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EDITORIAL

The right position at the right time: mobility makes a difference

''Teach us to live that we may dread unnecessary time in bed. Get people up and we may save our patients from an early grave'' (Asher, 1947). In a 1947 article published in the British Medical Journal, Dr Asher made that statement. However, it has taken a long time for the science of positioning to be seen as a treatment modality in caring for acute and critically ill patients. For a number of years, nurses have recognized that positioning prevents skin breakdown, mobilizes secretions and provides comfort without identifying the impact different types of positioning strategies have on pulmonary gas exchange, ventilator weaning outcomes and the prevention of de-conditioning in survivors of intensive care. The importance of positioning as a priority of practice is challenged in a high technology based environment. In a study looking at positioning of critically ill patients over an eight-hour time period only 2.70% achieved every two-hour position change and 49.5% never moved during an eight-hour period (Krishnagopalan et al., 2002). Critical care nursing has a problem and the solution rests in increasing awareness of the importance of positioning on short and long-term patient outcomes. If nursing does not pay attention to this care activity often it does not get done.

We know that the primary function of the lung is to perform gas exchange. In order for gas exchange to take place, the air distributed in the lungs has to match up with perfusion. Body position/gravity and lung injury influence this ventilation/perfusion match. Science has told us that if we aren't standing upright, sitting straight up is the next best position to breathe if our lungs are in fairly good health (Bryan et al., 1964; West, 1985). When we are hospitalized, especially during the immediate phase of a critical illness our bodies cannot tolerate sitting upright because of the effect on our cardiovascular system. Often these patients have limited self-movement because of their disease, treatment or medications being administered. As a result, alternative strategies for body position must be used to benefit gas exchange and prevent the development of hospital-acquired pneumonia.

What impact does a stationary supine position have on the lung? In a supine position approximately 17% of the lung tissue rests under the compression forces of the heart exerting pressure on the lung tissue. The effect is a more positive pleural pressure resulting in collapse of the alveoli. The amount of lung tissue susceptible to this force can increase up to 37% depending on the size of the heart (Malbouisson et al., 2000). Another factor contributing to lung mechanics while in the supine position are the abdominal contents and their relationship to the diaphragm. In spontaneous healthy breathing, in the supine position, the diaphragm will act as a shield against the pressure exerted by the abdominal contents preventing those contents from interfering with dependent air distribution. In individuals who are sedated and/or have lung injury and/or receiving mechanical ventilation in the supine position, a significant amount of pressure is exerted on the diaphragm by the abdomen. This causes the dependent sections of the lung not to expand the way they are supposed to resulting in less air in the lungs at end of expiration to match up with perfusion and exchange oxygen (Froese and Bryan, 1974). It appears that the larger the abdomen the greater the effect is on air exchange.

In a study design to determine the best position to facilitate breathing in patients with large abdomens, researchers discovered that sitting upright at a 90° angle, once thought to be the best position to breathe in while in bed, did not work well for patients with large abdomens. They discovered that patients with large abdomens actually breathe better when the head of the bed was at 45° and the

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bed was placed in what is called the reverse trendelenburg or lowering of the leg and feet area. This 'drop down' of the abdomen results in less pressure being exerted on the lungs (Burns et al., 1994). It is clear that in the 21st century the equipment we use in managing hospitalized patients must be technically smart and have the versatility to meet multiple clinical needs.

Positioning therapies have been targeted to meet specific lung pathology. The literature has demonstrated conclusively that if a patient experiences a consolidated type pneumonia in one lung, that positioning with the good lung down will result in better oxygenation (Zach et al., 1974). What position would be best for patients with bilateral lung disease? That determination is made based on the severity of the patients lung disease and critical illness. For a large number of patients, turning every two hours is not enough to preserve the oxygenating ability of the lungs or to prevent pneumonia (Ray et al., 1974). Many hospitals use a bed that provides a therapy called continuous lateral rotation (CLRT) when caring for critically ill patients who are at risk of pneumonia or currently have lung injury. The bed provides on average six to eight complete full body left-center-right turns every hour. An effective turn is when one lung is above the other. The research dictates that patients should be rotated greater than 18 hours a day to achieve maximum benefit (deBoisblanc et al., 1993; Choi and Nelson, 1992; Fink et al., 1990; Gentilello et al., 1988; Kel- ley et al., 1987; Sahn, 1991; Summer et al., 1989).

One way to describe the physiology of continuous motion is to consider a patient's acutely injured lungs when lying stationary in a supine position to be like a glass of swamp water. All the solute settles at the bottom. In the lungs, all the fluid and bacteria settle in the dependent area where gravity places the best blood flow. As a result, this leads to a mismatch of ventilation to perfusion. If you were to shake the glass of swamp water the solid part would break up and move around. In the lungs, this motion helps redistribute the fluid and bacteria for easier removal by suctioning as well as making it easier for exchange gas. There have been a significant number of studies that have examined the benefits of continuous lateral rotation therapy (Anzueto et al., 1997; Choi and Nelson, 1992; deBoisblanc et al., 1993; Fink et al., 1990; Gentilello et al., 1988; Kelley et al., 1987; Kirschenbaum et al., 2002; Sahn, 1991; Summer et al., 1989; Traver et al., 1995; Whitman et al., 1995). Although the studies have small sample sizes and some methodological difficulties, most studies have reached similar conclusions. This therapy when used correctly reduces the incidence of atelectasis, nosocomial pneumonia, time on a mechanical ventilator and stay in an ICU making it very beneficial and cost effective.

A barrier to the use of various positions as a part of pulmonary treatment is haemodynamic instability experienced when attempting to turn a critically ill patient. Haemodynamic instability in critically ill patients during turning may occur as a result of spending prolonged lengths of time in a stationary position. A lessening of the carotid-cardiac baro-reflex responsiveness is caused by prolonged bed rest and correlates with orthostatic hypotension and syncope (Convertino et al., 1990). Head motion alone can reduce baroreflex response by 30% causing a reduction in heart rate. When individuals change their gravitational reference from a lying to sitting position the body goes through a series of physiological adaptations to maintain cardiovascular homeostasis (Convertino et al., 1997). Critically ill patients may experience a similar adaptation when turning laterally or moving into a prone position. With changes in gravitational plane (position change) the stretch receptors read the shift in plasma volume and respond by sending information to the autonomic nervous system to constrict the vasculature (Doering, 1993). Astronauts, as an example, must adapt to changes in gravity in order to maintain an effective circulating volume. Training is done to assure tolerance of gravitational changes on baroreflex and vestibular response. This assures the astronauts cardiovascular adaptation in space. A similar mechanism may be important in critically ill patients. If we train them to turn by preventing prolonged gravitational equilibration in a stationary position for extended lengths of time, less instability with position changes may result. Commonly, patients are unstable when turned following long intervals in a stationary position in the Operating Room, Emergency Room, and CAT (Computerized Axial Tomography) scan. Such patients may benefit from training with rotational therapy. In addition to the stretch receptors, the vestibular system influences many components of the autonomic nervous system. Important sympathetic and parasympathetic stimuli regulate cardiovascular function during movement and change in posture (Convertino et al., 1997). A manual turn is usually accomplished rapidly making vestibular adjustment much more difficult. This is in contrast to the slow rolling motion associated with rotational therapy. This may serve as another reason to choose rotational therapy as a method for training the critically ill patient to tolerate turning so it is no longer a barrier to position therapy.

So when is the correct time to discontinue CLRT therapy? Would it be correct to leave patients rotating until they are up on their feet again? A good rule of thumb for discontinuing the therapy is when the patient no longer meets the clinical criteria that resulted in the therapy being initiated. In addition, if a patient can be mobilized safely into an upright and/or chair position, they now have other mobility options to facilitate secretion removal and promote gas exchange. Florence Nightingale wrote in Notes on Nursing that ''whatever a patient can do for themselves, it is better ... less anxiety'' (Nightingale, 1992). Completely controlling a patient's body position may be necessary in the critical phase of their illness but extending that beyond the appropriate time may result in feelings of powerlessness and ultimately delay healing because of a perceived lack of control. So how do we successfully progress our patients towards more independent function through mobility? We can combat the physical de-conditioning that occurs with bed rest by using a stepwise mobility progression program. Once the patient's cardiovascular system is able to tolerate the head of bed higher than 45° we begin the program. The goal during all phases of the patient's illness is to maintain a head elevation at 45° to reduce the risk of aspiration and help prevent ventilator associated pneumonia (Drakulovic et al., 1999). Some patients experience haemodynamic instability when the head of the bed is elevated in comparison to the supine position. The cause of this instability may be related to a reduction in cardiac output created by the position change (Dalrymple et al., 1979; Russell, 1981). Another challenge to implementing the head of bed research occurs when practitioners must take into account the impact of significant sheering and friction on the skin that has been demonstrated with head elevations above 30° (WOCN, 2003). The risk benefit profile of decreasing the risk of pneumonia versus haemodynamic instability and/or decreasing the risk of skin breakdown must be considered. Once the patient is able to physiologically tolerate higher than 45°, the goal is to progress to stepwise increases in the head of the bed, followed by placing the legs in a dependent position. If this is tolerated, dangling of the legs followed by weight bearing should begin as soon as possible. An increase in general muscle strength will ultimately help with liberating a patient from the ventilator.

Methods and equipment that support this stepwise mobility progression are essential in order to meet the physiological demands of the healing process. This will allow nurses and physiotherapists to ''do the right thing'' with minimal use of manpower. Mobility is a fundamental nursing activity that requires in-depth knowledge and skill to effectively apply to critically ill patients. It does not require a physician's order to initiate. When mobility is a core component of care it helps with secretion management, reducing feelings of powerlessness, preventing muscle wasting, improving gas exchanging and decreasing the incidence of atelectasis and ventilator associated pneumonia. Matching the right time of the illness to the right positioning strategy will help to achieve positive patient outcomes. We have a unique opportunity as nurses to non-invasively impact our patient's outcome through the independent activity of ''turning''.

References

Anzueto A, Peters JI, Seidner SR, Cox WJ, Coalson JJ. Effects of continuous bed rotation and prolonged mechanical ventilation on healthy, adult baboons. Crit Care Med 1997;25:1560–4.

Asher RAJ. The dangers of going to bed. Br Med J 1947;4:967.

Bryan AC, Bentivoglio LG, Beerel F, MacLeish M, Zidulka A, Bates DV. Factors affecting regional distribution of ventilation and perfusion in the lung. J Appl Physiol 1964;19:395–402.

Burns SM, Egloff MB, Ryan B, Carpenter R, Burns JE. Effect of body position on spontaneous respiratory rate and tidal volume in patients with obesity, abdominal distension and ascites. Am J Crit Care 1994;3:102–6.

Choi SC, Nelson LD. Kinetic therapy in critically ill patients: combined results based on meta-analysis. J Crit Care 1992;7:57–62.

Convertino VA, Doerr DF, Eckberg DL, Fritsch JM, Vernikos-Danellis J. Head-down bed rest impairs vagal baroreflex responses and provokes orthostatic hypotension. J Appl Physiol 1990;68:1458–64.

Convertino VA, Previc FH, Ludwig DA, Engelken EJ. Effects of vestibular and oculomotor stimulation on responsiveness of the carotid-cardiac baroreflex. Am J Physiol 1997;273:615–22.

Dalrymple GE, MacGowan SW, Maclead GF. Cardiorepiratory effects of sitting position in neurosurgery. Br J Anaesth 1979;51:1079–81.

deBoisblanc B, Castro M, Everset B, Ghender J, Walker C, Summer W. Effects of air-supported, continuous, postural oscillation on the risk of early ICU pneumonia in nontraumatic critical illness. Chest 1993;103:1543–7.

Doering LV. The effect of positioning on hemoynamics and gas exchange in the critically ill: a review. Am J Crit Care 1993;2:208–16.

Drakulovic MB, Torres A, Bauer TT, Nicolas JM, Nogue S, Ferrer M. Supine body position as a risk factor for nosocomial pneumonia in mechanically ventilated patients: a randomised trial. Lancet 1999;354:1851–8.

Fink M, Helsmoortel CM, Stein KL, Lee PC, Cohn SM. The efficacy of an oscillating bed in the prevention of lower respiratory tract infection in critically ill victims of blunt trauma. Chest 1990;97:132–7.

Froese A, Bryan AC. Effects of anaesthesia and paralyses on diaphragmatic mechanics in man. Anesthesiology 1974;41:242–55.

Gentilello L, Thompson DA, Tonnesen AS, Hernandez D, Kapadia AS, Allen SJ, et al. Effect of a rotating bed on the incidence of pulmonary complications in critically ill patients. Crit Care Med 1988;16:783–6.

Kelley RE, Vibulsresth S, Bell L, Duncan RC. Evaluation of kinetic therapy in prevention of complications of prolonged bed rest secondary to stroke. Stroke 1987;18:638—42.

Kirschenbaum L, Azzi E, Sfeir T, Tietjen P, Astiz. Effect of continuous lateral rotational therapy on the prevalence of ventilator-associated pneumonia in patients requiring long-term ventilatory care. Crit Care Med 2002;30:1983-6.

Krishnagopalan S, Johnson W, Low LL, Kaufman LJ. Body position of intensive care patients: clinical practice versus standards. Crit Care Med 2002;30:2588—92.

Malbouisson LM, Busch CJ, Puybasset L, Cluzel P, Rouby JJ. Role of the heart in the loss of aeration characterizing lower lobes in acute respiratory distress syndrome. Am J Respir Crit Care Med 2000;161:2005—12.

Nightingale F, 1992. Notes on nursing. Philadelphia, PA: J.B. Lippincott.

Ray JF, Ost L, Moallem S, Sanoudos GM, Villamona P, Parades RM, et al. Immobility, hypoxemia and pulmonary arteriovenous shunting. Arch Surg 1974;109:537—41.

Russell WJ. Position of patient and respiratory function in immediate post operative period. Br Med J 1981;283:1079—80.

Sahn SA. Continuous lateral rotation therapy and nosocomial pneumonia. Chest 1991;99:1263—7.

Summer WR, Curry P, Haponik EF, Nelson S, Elston R. Continuous mechanical turning of ICU patients shortens length of stay in some diagnostic-related groups. J Crit Care 1989;4:45—53.

Traver G, Tyler M, Hudson L, Sherrill D, Quamm S. Continuous oscillation: outcome in critically ill patients. J Crit Care 1995;10:97—103.

West JB. Respiratory physiology: the essentials. Baltimore: Williams & Wilkins; 1985

Whitman K, Nachtmann L, Kramer D, Sereika S, Bierman M. Effects of continuous lateral rotation therapy on pulmonary complications in liver transplant patients. Am J Crit Care 1995;4:133—9.

Wound, Ostomy, and Continence Nurses Society (WOCN). Guideline for prevention and management of pressure ulcers. Glenview (IL): Wound, Ostomy, and Continence Nurses Society (WOCN); 2003. 52 p. [WOCN clinical practice guideline; no. 2].

Zach MB, Pontoppidan H, Kazemi H. The effects of lateral positions on gas exchange in pulmonary disease. Am Rev Respir Dis 1974;110:149.

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