in care, the number of times tubing may have been in contact with the floor, and the estimated time spent managing tubes, cords, and wires at the bedside with and without the use of the banding device. The Bowker test of symmetry was used to test for differences between the responses to surveys given before and after use of the bands. Because of small cell counts, several of the response categories on these 2 surveys were dichotomized as agree or disagree, and a zero-cell correction was used as necessary.

Results

Before Use of the Bands

A total of 43 surveys (58%) were collected before use of the bands. The results suggested that nurses were concerned about the management of spaghetti syndrome in the critical care unit (Tables 2-4). All 43 respondents acknowledged that a system for organizing therapeutic
tubing and wires would improve the efficiency of patient bedside care, and 98% stated that the banding system would provide a more comfortable and calming environment for patients. In addition, 91% of the respondents acknowledged that the patient bedside cords, tubes, and cables were sometimes on the floor, and 84% reported that they were spending a large amount of time at shift change reorganizing the cords, tubes, and cables. The majority of the nurses (56%) thought that the tubing, wires, and cables around the patients’ bedsides were not organized, and 93% thought the tubing, wires, and cables were apt to become tangled (Tables 2 and 3).

**After the Nursing Shift**

A total of 404 surveys were collected after nursing shifts during the 1-month study period. Of these, 55% described a nurse’s encounter with a patient with the banding device, and 45% described an encounter without any banding device (Table 4). Survey responses indicated that if a banding device was in place on the bedrail, the patient was less likely to have a disruption in care due to problems with tangled therapeutic tubing (\( P = .006; \) odds ratio = 1.75; 95% CI = 1.18-2.61). Nurses were more likely to spend less than 1 minute organizing tangled tubing if a banding device was used (\( P = .002; \) odds ratio = 1.93;
95% CI = 1.29-2.91), and the therapeutic tubing was less likely to ever have been on the floor (P < .001; odds ratio = 2.53; 95% CI = 1.54-4.13).

After Use of the Bands

A total of 30 surveys (40%) were collected after use of the bands. Results suggested that using a banding device at the patient’s bedside significantly aided in managing spaghetti syndrome (Table 2). A total of 80% of the respondents indicated that the banding device was effective in organizing therapeutic tubing and wires at the bedside (P = .04), and 69% indicated that the banding device accomplished the task of creating an organized, clean, and calm bedside environment (P = .005). The nurses indicated that, in general, the perceived likelihood of the risk of contamination from therapeutic tubing being on the floor was significantly decreased when the banding device was used (P < .001), as was the perceived likelihood of therapeutic tubing being damaged (P < .001) or being tangled in the bed rails (P = .03; Table 3).

Discussion

Introduction of a new process in health care usually meets some resistance and questioning. The results

Table 3  Survey questions and responses before and after use of a strap band device: how likely questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Results before use of device (n = 43)</th>
<th>Results after use of device (n = 30)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>How likely do you think it is that the tubing, wires, and cables may become tangled at the bedside?b</td>
<td>Extremely likely: 44% (n = 19)</td>
<td>10% (n = 3)</td>
<td>.03</td>
</tr>
<tr>
<td></td>
<td>Very likely: 37% (n = 16)</td>
<td>17% (n = 5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Somewhat likely: 12% (n = 5)</td>
<td>26% (n = 8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not very likely: 7% (n = 3)</td>
<td>47% (n = 14)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not at all likely: 0% (n = 0)</td>
<td>0% (n = 0)</td>
<td></td>
</tr>
<tr>
<td>How likely do you think it is that tubing, wires, and cables can become damaged in the bed rails?bo</td>
<td>Extremely likely: 23% (n = 10)</td>
<td>3% (n = 1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>Very likely: 37% (n = 16)</td>
<td>7% (n = 2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Somewhat likely: 21% (n = 9)</td>
<td>30% (n = 9)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not very likely: 19% (n = 9)</td>
<td>53% (n = 16)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not at all likely: 0% (n = 0)</td>
<td>7% (n = 2)</td>
<td></td>
</tr>
<tr>
<td>How likely do you think it is that tubing can become contaminated from being on the floor?b</td>
<td>Extremely likely: 67% (n = 29)</td>
<td>6% (n = 2)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>Very likely: 26% (n = 11)</td>
<td>6% (n = 2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Somewhat likely: 7% (n = 3)</td>
<td>47% (n = 14)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not very likely: 0% (n = 0)</td>
<td>40% (n = 12)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not at all likely: 0% (n = 0)</td>
<td>0% (n = 0)</td>
<td></td>
</tr>
</tbody>
</table>

b Because of rounding, not all percentages total 100.

bo The categories extremely likely, very likely, and somewhat likely were combined to make a category, and the categories not very likely and not at all likely were combined to make a category for the statistical analysis.

Table 4  Impact in daily practice: survey results after nurses’ shifts

<table>
<thead>
<tr>
<th>Question</th>
<th>Total sample (N = 404)</th>
<th>Banding device used Yes (n = 223)</th>
<th>No (n = 181)</th>
<th>Percentage of group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banding device used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of times care was disrupted because of tangles in therapeutic tubinga</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>56</td>
<td>62</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Once</td>
<td>24</td>
<td>24</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Twice</td>
<td>12</td>
<td>9</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>3 or more times</td>
<td>8</td>
<td>5</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Extra time (minutes) spent untangling therapeutic tubinga</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1</td>
<td>64</td>
<td>71</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>25</td>
<td>18</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>&gt;5-10</td>
<td>8</td>
<td>7</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>&gt;10-15</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>&gt;15</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>No. of times therapeutic tubing was on the floora</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>57</td>
<td>61</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>Once</td>
<td>22</td>
<td>25</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Twice</td>
<td>11</td>
<td>8</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>3 or more times</td>
<td>10</td>
<td>6</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

a Statistically significant difference (P < .05) between the group that used the banding device and the group that did not.
suggested that before use of the banding device, nurses had genuine concerns about the management of bedside tubing and cords in the critical care unit. The results of surveys completed after use of the bands and after each nursing shift suggested that the nurses in this critical care unit thought that use of the new standard process with use of the color-coded banding devices had a positive impact on patient care. Use of the banding device to manage the therapeutic tubing yielded significant improvements in perceptions of efficiency and resulted in fewer disruptions in care and less nursing time spent untangling cords.

Nurses felt that the bands allowed a sense of organization, saved time, and had a potential for process improvement. The findings also indicate that use of the banding device might protect against damage to tubing, cables, and cords used at the patient bedside. Additionally, using a standard process of bundling and suspending tubing and cables with color-coded sleeved-strap devices may help differentiate clean from dirty tubing, minimize potential errors and damage to equipment, and may help create a more controlled, safe, and sanitary environment.

The results suggest that a quality benchmark might be achieved by implementing a routine standardized process that focuses on the prevention of entanglement of therapeutic tubing, cords, and cables by using a simple bedside apparatus such as a sleeved-strap banding device. Although spaghetti syndrome has been considered a serious patient care issue for many years, few studies have proposed a solution to this problem.\(^{1,3,5,6,10,11,15,16}\) We hope that the results will reenergize the interest in solving the problem of spaghetti syndrome and lead to the development of protocols and standard processes for use of a simple solution to control entanglement of bedside tubing and wires for all hospitalized patients.

**Limitations**

Although the banding device was initially tested in several small internal pilot studies, with favorable results, the findings in this larger study are limited because the data are from a single critical care unit and were self-reported and voluntary. Thus, the results may not be applicable to other types of patient care settings. Although the results were favorable, the study was only 1 month long. For better understanding of the implications of using a banding cord-control device in a critical care unit, a longer study period is warranted to measure the health care outcomes and the impact on the delivery of the quality of care due to use of the band. Additionally, the impact of the process on infection risk or other clinical outcomes was not determined, so conclusions cannot be drawn about improvements due to use of the band in these types of outcomes. Although the results suggest that use of the banding device may lead to marked improvements in efficiency of nursing care, several nurses did not express any perception of improvements in the management of spaghetti syndrome. Some nurses even reported that use of the banding device added more time to tending to the tangle of therapeutic tubing. This finding could be attributed to the lack of familiarity with the new process. A longer study period in which nurses could become more comfortable with using such a device might yield different results.

Because the data were self-reported by the nurses, the information collected via the surveys reflects recall bias. Ideally, future studies should address this limitation by having dedicated observers gather quantitative instantaneous measurements about time and the number of times the therapeutic tubing became tangled or was in contact with the floor in the patients’ rooms. The participation rate in the study decreased from 43 respondents in the survey before use of the banding device to 30 respondents in the survey after use of the device, and because of the voluntary and anonymous nature of the study, we could not determine if the nurses who completed the “before” survey also completed the “after” survey. In addition, we could not determine how many different nurses completed the surveys administered after the nursing shifts. Future studies should take this lack of specificity into consideration and determine a more unique method of reporting that maintains anonymity.

**Conclusion**

Our findings indicate that a simple flexible sleeved-strap banding device can be used in the intensive care unit to organize therapeutic tubing, cables, and wires at patients’ bedsides and that use of the device may promote improvements in nursing care.
Our results also suggest that the banding apparatus promoted perceptions of improvements in efficiency and quality of nursing care. With a simple innovative focus on fundamental efforts to increase efficiency, decrease variability, and minimize risk and error, improvements might occur in patient as well as employee satisfaction.

If use of a color-coded banding devices could potentially protect and organize therapeutic tubing, cables, and wires at the bedside and reduce the risk and likelihood of error, then developing standard protocols for use of such devices should be considered and implemented. These results and the desire of nurses to improve patient care and increase safety in the workplace warrant future studies to investigate use of these bedside devices and the relative impact of their use to prevent damage or contamination of therapeutic tubing, cables, and cords; incidents of hospital-acquired infections; length of stay; and improvements in the quality and value of critical care. CCN

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None reported.

References
Nurses play an important role in supporting families who are faced with the critical illness and death of their child. Grieving families desire compassionate, sensitive care that respects their wishes and meets their needs. Families often wish to continue relationships and maintain lasting connections with hospital staff following their child's death. A structured bereavement program that supports families both at the end of their child’s life and throughout their grief journey can meet this need. (Critical Care Nurse. 2015;35[6]:46-56)

The critical illness and death of a child are undoubtedly the most difficult experience any family faces, and nurses may find it difficult and uncomfortable to communicate with the family of a dying child. Some nurses feel anxiety related to the experience of death and are inadequately prepared to provide end-of-life care.3,6,7

We begin by presenting a case that illustrates a family’s response when faced with such a life-altering event and the challenges nurses face in caring for and communicating with the family throughout the end-of-life experience. Next, we review practical strategies that nurses can use to communicate with patients’ families at the end of a child’s life. We also provide additional strategies to provide compassionate, sensitive care that respects a family’s wishes and attends to the needs of the family. Finally, we describe a bereavement program designed to facilitate lasting communication with the grieving family.
Needs of Parents of a Dying Child

Jamie’s case illustrates that despite a team’s best intentions, establishing open communication and mutual care goals with a distressed family may be difficult. However, perceptions of what parents have found helpful at the time of their child’s death have been explored.8-17 For example, 56 mothers and fathers whose child died in the PICU were asked what facets of care they found most helpful at the end of their child’s life.18 These parents appreciated staff who were accessible and caring, provided understandable explanations of their child’s condition, and recognized that details may need to be repeated for the information to be absorbed. Other themes detected in similar studies7,8,14,17,20 of bereaved parents indicate that the parents want to be involved in care decisions and to be offered the opportunity to parent their dying child as much as possible. Additionally, parents need to know that the staff are “experienced and competent” and have thoroughly explored all treatment options for the child.1,9 Some parents have stated an overwhelming need for compassionate, sensitive staff, and others have appreciated having members of the health care team maintain contact with the family after the child’s death.1,9,16,18-21

Strategies to Support Families During Illness and at the Time of Death

To provide physical, psychosocial, and spiritual care for grieving families, nurses need excellent communication skills and knowledge of appropriate interventions at the end of life.3,5,6,22,23 A nurse’s approach should draw from his or her individual experiences, compassion and sensitivity, and consideration of the family’s cultural norms and spiritual beliefs.8 Further nursing interventions are then adapted to the child’s age and developmental level, and as the situation progresses from diagnosis through the course of illness and treatment, whether acute or chronic, to continued support after the child’s death.24,25

When communicating with the family of a dying child for the first time, nurses should establish rapport. Nurses should introduce themselves and their role in caring for the child and also learn family members’ names and the members’ relationship to the patient.9 Greeting formalities demonstrate courtesy and respect and provide an opportunity to assess any need for assistance in language interpretation.26,28 Non–English-speaking families may find information provided in English contradictory or

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confusing.10,26-29 Calling the child by name and asking the family if the child has a nickname may invite the family to engage in further communication about the child.28 Addressing the family’s needs for facial tissues, food and drink, locating restrooms, and other necessary resources is another strategy to build rapport.11,30 Nurses can further establish a relationship with the family through inquiry and reflection.23,31-33 Asking open-ended questions such as “What can I do for you at this moment?” encourages family members to express what is immediately important to them.34 Variations of open-ended questions include “Can you tell me a little more about . . . ” or “Help me to better understand . . . ”34 Asking yes-no questions may be helpful during a crisis but otherwise could convey coldness or disinterest.35 Active listening is a strategy to encourage dialogue while validating that the story shared is important.9,24-26,36,37 Three skills critical to active listening are asking questions, paraphrasing responses, and acknowledging feelings.2,25,34,38 When words are appropriate, parents appreciate candid and honest information spoken in a gentle, caring tone.12,39,40

In a time of crisis, lay language that is succinct and slow in cadence is most easily understood.32,39 Gordon et al40 interviewed bereaved parents whose child died in a PICU to determine the families’ perceptions of the communication they had with clinicians during the child’s hospitalization. A total of 72% of the parents criticized clinicians who did not fulfill the clinicians’ responsibility to communicate professionally, clearly, and with appropriate affect. Parents further described clinicians’ behavior as unprofessional when staff suggested the parents face the reality of their child’s situation. In another study8 on perspectives of palliative care and bereavement follow-up, 68% of family members indicated that someone from the health care team made a careless or insensitive remark. Family members may remember for years the pain and anger that result from insensitive communication.39 Table 1 gives statements to avoid and alternative examples of more compassionate end-of-life communication. Because each family situation is different and the dynamics are varied, nurses will need to determine responses that are appropriate for the circumstances.

Because each situation is different, nurses will need to determine responses that are appropriate for the circumstances.

<table>
<thead>
<tr>
<th>Statements to avoid</th>
<th>Rationale and recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>“How are you feeling?”</td>
<td>This question could be misconstrued as insensitive at a time when the family is obviously experiencing loss and emotional pain. Ask, “How may I best support you right now?”</td>
</tr>
<tr>
<td>“I know how you feel.” Or “I understand how you feel.”</td>
<td>An “I know” or “I understand” comment is less about how the bereaved feels and more about how the speaker feels. Dialogue may be encouraged by acknowledging the person’s unique experience: “I can only imagine how you are feeling right now.”</td>
</tr>
<tr>
<td>“You have other people to live for.” Or “Think of all the memories for which you have to be grateful.” Or “Count your blessings.”</td>
<td>At a time of unbearable loss, these statements seem dismissive and can create resentment. Well-intentioned advice minimizes the family’s pain and grief. Instead ask, “Are there family members or friends you would like me to help you contact?”</td>
</tr>
<tr>
<td>“You’re young. You can always have another child.” Or “It is good that you have other children.”</td>
<td>A bereaved family needs to be assured that their child’s life was unique and extraordinary, and worthy of remembering and celebrating.41,42 Listen for cues in what the family says about the child to engage them in dialogue about their favorite memories or stories. Storytelling promotes coping.</td>
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<td>“There is a reason for everything.” Or “It is God’s plan.”</td>
<td>For a grieving family, no reason in the world will be enough to justify their child’s death.42 Losing a child to death may elicit doubts of faith.43 Nurses should support the family’s spiritual worldview.19 For example, “What role does faith play in your life?”</td>
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<td>“Time heals all wounds.”</td>
<td>This statement skips to the future and disregards the crisis of the present moment. Validate the family’s present feelings by saying, “This is tough, isn’t it?”</td>
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<td>“Your child is in a better place.” Or “He/she is better off now.”</td>
<td>These statements may be perceived as diminishing the child’s value.18 Although some families may voice these expressions, nurses should refrain from euphemistic speech such as “passed away,” “deceased,” “gone to heaven,” or “in a better place.”</td>
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Table 1 Recommendations for end-of-life communication

CriticalCareNurse Vol 35, No. 6, DECEMBER 2015 www.ccnonline.org
express hope for miraculous healing, despite a clear understanding of their child’s prognosis. Maintaining hope through adversity and loss is a dynamic process that often indicates adaptive coping.50,51 Nurses can acknowledge a family’s hope by sharing a commitment to the child’s well-being with a wish-worry statement, rather than discounting the family’s feelings.26,39,48,52 For example, a nurse may say, “I also wish for Jamie to get better, but I worry that her condition is very serious.”

Early integration of palliative care resources can facilitate difficult dialogue between a dying child, the child’s family, and the treatment team.53,54 Use of age-appropriate advance planning guides such as My Wishes53 for school age children and Voicing My Choices: A Planning Guide for Adolescents and Young Adults54 might have given Jamie and her parents the opportunity to explore her wishes earlier in her illness, a situation that might have aided later communication. Jamie’s parents might have felt less distressed if they had had a directive outlining what was important to Jamie and how she wished to be cared for by her family and the medical team.

Nonverbal communication is a critical element in supporting grieving families.13,39 A nurse’s physical presence, body orientation, eye contact, facial expressions, and gentle touch can convey respectful acknowledgment of a family’s vulnerability, displacement, and coping.

Attention to cultural norms is vital, as is sitting at eye level with the family.50,55 Examples of important nonverbal communication techniques are given in Table 2.

Periods of silence may invite a family member to ask a difficult question or express strong emotion, thereby allowing the nurse to become more attuned to the family’s needs.2,31,32 Back et al58 caution that merely withholding speech, however, may generate an awkward silence rather than an enriching one. By focusing on an empathic sharing of the experience, clinicians can create moments of “compassionate silence” that convey mutual respect and understanding. To cultivate silence awareness, nurses can practice experiential exercises, such as deep breathing or mentally counting to 10 before responding.25,58

Strategies to optimize communication with families must include special consideration of a patient’s siblings, who are markedly affected by the critical illness and death of their brother or sister.19,30,59-61 In a study by Steele et al,60 siblings 8 to 17 years old who had a brother or sister die of cancer expressed their desire to be included in conversations and involved in the end-of-life experience.60 Youngblut et al61 sought parents’ perspectives of surviving siblings’ needs. The results indicated that siblings felt they did not have enough time to be with the dying child and/or say goodbye. Surviving siblings also expressed the desire to maintain

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Table 2 Nonverbal communication techniques

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<td>Presence</td>
<td>Presence is “the capacity to be fully there with a quality of attention and authenticity.”56 A nurse who is present is fully engaged in the moment and not distracted by personal bias or other obligations.37 Mindful body practices, including breathing deeply and exhaling slowly, may help nurses to cultivate “compassionate intention.”33</td>
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<td>Body orientation</td>
<td>Maintaining an open stance with good posture demonstrates that the nurse is grounded, open, and not guarded. Arms, hands, and legs should be uncrossed and accessible. Standing diagonally to the side of someone is less confrontational than standing directly in front of the person.57 Be cognizant of the power differential created by who is standing up and who is sitting down. Many people, including children, may engage in conversation more openly if they are communicated with rather than “talked down to.”</td>
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<td>Eye contact</td>
<td>Eye contact can demonstrate active listening.13,26 The nurse should take cues regarding comfort with eye contact from the family and from the person with whom the nurse is speaking. Be aware that in some cultures, direct eye contact can communicate disrespect. With children, however, eye contact does not necessarily equate to listening; a child may be listening intently without making eye contact.</td>
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<td>Facial expression</td>
<td>Entire conversations can be communicated through facial expressions. A compassionate expression communicates sincerity when offering a condolence. A gentle smile may serve to acknowledge a memorable story about the deceased.</td>
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<tr>
<td>Touch</td>
<td>Observe cultural considerations and family norms. If appropriate, begin with a light touch on the forearm, elbow, or shoulder to gauge the family member’s responsiveness to touch and establish your physical accessibility. If the family member reaches out to the nurse, offering a hug or holding a hand may be a form of consolation. The nurse should ask permission before hugging children or spouses/partners.</td>
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a connection with their deceased brother or sister. To honor siblings’ presence and unique contributions, nurses may explore with parents how to include siblings in meaningful ways. An important aspect is obtaining parental permission and respecting parental preferences about end-of-life communication while providing the siblings with honest, accurate information. Dialogue with siblings should be congruent with the siblings’ age and developmental level, and not euphemistic or metaphorical.

Supporting the Family After the Child’s Death

Nurses may feel awkward and unsure about how to support a family once a child has died. A nurse can begin with a condolence, an acknowledgment of suffering. A condolence, when expressed with genuine emotion, can be a few simple, poignant words, such as “I am so sorry” or “I wish things were different.” In a study by Meyer et al., bereaved parents described the value of staff members’ genuine verbal and behavioral expressions of kindness and compassion.

Crying or praying with a grieving family may be appropriate as well as healing for the family. However, during times of conflict or difficult decision making, nurses should respect the family unit and refrain from overidentification. A grieving family can also be comforted by hearing their child’s name and knowing that their child will be missed.

For many families, the death of their child may be the first time they have seen or touched a dead body. Family members should be offered the opportunity to view the body and, before doing so, should be prepared with a gentle, accurate description of what they will see and hear when they enter the room. Nurses should use sensitive explanations in lay language to describe the physical changes that occur in the body at or after death. Clarification at the bedside may also help alleviate apprehension about witnessing open eyelids, blood pooling with gravity, and expelled body fluids.

The shock of a child’s death, regardless of how anticipated, is often paralyzing to families, leaving them uncertain about what to do next. Nurses can create an environment conducive to grieving by minimizing distractions in and around the room, which will provide the family privacy and uninterrupted time to say goodbye. A sign on the patient’s door, such as a picture of a butterfly, may signify to hospital personnel the family’s need for privacy. When other family members are present, arrangements for additional seating, including a rocking chair for parents, may make the room more comfortable.

Nurses can offer the family space to pray, sing, and talk to their child. Nurses can also propose opportunities for parents to hold or lie in bed with their child and to help with bathing and dressing, if the parents wish to do so. A group of parents and legal guardians whose child died in the PICU described the importance of having enough time with their deceased child and not feeling rushed. Family members also had a desire to grieve in the presence of their child’s body. Assuring the family that they may stay with their child as long as they wish, as permitted by hospital policy, shows compassion, as does offering to step outside the room but remain nearby.

Families may exhibit different expressions of mourning. Physical manifestations of great emotional pain, grief, and anger may create a sense of discomfort and disruption to others who are nearby. Wailing loudly and falling to the floor are normal expressions of mourning for some people. To de-escalate tension in or around the room, nurses can provide an appropriate space for such expression by closing the patient’s room door or guiding the grieving family members to a more private place. Alternatively, closing adjacent doors and strategically placing a staff member to route the flow of traffic away from the grieving family will afford the family members privacy.

Giving a family tangible mementos such as the child’s gown, blanket, bracelet, or toys is another way to convey that the child’s life was important. Feedback from bereaved parents has indicated that families often do not know it is appropriate to cut a lock of hair or take pictures until the possibility is suggested to them and have later regretted not doing so.

Procedures for organ and tissue donation, involvement of a medical examiner, and handling the child’s body should be explained to the family with sensitivity, by using language that distinguishes between the human body and the child’s spirit. On occasion, families may request to transport the body themselves to the funeral home. This request may be honored, depending on hospital-specific policies and state requirements.
A year after Jamie died, her father contacted the hospital gift shop manager with the request to send balloons to the patients currently in the PICU in memory of his daughter. The gift shop manager contacted the PICU nurse manager about the unusual request and asked for guidance on a response. Recognizing the father’s name, the nurse manager elected to contact him to discuss his wishes. Jamie’s father asked whether specific nurses and doctors involved in her care still worked in the PICU and if they ever mentioned his daughter. It became readily apparent that the parents were struggling with their grief and desperately wanted to know that the nursing and medical staff remembered their daughter. After a very poignant conversation, the father offered to send balloons to all the patients with “get well” wishes, and a bouquet to the staff in Jamie’s memory. The parents have continued the tradition of sending the balloons every year on the anniversary of Jamie’s death.

When the family is ready to leave the hospital, verifying their safe transportation home shows concern and care. Accompanying the family to the hospital’s main entrance gives nurses the opportunity to respond to the family’s last requests and to identify any unmet needs that will require follow-up.

**Ongoing Support and Lasting Communication**

The prolonged effects of grief on a bereaved family may not be fully comprehended by others who have not experienced such a loss. Some religions and cultures call for a year of mourning. However, for many families, the mourning process may be much longer. Birthdays, important family events, and the anniversary of the child’s death are perpetual reminders of the family’s loss. Parents report fearing that their child will be forgotten and describe a marked need to maintain a connection with their child after the child’s death. Additionally, families report feeling lost or abandoned by health care providers after the child dies. Many parents have a need to continue a relationship with the hospital staff and perceive this relationship as an extension of caring and acknowledgment. The ongoing need for support following a child’s death is illustrated by the subsequent encounter with Jamie’s family.

Nurses can initiate steps to help a family establish lasting communication and redefine the family’s roles after the child’s death. This understanding led to the development of a multidisciplinary bereavement committee at University of Florida Health, Shands Children’s Hospital, Gainesville, Florida, and the creation of the Life Journey Bereavement Program.

The Life Journey Bereavement Program, supported by funds from the Children’s Miracle Network Hospitals, initially provides end-of-life support to families by assisting them with the preservation of final gifts at the time of their child’s death. Examples include molds of the child’s hand or foot or both (Figure 1) made by the staff and placed in a memory box along with a lock of hair, a blanket donated by volunteers, and any other meaningful items identified by the family. If death is anticipated and the family is comfortable, these activities can be done before the death occurs. These gifts of kindness serve as tangible evidence of the child’s presence in the family’s life.

Hospitalized children who have died are identified in a weekly report generated from the hospital information system. The hospital’s bereavement committee, composed of representatives from nursing, child life, guest services, pastoral care, and social work services, also identifies patients with whom committee members have established relationships who have died outside the hospital. After a family profile (Figure 2) is completed by the social worker most familiar with the family, the family is enrolled in the Life Journey Bereavement Program. During the next 13 months, guest services specialists

**Figure 1** Hand mold.
prepare packets of bereavement literature according to the family’s profile. These packets address the grief experiences of various family members, including mothers, fathers, grandparents, and siblings. Letters with corresponding materials are sent to the families on a monthly basis for the first 4 months and then every other month, until the first anniversary of the child’s death. Special holiday and the first anniversary letters are included (Figure 3). Each letter contains a paragraph about how to contact the patient and family resources department at the hospital for additional support and instructions if the family chooses not to participate in the program.

Families enrolled in the Life Journey Bereavement Program are invited to an annual remembrance service.
to celebrate the lives of their children. This service provides families an opportunity to share their grief with others who have experienced the same kind of loss and to reconnect with the staff members who cared for their child, a need that has been repeatedly identified in the literature.8,10,12,19,21,66 The service includes music, poetry, sharing memories, art projects sponsored by the Arts in Medicine program, and release of live butterflies to honor the memory of the children.

The importance of the Life Journey Bereavement Program was perhaps best exemplified by the experience of a sibling who attended a recent remembrance service. When he opened the glassine envelope containing the butterfly (Figure 4), it gently moved its wings but made no attempt to fly away. At the prompting of a nurse, the child whispered a special message to his deceased sister. At that moment, the butterfly took flight, as if to carry the message to its intended recipient.

Summary

The needs of families faced with the death of their child present challenges to pediatric nurses who may feel unprepared to deliver compassionate and sensitive care at the end of life. The practical strategies outlined in this article may enable nurses to confidently communicate with the child’s family during the dying process and after the child’s death, while providing a profound and meaningful experience for the family. A bereavement program that supports the hospital staff’s connection with the family after the child’s death attends to the family’s grief journey and acknowledges the value of their child’s life and unique legacy.

A butterfly lights beside us like a sunbeam. And for a brief moment, its glory and beauty belong to our world. But then it flies on again, and though we wish it could have stayed, we feel so lucky to have seen it.

—Author Unknown
Financial Disclosures
None reported.

References

To learn more about end-of-life care for pediatric patients, read “Pediatric Nurses’ Perceptions of Obstacles and Supportive Behaviors in End-of-Life Care” by Beckstrand et al in the American Journal of Critical Care, November 2010;19:543-552. Available at www.ajcconline.org.


1. Which of the following statements specifically demonstrates acknowledgement of hope and support for loved ones during a child's critical illness?
   a. "I also wish for Jamie to get better, but I worry that her condition is very serious."
   b. "How are you feeling?"
   c. "What role does faith play in your life?"
   d. "I can only imagine what you are feeling right now."

2. Which of the following statements should be avoided in end-of-life discussions with families?
   a. "Are there family members or friends you would like me to help you contact?"
   b. "How are you feeling?"
   c. "What role does faith play in your life?"
   d. "I can only imagine what you are feeling right now."

3. Strategies to build rapport include which of the following?
   a. Asking yes or no questions to non-English-speaking families
   b. Addressing the family's needs for necessary resources like food and drink
   c. Encouraging the family to let go and resume living as part of the grieving process
   d. Assuring the family they will make it through a loved child's passing

4. Which of the following is not included in a memory box?
   a. Hard copies of medical records
   b. A lock of the child's hair
   c. The family's cultural and spiritual beliefs
   d. Meaningful items identified by the family

5. In the Life Journey Bereavement Program, the family profile is prepared by which discipline?
   a. Nursing
   b. Social work
   c. Medicine
   d. Pastoral services

6. Which of the following is one important aspect of the Life Journey Bereavement Program that provides families with the opportunity to share their grief with others?
   a. A memory box
   b. Monthly letters
   c. An annual remembrance service
   d. An open door to reach out to staff after a child's passing

7. Which of the following best supports the hospital staff's connection with the family after the child's death, attends to the family's grief journey, and acknowledges the value of their child's life and unique legacy?
   a. Caring, compassionate nursing staff
   b. Hospital-based pastoral services
   c. Follow-up by the child's primary attending physician
   d. A multidisciplinary bereavement program

8. After a child's death, family members have expressed the need to do which of the following?
   a. Hear repeated explanations of the child's condition
   b. Explore all treatment options
   c. Hold on to the hope for a miracle
   d. Have enough time with their deceased child

9. When providing care during illness and time of death, nurses should draw from which of the following?
   a. Their individual experiences
   b. Their compassion and sensitivity
   c. The family's cultural and spiritual beliefs
   d. All of the above

Test answers: Mark only one box for your answer to each question. You may photocopy this form.

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Test ID: C156 Form expires: December 1, 2018 Contact hours: 1.0 Pharma hours: 0.0 Fee: AACN members, $0; nonmembers, $10 Passing score: 7 correct (78%) Synergy CERP Category B Test writer: Sean G. Smith, BSN, RN, Paramedic, NREMT-P, CNPT, PP-C, CP-C, CCRRN-CMC, CCRRN-R, CEN, CPRN, CPEN

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Making It Meaningful: Finding Quality Improvement Projects Worthy of Your Time, Effort, and Expertise

Julie M. Stausmire, RN, MSN, ACNS-BC
Charla Ulrich, RN, BSN, MOD, CIC

This article is the second of a 4-part quality improvement resource series for critical care nurses interested in implementing system process or performance improvement projects. The article is a brainstorming session on paper, written to assist nurses and managers in identifying possible quality improvement projects that are meaningful to them and will make a real difference in their critical care units. Every unit and institution has its own unique mix of resources, culture, physical environment, patient population, technology, documentation processes, health care providers, and multiple other factors. Thus specific patient care and safety challenges must be identified and prioritized individually for quality improvement by each unit. Projects also must be manageable and within the scope of time, effort, and expertise available—no quality improvement project is "too small" if it is applicable to your critical care area and will improve outcomes. (Critical Care Nurse. 2015;35[6]:57-62)

As the nurse manager of the trauma intensive care unit, you have just received the most recent patient satisfaction scores, and they are still below the preferred institutional benchmark. The lowest scoring items are (1) staff effort to include patients/families in decisions about treatment, (2) how well nurses kept patients/family informed, and (3) the amount of attention paid to the patient's special or personal needs. At the next team meeting, you invite your staff to offer suggestions on how to improve satisfaction scores. A lively discussion erupts, with some nurses recommending a research project and others a quality improvement (QI) project. Using published guidelines,¹ the group decides to use current evidence-based knowledge and best practices applicable to their patient population that will address the identified deficiencies (QI) versus trying to generate new knowledge or

CE Continuing Education

This article has been designated for CE credit. A closed-book, multiple-choice examination follows this article, which tests your knowledge of the following objectives:

1. Describe how to determine process improvement priorities
2. Review the use of process improvement methods that will work for your facility
3. Review patient safety strategies and initiatives endorsed by the Agency for Healthcare Research and Quality to prevent harm

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interventions (research). One team member volunteers to initiate a literature search related to patient satisfaction scores and evidence-based interventions for intensive care units while another offers to contact a nurse manager of a similarly sized trauma unit at a different institution who consistently has high patient satisfaction scores. A future meeting date is set to discuss their findings.

In this scenario, the critical care manager had an identified QI system issue that needed to be addressed. In other cases, multiple unit issues may need to be investigated or the manager may be approached by an undergraduate or graduate level nurse interested in doing a capstone project who is looking for suggestions. How do you decide which project to tackle? Do you have the resources, time, institutional support, and expertise equal to the complexity of the project to ensure the project can be carried out, or is it doomed to fail? The purpose of this article is to examine a variety of factors that should be considered before embarking on a QI project to maximize the odds of success.

Identifying System and Performance Projects Specific to Your Unit or Patient Population

There’s No Place Like Home

First look at patient safety and preventable harm situations on your own unit or in your institution—is there anything that poses an immediate threat of actual or potential harm that needs to be urgently addressed? Has there been a sentinel event applicable to your critical care area? Do incident reports document any patterns or trends related to specific types of occurrences such as falls or infection rates? Are there any high-volume, high-risk population groups, procedures, or treatment options that consistently increase morbidity and length of stay for your unit?

Use your institutional experts, primarily the managers of the QI, risk management, and infection control departments. Hospitals are federally mandated to report clinical outcome statistics for a variety of measures, and many institutions voluntarily belong to registry systems that provide risk-adjusted benchmarks for tracking institutional clinical outcomes against other institutions. One such program is the American College of Surgeons Trauma Quality Improvement Program, which collects reliable data, identifies institutional characteristics associated with improved outcomes, and provides feedback to more than 200 participating trauma centers.

Recreate It, Don’t Reinvent It

Let the experts do the work for you. Professional organizations have the combined resources and expertise to review the most current evidence-based studies and best practices in order to develop standard-of-care guidelines and recommendations. The Centers for Medicare and Medicaid Services, National Committee for Quality Assurance, National Quality Forum, Agency for Healthcare Research and Quality, and the Institute for Healthcare Improvement each offer a variety of ready-to-use guidelines, outcome measures, references, data collection tools, and data-reporting tools for QI.

The American Association of Critical-Care Nurses offers free online access to 2 clinical tool kits to help simplify the sharing and implementation of new practices. Each kit provides evidence-based strategies, resources, guidelines for implementation, examples of best practices, and change implementation tools. The available toolkits are Strategies for Managing Alarm Fatigue, which addresses the desensitization of nurses to noticing and responding to clinical alarms, and Implementing the ABCDE Bundle at the Bedside, to help prevent the unintended consequences of critical illness such as delirium, prolonged ventilation, and excessive muscular deterioration.

The June 2013 issue of Critical Care Nurse was devoted to patient safety strategies and initiatives to prevent harm. Grif Alspach discussed the work of a project team commissioned by the Agency for Healthcare Research and Quality that came together with an international group
of experts and stakeholders to analyze, critique, and appraise the evidence for various patient safety strategies. 11 The expert panel recommended 10 patient safety practices for immediate adoption by health care professionals and an additional 12 practices that were encouraged for adoption10 (Tables 1 and 2). Dr Alspach expanded on the tables in her editorial, providing information about the frequency and severity of each of the strategies, the strength of the evidence, cost estimates, and the degree of difficulty to implement.11

Steal Shamelessly

Too often we focus on what is not working and we forget to look at what is being done well. If a critical care unit in your institution or another institution is thriving, study that unit! What are the staff in that unit doing differently that can be identified, quantified, duplicated, and implemented on your own unit? Talk to the unit managers, staff, physicians, and other health care professionals to get their input on why that unit is successful. Try to do a 24-hour walk-through of their day from both a patient/family perspective and from a staff perspective. Make a flow chart of your unit and the successful unit and compare them for similarities and differences. Depending on the practice issue, you may want to include tangible factors such as staffing, staff mix, availability of advance practice nurses as mentors, number of beds, mean severity scores, population served, mean age, most common diagnoses, interaction with resident physicians, use of hospitalists or intensivists, technology related to available equipment and supplies, technology for medical record documentation, use of evidence-based practices such as checklists and bundles, common patient safety concerns, and QI initiatives. Intangible factors are more difficult to measure but may include communication techniques with peers, patients, and families; expectations for staff professionalism; the mix of novice to expert care providers relative to knowledge and expertise; interaction with other systems of care; and educational opportunities for staff and patients. You will not be able to replicate everything, but “shamelessly steal” any ideas, techniques, procedures or checklists that they are willing to share.

Be Brutally Honest About Available Time and Resources

Transparency in reporting of outcomes, reimbursement based on outcomes, continued accreditation, and employment dependent upon outcomes is essential—no
matter where you work or what your professional role is in health care, it is all about measurable outcomes. Unfortunately, with a leaner work force and the push to do more with less, trying to incorporate yet another task into everyday practice may be met with resistance. An overly ambitious project that puts additional time constraints on employees and is perceived as not being of value will quickly wither and die. Projects should include the use of nurse, physician, or administrative champions as invaluable resources who can facilitate peer education and encourage implementation of QI projects through close personal connections to their colleagues. Farner et al\textsuperscript{12} described champions as “advocates of new ideas or projects for which they feel personal ownership” and they reported an “enhanced sense of collaboration and coordination of care” among nursing staff members when nurse champions were used as leaders.

Goldmann\textsuperscript{13} discussed 10 tips for incorporating QI activities into real work instead of parallel processes separate from the average work day. He suggests designing easy-to-use data collection forms or checklists that actually improve ease and reliability of charting both for QI and for routine care. The use of standardized order sets or drug utilization reviews are 2 examples of how QI data collection can be incorporated into regular workday activities.\textsuperscript{13}

We disagree with Goldmann’s opinion that projects should be of sufficient magnitude and impact to “make a major difference” and “rise to a level . . . designed to substantially improve key processes of care.” He discourages “limited though useful QI initiatives” that are small scale. Large projects may be too intimidating or overwhelming for novice participants or those with limited resources, increasing the odds the project will never get started or will meet with significant challenges and possible failure that will discourage future endeavors. QI needs to be realistic and achievable. It is not research—the intent is not to push the envelope, generate new knowledge, and get published but rather to use existing evidence and tools to change practices to prevent potential or actual harm. Start with “low-hanging fruit”—small projects that are well studied in the literature, have free ready-to-use resources, and can be easily initiated with a minimum budget and little disruption of work flow, but can result in significant outcomes specific to that unit. For example, hand hygiene remains 1 of the top 10 patient safety issues that have a seemingly simple answer but no real success with ongoing sustained compliance.\textsuperscript{14}

**Conclusion**

At the scheduled QI follow-up meeting, your team member summarizes her findings but is especially excited about studies she reviewed that used the relationship-based nursing care delivery model.\textsuperscript{15} One study prospectively implemented a project of providing safe, personalized care to maternity unit patients with measurable outcomes for patient satisfaction, patient safety, and improvements in the perception of nursing teamwork.\textsuperscript{16} A second retrospective study in a small rural hospital evaluated the impact of the relationship-based care model before and after implementation by using Press Ganey scores to measure patient satisfaction, length of stay, and readmission rates.\textsuperscript{17}

She had also located an online summary of a nursing doctorate project based on the relationship-care model that examined the impact of patient- and family-centered interventions on Press Ganey patient satisfaction scores.\textsuperscript{18} It provided a complete overview of the project, including the interventions used: a method for inviting patients and families to participate in the care plan, providing a bedside notepad for questions, and scripting for the health care team to ask patients and families “What do you want to see happen today?”\textsuperscript{18} The group was especially excited about the minimal cost and time commitment to implement and the focus on interpersonal communication skills and family-centered care. Input from the nursing staff indicated support for further exploration and possible replication of the interventions described. An experienced nurse with a successful history of championing new initiatives volunteers to contact the author for further discussion and possible mentoring. The meeting concludes with your promise to arrange an in-service training session for staff with the manager of the QI department to discuss various methods for conducting QI projects that are used by your institution.

Part 3 of this series, “Where and How To Get Started—the DIY (Do It Yourself) Guide for QI Projects” will provide an overview of the most commonly used QI methods and suggestions for how to plan, implement, evaluate, and report QI projects. The final article will discuss use of the Standards for Quality Improvement
Financial Disclosures
None reported.

References

CE Test  Test ID C1563: Making It Meaningful: Finding Quality Improvement Projects Worthy of Your Time, Effort, and Expertise

Learning objectives: 1. Describe how to determine process improvement priorities 2. Review the use of process improvement methods that will work for your facility 3. Review patient safety strategies and initiatives endorsed by the Agency for Healthcare Research and Quality to prevent harm

1. Some items to consider when choosing a quality improvement project for your department include all except which of the following?  
a. Availability of resources to manage the project  
b. Approval from the institutional review board to conduct the project  
c. Institutional support for the project  
d. Availability of expertise to complete the project  

2. Which of the following items should be considered when choosing a project?  
a. Identifying systems and performance projects specific to your unit  
b. Nurses and patients only  
c. Both a and b  
d. None of the above  

3. Which of the following is not a recommendation from the authors for identifying system and performance projects specific to your unit and patient population?  
a. Use of expert resources within your own institution  
b. Reinterventions based on creating new knowledge  
c. Recreate work that has already done  
d. Be honest about available time and resources  

4. Department-based quality projects should include which members of the care team?  
a. Nurses, physicians, facility senior leadership  
b. Nurses and patients only  
c. Nurses, physicians, and/or administrative champions  
d. All of the above  

5. Which of the following statements related to quality improvement is not true?  
a. Quality improvement is not research  
b. Quality improvement generates new knowledge  
c. Quality improvement is intended use existing evidence and tools to change practice and prevent actual or potential harm  
d. Quality improvement projects need to be realistic and achievable  

6. Which of the following are tips for choosing a quality improvement project?  
a. Areas of opportunity for implementing evidence into practice  
b. Application of tools that will change practice and improve patient safety  
c. Start with “low-hanging fruit” determined from evaluation of evidence-based practice  
d. All of the above  

7. Which of the following safety strategies have been endorsed by the American Association of Critical-Care Nurses since 2013?  
a. Checklists and bundles  
b. Hand hygiene and barrier precautions  
c. Interventions to reduce health care–associated infections  
d. All of the above  

8. Which of the following is a recommended way to identify successful quality improvement techniques from another unit that could be incorporated into your own unit’s practice?  
a. Share relevant quality improvement articles published in the nursing literature  
b. Make a flow chart of your unit and the successful unit to compare similarities and differences  
c. Use standardized checklists for specific outcome measures you are trying to improve that have been successful on other units  
d. All of the above  

9. Methods described in the case study include which of the following?  
a. A literature search that included a retrospective study  
b. A literature search that included a relationship to a care delivery model  
c. Both a and b  
d. None of the above  

10. Which of the following safety behaviors was listed as number one of the top 10 patient safety issues?  
a. Preoperative checklists and anesthesia checklists to prevent operative mortality  
b. Interventions to improve prophylaxis for venous thromboembolism  
c. Both a and b  
d. None of the above  

Test answers: Mark only one box for your answer to each question. You may photocopy this form.

1. ☐ a   ☐ b   ☐ c   ☐ d
2. ☐ a   ☐ b   ☐ c   ☐ d
3. ☐ a   ☐ b   ☐ c   ☐ d
4. ☐ a   ☐ b   ☐ c   ☐ d
5. ☐ a   ☐ b   ☐ c   ☐ d
6. ☐ a   ☐ b   ☐ c   ☐ d
7. ☐ a   ☐ b   ☐ c   ☐ d
8. ☐ a   ☐ b   ☐ c   ☐ d
9. ☐ a   ☐ b   ☐ c   ☐ d
10. ☐ a   ☐ b   ☐ c   ☐ d

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AMERICAN ASSOCIATION of CRITICAL-CARE NURSES

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Program evaluation

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<th>Relevant to nursing practice</th>
<th>Effective for this content</th>
<th>Level of difficulty</th>
<th>Time to complete program</th>
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Certification Test Prep
What Would Dr Seuss Say?

I consulted with my first teacher and my first doctor—Dr Seuss, and I offer 5 quotes of inspiration from him for success on certification examinations.

“You can get help from teachers, but you are going to have to learn a lot by yourself, sitting alone in a room.”
“The more that you read, the more things you will know. The more that you learn, the more places you’ll go.”
“Unless someone like you cares a whole awful lot, nothing is going to get better. It’s not.”
“You have brains in your head. You have feet in your shoes. You can steer yourself in any direction you choose. You’re on your own, and you know what you know. And you are the guy who’ll decide where to go.”
“Only you can control your future.”

Adult CCRN Practice Questions
1. A patient who received 4 units of packed red blood cells in the past 7 hours for an upper gastrointestinal (GI) bleed is now complaining of shortness of breath and generalized muscle cramping. Lung auscultation reveals inspiratory and expiratory wheezing. Which laboratory value would the nurse anticipate?

A. Potassium 4.7 mEq/L
B. Magnesium 2.1 mEq/L
C. Calcium 6.5 mg/dL
D. Sodium 131 mEq/L

Test plan topic: Renal and GI, Endocrine, Heme/Immune, Integumentary, 20% of the CCRN questions

2. On the second postoperative day following mechanical aortic valve replacement, a patient was started on warfarin and low-molecular-weight heparin. While reviewing the morning (AM) laboratory results on post-operative day 5,

<table>
<thead>
<tr>
<th>Post-operative day</th>
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<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin (Hgb), g/dL</td>
<td>8.3</td>
<td>9.0</td>
</tr>
<tr>
<td>Hematocrit (Hct), %</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>Platelets, x1000/μL</td>
<td>160</td>
<td>90</td>
</tr>
</tbody>
</table>

the nurse suspects that which of the following is developing?

A. Heparin-induced thrombocytopenia
B. Immune thrombocytopenia
C. Disseminated intravascular coagulation
D. Platelet destruction due to the mechanical valve

Test plan topic: Heme/Immune and Renal, GI, Endocrine, Integumentary, 20% of the CCRN questions

3. Three days following a unilateral nephrectomy, vital signs are temperature 38.5°C (101.3°F),
heart rate 95/min, blood pressure 88/40 mm Hg, respiratory rate 22/min, and oxygen saturation by pulse oximetry (SpO₂) of 94% on 2 L of oxygen via nasal cannula. The nurse should first anticipate administering a
A. Dopamine infusion
B. 30 mL/kg Normal saline bolus
C. 5% Dextrose (D5) 0.45 saline at 150 mL/h infusion
D. Norepinephrine infusion

Test plan topic: Multisystem, 14% of the CCRN questions

4. A patient with multiple injuries from a motor vehicle crash is admitted with a right flail chest, grade III liver laceration, and a right femur fracture. After mental status change, which of the following is the earliest sign of impending hypovolemic shock?
A. Systolic blood pressure < 90 mm Hg
B. Urine output < 30 mL/hour
C. Heart rate > 120/min
D. Respiratory rate < 20/min

Test plan topic: Multisystem, 14% of the CCRN questions

5. A patient with methicillin-sensitive *Staphylococcus aureus* pneumonia and respiratory failure has been receiving mechanical ventilation for 8 days. A new diastolic murmur at the second intercostal space near the right sternal border is auscultated by the nurse. This finding would be consistent with
A. Mitral regurgitation from a papillary muscle rupture
B. Aortic regurgitation from endocarditis
C. Tricuspid regurgitation from chordae tendini rupture
D. Pulmonic regurgitation from pulmonary hypertension

Test plan topic: Cardiovascular, 18% of the CCRN questions

Correct Answers and Rationales for Adult CCRN Practice Questions

1. Correct Answer: C
Rationale
Packed red blood cells contain a preservative called citrate that binds with the patient’s calcium, thereby lowering their ionized (though not their total) calcium. Hypocalcemia manifests as muscle cramping, tetany, and bronchospasm.

Sources

2. Correct Answer: A
Rationale
Heparin-induced thrombocytopenia (HIT) is an acquired allergy to heparin. The antibodies develop in response to heparin binding with platelet factor 4 (PF 4) protein. The antibodies decrease the number of circulating platelets. It typically takes 5 to 14 days for the antibody-antigen reaction to cause a decrease in platelet count. In HIT, the platelet count will decrease by either 50% or to less than 150 000/mm³. Immune thrombocytopenia (B) typically manifests with a platelet count of less than 20 000/mm³, in addition to petechiae and purpura. Disseminated intravascular coagulation (C) would have a decrease in both red blood cell and platelet count and is associated with both thrombosis and uncontrollable hemorrhage from multiple sites. Mechanical valves have a high risk of thrombogenicity and thrombosis and require lifelong anticoagulation (D).

Sources

3. Correct Answer: B
Rationale
The initial management for hypotension in septic shock is to administer 30 mL/kg of normal saline (NS) intravenously to increase intravascular volume and mean arterial pressure (MAP). D5 0.45 NS (C) is a hypotonic solution and is not indicated for fluid volume resuscitation. Norepinephrine (D) is the vasopressor of choice for hypotension (MAP < 65 mm Hg) in patients with sepsis who are refractory to isotonic fluid resuscitation. Norepinephrine provides both inotropic and vasoactive properties, but does not induce tachycardia as readily as dopamine does (A).

Source
4. Correct Answer: B
Rationale
All 4 assessment changes are possible in a patient in whom hypovolemic shock is developing. Change in level of consciousness (slightly anxious) occurs during class I shock. Low urine output (<30 mL/h) (B) and tachypnea (respiratory rate >20/min) first occur in class II shock (not D, which is <20/min). Tachycardia (C, heart rate >120/min) and hypotension (A) do not occur until class III shock.

Source
American College of Surgeons Committee on Trauma. Advanced Trauma Life Support Student Manual. 9th ed. Chicago, IL: American College of Surgeons; 2012.

5. Correct Answer: B
Rationale
The aortic valve is heard best at the second intercostal space (ICS) at the right sternal border. Aortic regurgitation (insufficiency) murmurs occur during diastole when the aortic valve leaflets are unable to close properly. The pulmonic valve (D) is heard best at the second ICS at the left sternal border. Pulmonic regurgitation murmurs also occur during diastole when the pulmonic valve should be closed. The mitral valve is heard best at the fifth ICS at the midclavicular line under the left nipple. The tricuspid valve is best heard at the fourth ICS near the left sternal border. Both mitral and tricuspid regurgitation murmurs occur during systole and result from inadequate valve leaflet closure.

Source

CSC Practice Questions
1. What electrolyte disorder is associated with the following electrocardiography (ECG) tracing?
   A. Hyperkalemia
   B. Hypokalemia
   C. Hypermagnesemia
   D. Hypomagnesemia

II. Other Patient Care Problems, F3. Renal–Life-threatening Electrolyte Imbalances, 24% of the CSC questions

2. A patient is being DDD paced at a rate of 90 beats per minute (bpm). The ECG monitor shows a heart rate of 70/min and occasional pacing spikes without a ventricular complex. Which intervention is the most appropriate?
   A. Increase the sensitivity
   B. Increase the output
   C. Decrease the sensitivity
   D. Increase the pacer rate

III. Interventions A4 Cardiovascular–Epicardial Pacing, 33% of the CSC questions

3. Following aortic valve replacement surgery for a stenotic valve, the assessment includes the following:
   Blood pressure (BP), 130/76 mm Hg
   Cardiac output (CO), 3.9 L/min
   Heart rate (HR), 90/min
   Cardiac index (CI), 1.8
   MAP, 90 mm Hg
   Systemic vascular resistance (SVR), 1641 dynes sec cm⁻⁵
   Central venous pressure (CVP), 10 mm Hg
   Venous oxygen saturation (SvO₂), 59%
   Pulmonary artery pressure (PAP), 34/18 mm Hg
   Urine output (UO), 20 mL/h
Which of the following interventions should the nurse anticipate performing first?
   A. Epinephrine infusion
   B. Furosemide 40 mg
   C. Intravenous (IV) fluid bolus
   D. Nitroprusside infusion

I. Cardiovascular Patient Problems, B6 Surgical Treatment of Valvular Disease, 33% of the CSC test questions

4. Six hours after coronary artery bypass graft surgery, the hemodynamic assessment includes
   BP, 78/37 mm Hg
   CO, 3.1 L/min
   HR, 100/min
   CI, 1.8
   MAP, 52 mm Hg
   SVR, 774 dynes sec cm⁻⁵
   CVP, 22 mm Hg
   Svo₂, 56%
   PAP, 24/14 mm Hg
These findings are consistent with the development of
   A. Cardiac tamponade
   B. Type II protamine reaction
   C. Left ventricular dysfunction
   D. Right-sided heart failure
5. Which of the following findings are indicative of cardiac tamponade?
A. Low cardiac output, high CVP, and low PA pressures
B. Tachycardia, low cardiac output, and low filling pressures
C. Wide pulse pressure, tachycardia, and low cardiac output
D. Hypotension, low cardiac output, and narrow pulse pressure

Correct Answers and Rationales for CSC Practice Questions

1. Correct Answer: B
Rationale
Hypokalemia is also associated with an increase in dysrhythmias that occur due to enhanced automaticity and a delay in ventricular repolarization such as flattened ST segments, U waves, premature ventricular contractions (PVCs), ventricular tachycardia, and ventricular fibrillation. Hyperkalemia (A) is characterized by peaked T waves. A prolonged PR interval and widened QRS complex are present in hypermagnesemia (C). Hypomagnesemia (D) produces prolonged QT intervals and peaked T waves.

Sources

2. Correct Answer: B
Rationale
The presence of pacing spikes without ventricular response indicates loss of capture and the need for more current to enable capture. Changing the sensitivity up (A) or down (C) would affect the ability of the pacemaker to sense intrinsic beats and will not affect the ability to capture. Increasing the pacing rate (D) will result only in more frequent pacing.

Source

3. Correct Answer: C
Rationale
Aortic stenosis leads to the development of left ventricular hypertrophy and diastolic dysfunction. Volume is beneficial despite high filling pressures in the “stiff” ventricle and is needed to improve left ventricular filling. Catecholamines such as epinephrine (A) often cause tachycardia and generally do little to improve cardiac output in patients with diastolic dysfunction. Diuresis would exacerbate hypovolemia (B) and worsen left ventricular (LV) filling. Vasodilators (D) may reduce diastolic pressure and cause tachycardia. Afterload reduction without adequate filling would cause a significant decrease in blood pressure.

Source

4. Correct Answer: D
Rationale
Right-sided heart failure is characterized by a high CVP (with elevated V waves), low or normal PAP, and low CO. A patient with cardiac tamponade (A) would have high (and classically equal) CVP, pulmonary artery diastolic pressure (PAD), and pulmonary artery occlusion pressure (PAOP). Type II protamine reaction (B) is an anaphylactic reaction resulting in vasodilatation and low SVR. A patient with left ventricular dysfunction (C) would have a high SVR.

Source

5. Correct Answer: D
Rationale
Cardiac tamponade causes low blood pressure and low cardiac output due to decreased preload. A narrow pulse pressure occurs because of the increased diastolic pressure to compensate for the low cardiac output and the external pressure on the heart decreases the ability of the ventricles to “relax.” The arterial pressure waveform shows pulsus paradoxus, characterized by a fluctuation of 10 to 15 mm Hg in systolic pressure with inspiration.
Low pulmonary artery pressures (A), low filling pressures (B), or widening pulse pressure (C) would not be consistent with a diagnosis of cardiac tamponade because the pressure from the fluid within the sac causes a diastolic plateau and narrow pulse pressure.

Source

AACN Certcorp publishes a study bibliography that identifies the sources from which items are validated. The document may be found in the AACN Certification exam handbook. The contributor of each question written for this column has listed the source used in developing each item. CCN
Q Is full-dose delivery the total volume delivered (eg, 250 mL) or does this also include the amount of overfill within an intravenous piggyback or the amount left in the infusion set? What is the best practice standard for the full delivery of medications via intravenous pump when only a primary bag

A Earnest Alexander, PharmD, and Amanda Zomp, PharmD, BCPS, reply:

In today's age of smart infusion pumps, a major focus has been placed on guardrails or limits on infusion rates, with predetermined drug concentrations, infusion rates, dose limits, and total volumes. Both safety and efficacy are key considerations for dose infusions. A great deal of focus is placed on safety, by limiting infusion rates to avoid toxic effects. There often is not as much focus on efficacy, in terms of defining what constitutes a full-dose delivery of intravenous medications.

The total volume for most intravenous piggybacks (IVPBs) with either 0.9% NaCl or 5% dextrose in water (D5W) as diluents includes a small amount (up to 10%) of manufacturer overfill within each diluent bag above the volume indicated on the bag. For example, a 100-mL bag will actually contain up to a total volume of 110 mL of diluent. This slight variation in volume is considered acceptable by Food and Drug Administration standards.¹ If additional volume of drug is added to the IVPB, without removal of excess diluent, the actual total volume will be increased further. In many instances, this overfill volume is not considered to affect efficacy. However, for some agents and scenarios, overfill and drug volume added should be accounted for or removed because the total volume administered must be more exact.

Because of overfill associated with IVPBs, residual volume inevitably remains at the conclusion of the infusion if a pump is programmed to infuse the stated volume on the bag (eg, 100 mL). Because a percentage of the medication was also mixed with that overfill volume, a small amount of the medication remains as well. In addition, if an IVPB is administered as a primary infusion, an amount of volume and drug will be left in the infusion set at the end of the infusion (15-20 mL depending on the infusion set).

The clinical significance of the amount of drug lost as residual volume is unknown. Studies that evaluate clinical outcomes associated with specific medication doses often do not report specific details of intravenous administration.
such as the type of infusion pump used, type of tubing used, or standard care regarding flushing tubing or using a carrier fluid. The clinical significance of residual volume or medication dose remaining in intravenous tubing varies depending on factors outlined in the Table: medication type, total volume of the dose, and specific population of patients. For example, medications with a narrow therapeutic index (eg, phenytoin [Dilantin], digoxin) can be dangerous if serum concentrations are too high or too low. If even a small percentage of the dose remains in the infusion set or is lost as overfill, the clinical significance would be higher than with another medication that has a wide therapeutic index (eg, levetiracetam [Keppra]).

An additional example was recently highlighted in a systematic review by Lam et al, who evaluated the effect of residual volume in intravenous tubing following extended infusion doses of piperacillin-tazobactam (Zosyn). Researchers calculated the percentage of piperacillin-tazobactam 3.375-g or 4.5-g doses that would be lost as residual volume in the intravenous tubing using 4 different intravenous infusion pumps. For a 3.375-g dose in 50 mL, up to 60% of the dose was lost, for a 3.375-g dose in 100 mL, up to 30% of the dose was lost, and for a 4.5-g dose, up to 30% of the dose was lost. Infusion pumps using microbore tubing resulted in significantly less drug lost (1%-15% of the dose). Despite the fact that clinical outcomes were not assessed in this study, the results suggest that processes may need to be developed to ensure that the full dose is delivered with extended infusion antibiotics such as piperacillin-tazobactam.

The Lippincott Manual of Nursing Practice suggests standards that advise following procedural guidelines for administering intermittent intravenous infusions, including cleaning the intravenous port before accessing, aspirating blood, flushing the catheter site, connecting intravenous tubing, administering the medication after reviewing the order and the patient’s allergies, infusing the medication at the prescribed rate, and flushing the catheter site after completion. The practice standards also describe the procedure for administering an IVPB as a secondary infusion; however, they do not address how to handle the residual volume in intravenous tubing when an IVPB is administered as a primary infusion.

In evaluating practice standards within 2 academic medical centers, some commonalities are noted. In children, patients receiving chemotherapy, and in instances with small-total-volume IVPBs (< 50 mL), the following steps are taken:

Step 1: 0.9% sodium chloride solution or other compatible carrier fluid is hung as the primary bag and used to prime the system.

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<th>Factor</th>
<th>Clinical significance and impact</th>
<th>Recommendation</th>
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<td>Type of medication</td>
<td>Precision of dose is important to optimize efficacy and minimize toxic effects</td>
<td>Precision should be used in delivering the full dose, as a standard of care</td>
</tr>
<tr>
<td>Chemotherapy (eg, oxaliplatin + fluorouracil)</td>
<td>Precision of dose is important to optimize efficacy and minimize toxic effects</td>
<td>Precision should be used in delivering the full dose, as a standard of care</td>
</tr>
<tr>
<td>Narrow therapeutic index (eg, phenytoin [Dilantin], digoxin)</td>
<td>Studies have highlighted residual waste concerns; however, this has not been associated with clinical outcomes</td>
<td>Process changes to minimize drug lost should be evaluated for feasibility</td>
</tr>
<tr>
<td>Extended infusion antimicrobials (eg, piperacillin-tazobactam [Zosyn])</td>
<td>Potential for a significant portion (up to 40%) of the dose to be lost if left as residual volume in the infusion set</td>
<td>Process changes to minimize drug lost should be evaluated for feasibility</td>
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<tr>
<td>Total dose volume</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 mL or less total volume (eg, clindamycin [Cleocin] premixed solution)</td>
<td>Precision of dose is important to optimize efficacy and minimize toxic effects</td>
<td>Precision should be used in delivering the full dose, as a standard of care</td>
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<tr>
<td>Population of patients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pediatric and neonatal (eg, small-volume pediatric syringes)</td>
<td>Precision of dose is important to optimize efficacy and minimize toxic effects</td>
<td>Precision should be used in delivering the full dose, as a standard of care</td>
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</tbody>
</table>
Step 2: IVPB is hung with the secondary tubing.
Step 3: Carrier fluid bag gets hung on a hook (usually supplied in the secondary tubing bag) so that it is lower than the IVPB that is hung on the intravenous pole.
Step 4: Program the pump in the secondary settings.
Step 5: Once the IVPB bag is empty, the pump will automatically pull from the carrier fluid bag so that it primes the IVPB fluid out of the tubing and into the patient.
Step 6: Carrier fluid is taken down after the IVPB is complete and the line is flushed.

A note of consideration is that both centers evaluated use Alaris smart pumps. As such, the secondary setting on the Alaris pumps limits infusion rates to no faster than 270 mL/h.

If none of the preceding factors are present to prompt concern related to clinically significant residual volume, no carrier fluid is necessary and no specific orders to flush/rinse the tubing at the end of the infusions are needed, so it is suitable to discard the residual volume left in the chamber or the tubing as waste. Infusions being administered via pump are considered empty and the full intravenous dose delivered when air is on the chamber and the pump stops.

Conclusion
Understanding the key characteristics that influence when a full intravenous dose has been delivered is important for bedside nurses. This understanding includes an appreciation of the clinical significance of residual volume remaining in intravenous sets after the total ordered volume has been infused. Studies in this area are limited, although practice patterns have emerged. In light of the paucity of data, further research is needed in order to provide more clear guidance. In most patient scenarios, residual volumes play a minor role. In a select few instances, residual volumes are more important. In these cases, certain steps may be taken to ensure that the full intravenous dose is delivered.

Financial Disclosures
None reported.

References

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Review Question

This review sought to determine the effects of glutamine supplementation in critically ill adults and after major surgery on infection rate, mortality, and other clinical outcomes, as well as to investigate potential heterogeneity across different patient groups and different routes of nutrition.¹

Relevance to Critical Care Nursing

Plasma levels of glutamine, a nonessential amino acid, are lower in patients who are critically ill or undergoing major surgery. Numerous clinical trials and a systematic review have provided evidence to suggest that glutamine supplementation may reduce infection and mortality rates in these patients. However, 2 recently published, large randomized clinical trials (RCTs) did not find any benefit of glutamine supplementation in critically ill patients.²,³ This review sought to include the most recent RCTs and evaluate all of the evidence in order to determine what impact glutamine supplementation may have on outcomes for critical care and major surgery patients.

Study Description and Results

Studies selected for this review included randomized or quasi-randomized controlled trials, excluding cross-over trials. Participants were adults with a critical illness or those undergoing elective major surgery. Any participants receiving prophylactic glutamine supplementation before surgery were excluded. The intervention of interest was glutamine supplementation via the parenteral or enteral route, whereas control groups received placebo or no intervention. Primary outcome measures included the number of infectious complications as well as 1- and 6-month mortality rates. Secondary outcomes included length of intensive care unit (ICU) and hospital stay, days of mechanical ventilation, side effects, and quality of life.

Two review authors independently screened abstracts, assessed full texts using a standardized data extraction form, assessed for risk of bias, and resolved any disagreements by discussion. Of the 89 full-text studies retrieved, 57 articles from 53 studies met inclusion criteria and were analyzed in the review (n = 4671 participants). The trials were grouped as follows: 19 studies on ICU patients with various diagnoses, 18 studies on patients undergoing abdominal, thoracic or laryngectomy surgery, 8 studies on burn patients, 7 studies on patients with acute pancreatitis, and 1 study on patients from ICU and other departments.

Author

Cass Piper Sandoval is a clinical nurse specialist in adult critical care at the Institute for Nursing Excellence, University of California San Francisco (UCSF) Medical Center and a certified Joanna Briggs Institute (JBI) Comprehensive Systematic Review trainer at the UCSF JBI Centre for Evidence-Based Patient and Family Care, San Francisco, California.

For questions related to this article, contact Cass Piper Sandoval at cass.sandoval@ucsf.edu.

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Dichotomous data were analyzed by calculating the risk ratio, along with number needed to treat when appropriate. Continuous data were analyzed as the difference between means. Heterogeneity was assessed by visual inspection of forest plots and with $\chi^2$ and I$^2$ statistics. If tests indicated no heterogeneity, a fixed-effect model meta-analysis was performed. If substantial heterogeneity existed, a random-effects model was used with cautious interpretation. Publication bias was assessed qualitatively using a funnel plot. All statistical tests were performed using RevMan software (version 5.2) and reported with 95% confidence intervals (CIs).

**Summary of Main Results**

- Pooled data on nosocomial infection rates showed that glutamine supplementation statistically significantly reduced infectious complications in critically ill or major surgery patients (33 studies: relative risk (RR) 0.79, 95% CI 0.71-0.87, $P < .001$) and that 12 patients needed to be supplemented to prevent 1 infection.
- Analysis showed no statistically significant difference between glutamine supplementation groups and controls in short-term mortality (36 studies: RR 0.89, 95% CI 0.78-1.02, $P = .10$) or long-term mortality (11 studies: RR 1, 95% CI 0.89-1.12, $P = .94$).
- Subgroup analysis of infectious complications and mortality outcomes did not find any statistically significant differences between elective surgical patients and critically ill patients, in patients with malignant versus nonmalignant disease, or in patients receiving enteral versus parenteral supplementation.
- Hospital length of stay was statistically significantly shorter in the supplementation group than in controls (36 studies: mean difference [MD] -3.46 days, 95% CI -4.61 to -2.32, $P < .001$). ICU stay was slightly longer in the glutamine-supplemented group (22 studies: MD 0.18 days, 95% CI 0.07-0.29, $P = .002$).
- Days of mechanical ventilation were found to be slightly shorter in the intervention group than in the control group (14 studies: MD -0.69 days, 95% CI -1.37 to -0.02, $P = .04$).
- There was no clear evidence indicating a difference between the groups for side effects and quality of life, as evidence on side effects was mixed and different measures of quality of life were used.
- Sensitivity analysis of only studies that had low risk of bias found that glutamine supplementation had beneficial effects in reducing the length of hospital stay (8 studies: MD -2.9 days, 95% CI -5.3 to -0.5), with no statistically significant difference between the groups for all of the other outcomes.

**Nursing Implications**

The available evidence on glutamine supplementation in critically ill or major surgery patients should be interpreted with caution as many of the included studies were at high risk of bias and had moderate heterogeneity. Nonetheless, the review found moderate evidence that glutamine supplementation can reduce infection rates and days of mechanical ventilation, and lower quality evidence that supplementation with glutamine can reduce hospital length of stay.

There is no evidence that mortality, length of ICU stay, and incidence of side effects are affected by glutamine supplementation in these patient populations.

**Financial Disclosures**

None reported.

**References**

Managing patients experiencing alcohol withdrawal is resource intensive and clinically challenging for nurses. Severe alcohol withdrawal occurs in approximately 40% of intensive care unit (ICU) patients and significantly increases both ICU and hospital mortality. Nurses must be able to recognize the signs of alcohol withdrawal, assess the patient, and initiate proper treatment. Intensive care patients with a diagnosis of alcohol withdrawal syndrome typically require escalating doses of benzodiazepines, which may lead to intubation and mechanical ventilation for airway protection. Patients may experience prolonged ICU stays and complications may develop. Treating patients with severe signs and symptoms of alcohol withdrawal has a substantial impact on health care system personnel requirements, resources, supplies, and cost.

Project Identification
The medical ICU (MICU) at Maimonides Medical Center is a 20-bed unit that primarily provides care for elderly patients with sepsis and pneumonia. From September 2013 until February 2014, approximately 20% of patients admitted to the MICU had the diagnosis or a history of alcohol and/or polysubstance abuse with comorbid conditions and exhibited symptoms of withdrawal within 72 hours of admission. The nursing staff was exhausted, managing the withdrawal patients’ extreme agitation and confusion, keeping the patients safe, and preventing complications such as falls and injury to self and others. Furthermore, clinicians were inconsistent with management of the patients’ signs and symptoms, using various dosages and different types of medications such as benzodiazepines, sedatives, and hypnotics. When presented with the opportunity to participate in the American Association of Critical-Care Nurses (AACN) Clinical Scene Investigator Academy (CSI), a team of 4 nurses from the MICU chose to focus their project on this challenging population of patients.

Purpose and Goal of the Project
The purpose of our CSI project, entitled “Stop DTs, Fast D/C,” was to develop and implement a nurse-driven, evidence-based protocol that uses pharmacological and nonpharmacological interventions to manage patients with alcohol and/or polysubstance withdrawal. The goals of the project were as follows:

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• To implement early recognition and management of signs and symptoms of withdrawal by using the Richmond Agitation Sedation Scale (RASS)
• To decrease the severity of symptoms
• To decrease ventilator days
• To decrease complications such as patient falls, injuries, and ventilator-associated pneumonia
• To decrease the length of stay in the MICU

Before the project, the nursing staff did not use a standardized tool to measure patients’ agitation levels. After completing a literature review, the team selected the RASS as the tool to use for that purpose. Although the Clinical Institute Withdrawal Assessment of Alcohol Scale, Revised (CIWA-Ar) is a widely known alcohol withdrawal screening tool, the team thought that the CIWA-Ar was too complex to use and was incompatible with the current nursing workload. The team concluded that the RASS is considerably easier to use, is less time consuming, and does not require input from patients. In addition, the unit’s nurses were already using the RASS for patients receiving continuous intravenous sedation. Therefore, they were already familiar with how to use the RASS. The RASS scores range from +4 (for overtly combative patients) to -5 (for unarousable patients).5

**Action Plan**

The CSI team collaborated with physicians and pharmacists to develop an algorithm-based treatment plan (Figure 1), which

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**Figure 1** Algorithm for management of patients in alcohol or substance abuse withdrawal.
dealing with patients experiencing withdrawal, their understanding of the use of the RASS, and their perception of the care that these patients received (Figure 2). Six months of baseline data regarding the unit’s incidence of falls, tracheostomies, ventilator days, and length of stay also were obtained (see Table). Next, an audit tool was created to track patients admitted in alcohol withdrawal.

Figure 2 Percentages of staff answering “always” on surveys before (red) and after (green) the intervention.

Abbreviations: DT, delirium tremens; RASS, Richmond Agitation and Sedation Scale.

Table Patient data

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<thead>
<tr>
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<tr>
<td>Falls</td>
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<td>3</td>
<td>3</td>
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</table>

included early identification of patients in withdrawal through collection of a comprehensive medical history, as well as assessment and treatment of pain. The algorithm identified appropriate pharmacological management, pertinent laboratory and diagnostic tests, and most importantly, appropriate nursing interventions. The first step in the algorithm was hourly RASS monitoring to ensure that the dosage of medication was appropriate. Medication dosage was increased for a RASS score of +3 or +4 and medication dosage and frequency of administration were tapered for a RASS score of -3 to -5.

Baseline data were obtained before the algorithm was implemented. The nursing staff in the MICU completed a paper survey assessing their stress level when dealing with patients experiencing withdrawal, their understanding of the use of the RASS, and their perception of the care that these patients received (Figure 2). Six months of baseline data regarding the unit’s incidence of falls, tracheostomies, ventilator days, and length of stay also were obtained (see Table). Next, an audit tool was created to track patients admitted in alcohol withdrawal.
and collect data regarding use of the algorithm.

The team launched their project educating both day and night staff about the algorithm with a special breakfast and provided staff with giveaways such as bags, water bottles, pens, and penlights with the project slogan. Posters of the slogan and the algorithm were strategically posted within the unit. “Champions” from day and night shifts were solicited to assist with identifying patients, implementing the protocol, and data collection. Frequent re-education sessions were held to reinforce the proper use of the algorithm.

Results

The team implemented the project and collected data for 6 months, and the results were impressive! A postsurvey of the nursing staff reflected an increased understanding of the RASS tool, an increased use of RASS by nursing staff, and an increase in the nursing staff’s confidence level in managing patients experiencing withdrawal. The anxiety that nurses felt when assuming care for patients experiencing withdrawal decreased when the nurses were empowered with the autonomy of using the algorithm (Figure 2).

Patients’ outcomes were improved by implementation of a nurse-driven algorithm that standardized care of patients experiencing withdrawal. The number of patients experiencing withdrawal who required a tracheostomy decreased from 11 patients before the implementation of the project to 1 patient afterward, a 91% reduction. The number of falls in the MICU decreased 25% even with limited ancillary staff and one-to-one companions being used with patients at risk of falling. The mean length of stay in the MICU for patients experiencing withdrawal decreased 1.3 days and their hospital length of stay decreased a mean of 5 days. One year after project implementation, positive outcomes continue (see Table).

The CSI team continues to improve the project protocol on the basis of staff feedback. The RASS is now assessed for all patients in the MICU every 4 hours. An order set based on the algorithm was created with the help of the pharmacy and medical information systems departments for ease of order entry.

Clinical Implications

The goal of the CSI program is to empower staff nurses with the knowledge and support necessary to become clinician leaders and change agents whose initiatives positively influence both patient and organizational fiscal outcomes that can be easily scaled hospital-wide. As a result of the CSI Academy project, the nurses in the MICU at Maimonides Medical Center feel empowered to affect patient care proactively through the use of their nurse-driven alcohol withdrawal protocol. The project was successful and is ongoing in the unit. Because of the successful outcomes on this unit, the project is being translated to other areas within the hospital.

For more information on this project, please visit the AANC CSI database at www.aacn.org/csi. CCN

Financial Disclosures

None reported.

References


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In Our Unit highlights unique practices, innovations, research, or resourceful solutions to commonly encountered problems in critical care areas and settings where critically ill patients are cared for. If you have an idea for an In Our Unit article, send it to Critical Care Nurse, 101 Columbia, Aliso Viejo, CA 92656; e-mail, ccn@aacn.org.
ICU Liberation: The Power of Pain Control, Minimal Sedation, and Early Mobility

Reviewed by Linda Bell, RN, MSN

The Society of Critical Care Medicine has developed the ICU Liberation initiative that has many components. This book is just one piece of the full array of resources that have been developed around this topic. The goal of this project is to help decrease intensive care unit (ICU) length of stay and affect the unintended consequences of inadequately managed pain, oversedation, and immobility. This book first states the issues and then determines gaps in practice, how to measure improvement, and how to use tools to help achieve the intended goals.

A major strength of ICU Liberation is the interprofessional author list. The combination of physicians, nurses, advanced practice nurses, physical therapists, pharmacists, respiratory therapists, social workers, psychologists, and performance improvement specialists who contributed to content in specific areas of concern is impressive. It is clear that no one profession in the group can manage all aspects of patient care to achieve the goal of ICU liberation.

The content is rich with figures and tables that describe everything from respiratory flow waves to how to develop measurement tools. Chapters include examples of assessment tools; for example, the Need for Sleep chapter contains an ICU Sleep Assessment tool to use as a foundation for developing an assessment process in your unit. Additionally, each chapter has a list of references for evidence to support the recommendations in the content.

The benefit is that the content can be applied to any patient in the ICU, regardless of diagnosis. This book will help you monitor processes, quality, and outcomes in an organized and meaningful way. It provides a roadmap to help any unit achieve the goal of liberating their patients from the ICU.

Linda Bell is a clinical practice specialist at the American Association of Critical-Care Nurses in Aliso Viejo, California.

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Fast Facts for Evidence-based Practice in Nursing, 2nd edition

Evidence-based practice is always a difficult topic. The goal of this book is to provide a concise, easy-to-read overview of the process from determining the question you are trying to answer and doing a literature review. Two tables in the book are worth the price of admission: the guide to critiquing quantitative research and the guide to critiquing qualitative research. Reading the literature is not enough; nurses need to be knowledgeable consumers in order to use the evidence available.
Nurses encounter issues every day that could affect their future right to practice. This book is written in a question and answer format that addresses issues of practice authority and the nursing role, as well as issues related to the patient such as privacy, safety, and the ability to consent. Buppert also wades into the world of the electronic medical record to answer questions that have taken on a new context in the electronic world. Although primarily written as a resource for nurses in all roles, Buppert includes a short chapter on workplace financial issues that affect the nurse practitioner and the RN first assistant.

Lubkin’s Chronic Illness: Impact and Intervention, 9th edition

Chronic illness is a fact in the health care community. This book is divided into 2 sections: impact of chronic illness on patient and family and impact on the system. Many texts focus on specific disease management; however, this book focuses on the issues that face a patient and family with any diagnosis with long-term management needs, including spirituality and palliative care. In each chapter, the author introduces the topic, suggests interventions, identifies outcomes, and provides references for supporting evidence. CCN
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Los Angeles
Leadership Symposium: The Essence of Courageous Care
Date: February 27, 2016.
Place: UCLA Campus Carnesale Commons, Palisades Ballroom. Address: 251 Charles E Young Dr West, Los Angeles, CA 90095. Sponsor: AACN Chapter at UCLA.
Keynote Speakers: Karen McQuillan, Kathleen Vollman. Contact: Anna Dermenychyan. Phone: (818) 823-3943. E-mail: adermenychyan@mednet.ucla.edu. Fee: Early registration, $75; students, $45.

Date: March 14-18, 2016.
Place: Rio All-Suites Hotel and Casino.
Address: 3700 W Flamingo Rd, Las Vegas, NV 89103. Sponsor: Vickie Milazzo Institute. Keynote Speaker: Vickie L. Milazzo. Contact: Vickie L. Milazzo. Phone: (800) 880-0944. Fax: (713) 942-8075. E-mail: mail@LegalNurse.com. Website: www.LegalNurse.com. Fee: Varies. Credits: 25.3 CEUs (5-day seminar), 40 CEUs (online)

Florida
Plantation
41st Annual BCCAaN Spring Seminar
Date: April 2, 2016.
Place: Renaissance Hotel. Address: 1230 South Pine Island Rd, Plantation, FL 33324. Sponsor: Broward County Chapter of AACN. Keynote Speakers: Karen McQuillan, Mary Bylone, Douglas Houghton, Sheryl Gilson. Contact: Patty Kelly. Phone: (954) 722-8020. E-mail: pattykelly7@att.net. Fee: Before March 15, 2016: member, $75; nonmember, $100. After March 15, 2016: member, $100; nonmember, $125. Credits: 6.2 CEUs

Illinois
Itasca
2016 Midwest Critical Care Conference
Date: March 21-22, 2016.
Place: Eaglewood Resort and Spa. Address: 1401 Nordic Rd, Itasca, IL 60143. Sponsor: Northwest Chicago Area Chapter (NWACAC) of AACN. Contact: Jenny A. Zaker. Phone: (847) 309-0662. E-mail: zakerj46@gmail.com. Fee: TBD. Credits: TBD

Nevada
Las Vegas
Certification in Legal Nurse Consulting (5-Day Seminar and Online)
Date: March 14-18, 2016.
Place: Rio All-Suites Hotel and Casino.
Address: 3700 W Flamingo Rd, Las Vegas, NV 89103. Sponsor: Vickie Milazzo Institute. Keynote Speaker: Vickie L. Milazzo. Contact: Vickie L. Milazzo. Phone: (800) 880-0944. Fax: (713) 942-8075. E-mail: mail@LegalNurse.com. Website: www.LegalNurse.com. Fee: Varies. Credits: 25.3 CEUs (5-day seminar), 40 CEUs (online)

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Why did you become a nurse?
Because my mom worked in the health care field and I always knew I wanted to help people, nursing was the obvious choice for me.

What about your job as a nurse makes you happy?
My biggest joy is sharing what I know with new nurses and watching them grow. I often precept and mentor new nurses in our critical care setting. I work closely with them for an extended period, and then celebrate as they flourish in our unit.

Tell us about an extraordinary experience you’ve had as a critical care nurse.
A 14-year-old girl needed a large-bore hemodialysis catheter placed emergently at the bedside. She was frightened and in severe respiratory distress from a hemorrhagic process in her lungs. The attending physician was concerned about intubating her and wanted to place the catheter with no sedation or pain medication. The girl was prepped and draped for the procedure, and I stayed under the drapes with her. I explained what was going on, and we held hands and sang Katy Perry songs. The catheter was inserted, secured, sutured, and dressed with no sedation. Her courage amazed me, and it was so rewarding to be able to keep her calm and distracted. We developed a close relationship, and I cared for her and her family throughout her stay in the pediatric intensive care unit.

What are the challenges you encounter and how do you overcome them?
One of the biggest challenges is the overwhelming amount of documentation required when caring for my patients. At times, it feels as if I spend more time in front of the computer than giving hands-on care. When I get behind in my charting, I ask a colleague to watch my assignment so I can catch up. I have a great group of coworkers and we help each other out when needed.

What has your journey as a nurse been like?
I started my career in a pediatric intensive care unit. I had fantastic preceptors and mentors and I received a wonderful foundation. I relocated and have been at the same hospital for the last 27 years. I have advanced training in the care of pediatric trauma patients, pediatric medical and surgical patients, kidney transplant patients, and open-heart surgery patients. My strength is working with grieving families, and I’m interested in pursuing training in palliative care in the future.

At the end of a busy day, how do you find balance in your life?
I live 1 hour away from the hospital. The drive home is my time to decompress. I rehash the night’s events and by the time I pull into my driveway, I’m ready to enjoy my home and my family.

What would we be surprised to know about you?
I have never had a massage!

How has AACN played a role in your career?
I’m proud to be a certified nurse through AACN, and I encourage and support my colleagues to do the same. I’ve attended NTI in several cities and always return re-energized. I was humbled to be recognized by AACN for the Circle of Excellence Award in 2008 for my role as a preceptor. This honor has truly been the highlight of my career. CCN

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