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Lynn Schallom, Norma A. Metheny, Jena Stewart, Renée Schnelker, Janet Ludwig, Glenda Sherman and Patrick Taylor

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SHORT COMMUNICATION

**EFFECT OF FREQUENCY OF MANUAL TURNING ON PNEUMONIA**

By Lynn Schallom, RN, MSN, CCNS, CCRN, Norma A. Metheny, RN, PhD, Jena Stewart, RN, MSN, CS, M-SCNS, CCRN, Renée Schnelker, RN, GM-SCNS, Janet Ludwig, RN, MSN(R), CS, Glenda Sherman, RN, MSN, and Patrick Taylor, RN, BSN. From St Louis University School of Nursing (LS, NAM, JS, RS, JL, GS, PT), St Louis, Mo.

Clinicians have long recognized that patients should be turned at least every 2 hours.1 In fact, routine turning of critically ill patients is viewed as a standard of care to prevent pneumonia.2 Although a 2-hour manual turning schedule is widely embraced in theory, it is unclear if it alters pulmonary function3 or if it is uniformly practiced. In a study4 of 74 critically ill patients from 3 hospitals, only 2 patients had position changes every 2 hours. Even if a 2-hour turning schedule is enforced, it is unclear if this frequency of turning would be sufficient to prevent pulmonary complications.5

Although Traver et al6 found no difference in the incidence of pneumonia between patients cared for on oscillating beds and patients who had manual turning every 2 hours, other investigators3 found that kinetic therapy beds were superior to manual turning in reducing pulmonary complications in critically ill patients. Whether the benefit derived from kinetic therapy beds is due to the frequency of turning or to a turn angle of 40° or greater is not clear. Despite the efficacy of kinetic therapy beds, it is doubtful that they can be made available to all patients who might need them. Thus, the extent to which manual turning, which presumably is available to most patients, can prevent pulmonary complications warrants further study.

The objective of this descriptive study was to compare the frequency of bihourly turning in critically ill tube-fed patients receiving mechanical ventilation in whom pneumonia did or did not develop after 3 consecutive days of data collection.

**Methods**

The study was approved by the appropriate institutional review body and was carried out in accordance with the standards set forth in the Helsinki Declaration of 1975. The study reported here is a component of a larger project designed to determine the frequency of aspiration and pneumonia during the first 3 days of tube feedings in critically ill patients receiving mechanical ventilation. For this segment of the larger study, 284 critically ill tube-fed patients receiving mechanical ventilation were recruited from a variety of intensive care units (trauma/surgery, neurosurgery/neuromedicine, general medicine, and cardiac medicine/surgery). Most (n = 279) patients had endotracheal tubes in place at the time of entry into the study; the remainder had tracheostomy tubes. A total of 176 patients had nasally inserted tubes, 96 had orally inserted tubes, and 12 had gastrostomy tubes. The patients’ mean age was 51.8 years (SE 1.1, range 18-95). More men than women participated in the project (60.6% vs 39.5%, respectively). Exclusion criteria were use of kinetic therapy beds and diagnosed pneumonia at the time of entry into the study.

For a period of 3 days, from 8 AM until midnight, a research nurse made hourly observations of the body positions of the 284 patients; thus, a total of 13,632 observations (48 x 284) were made. A turn was defined as movement from supine to either side, either side to supine, one side to the other side, or from the bed to a chair. No attempt was made to quantify the degree of each turn. None of the patients observed during the study was in the prone position.

Weight in kilograms was recorded for each patient at time of entry into the study. Levels of consciousness and sedation were measured 5 times daily for each of the 3 days (days 1-3). A pneumonia score was calculated at the end of the 3-day study period (day 4). Instruments used to make the measurements were as follows.

A version of the Glasgow Coma Scale modified for intubated patients was used to assess level of consciousness (possible scores, 3-15). The Vancouver

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Interation and Calmness Scale was used to measure the level of sedation. This scale was designed for patients receiving mechanical ventilation; the possible range of scores is 10 to 60 (the lower the score, the higher is the level of sedation). The Clinical Pulmonary Infection Score (CPIS), as described by Pugin et al, was used to assess for pneumonia; this scale uses a combination of 6 variables: oxygenation, body temperature, white blood cell count, radiographic evidence of infiltrates, cultures of tracheal aspirates, and volume/appearance of tracheal aspirates. Analysis of arterial blood gases was used to calculate the oxygenation component of the CPIS. The lowest possible score on the CPIS is 0, and the highest is 12; a score of 7 or greater is considered positive for pneumonia.

Turning frequency and data on individual components of the CPIS were collected by the research nurses. One full-time and 2 half-time nurses collected most of the data; however, an additional 10 nurses were hired to provide coverage for data collection (16 h/d, 7 d/wk) during the 2-year study period of the larger project. Each data collector underwent a 1-week training period; in addition, the project director observed all of the research nurses at frequent intervals to monitor the accuracy of data collection and reporting. The project director calculated all of the CPIS scores; she did not collect data.

Descriptive statistics were used to report the data. A 2-sample t test was used to determine the extent to which the frequency of turning during the 3-day observation period affected the pneumonia score on day 4. Nonparametric statistics and logistic regression were used to examine the effects of specific types of injuries and medication use.

Results

Although 23 bihourly turns were possible for each patient during the observation period, the mean number of turns observed per patient was 9.64 (SE 0.32, range 0-23). Patients included in the study were relatively dependent on others for repositioning; for example, the patients’ mean score on the Glasgow Coma Scale was 6.9 (SE 0.17), and the mean score on the Vancouver Interaction and Calmness Scale was 35.6 (SE 0.24), indicating a high level of sedation.

Pneumonia, as defined by a CPIS of 7 or higher, had occurred in 49% of the patients at the end of the 3-day study. CPIS values ranged from 0 to 6 (mean 4.25, SE 0.04) for the patients without pneumonia and from 7 to 12 (mean 7.71, SE 0.08) for the patients with pneumonia. Patients with pneumonia were turned less frequently (mean turns 8.67, SE 0.43) than were those without pneumonia (mean turns 10.62, SE 0.45; P = .003).

An attempt was made to determine if selected clinical factors such as degree of elevation of the head of the bed, frequency of supine positioning, type of injury, and use of paralytic agents influenced the relationship between frequency of turning and pneumonia. Mean elevation of the head of the bed was significantly lower in patients with pneumonia (21.9°) than in those without pneumonia (24.9°; P = .04). However, the relationship between frequency of turning and pneumonia remained significant when this variable was controlled for in the analysis (P = .01). The mean percentage of time that patients were in the supine position was significantly greater in those with pneumonia (72.6%, SE 1.6%) than in those without pneumonia (65.2%, SE 1.8%; P = .002). The supine position was used significantly more often in patients receiving vasopressors (P = .04) and in those with spinal cord injury (P = .007), pelvic fractures (P = .01), multiple fractures (P < .001), and elevated intracranial pressure (P = .02) than in patients without these characteristics. However, the relationship between frequency of turning and pneumonia remained significant when these variables were controlled for in the analysis (P = .01). Patients who received paralytic agents had a higher incidence of pneumonia than did patients who did not receive these agents (P = .02); however, when frequency of turning was controlled for in the analysis, the relationship between use of paralytic agents and pneumonia was not significant (P = .12). In summary, frequency of turning was independently related to the development of pneumonia.

Even after factors such as backrest elevation, supine positioning, and use of paralytic agents were accounted for, pneumonia was more likely to develop in patients who were turned less often.

Possible barriers to turning every 2 hours were examined. Although heavier patients and those who received vasopressors tended to be turned less often than were patients who weighed less or did not receive vasopressors, the differences were not significant. However, specific types of conditions, such as spinal cord injury (n = 30), pelvic fracture (n = 10), multiple extremity fractures (n = 26), and high intracranial pressure (n = 29), were associated with significant decreases in frequency of turning (P < .01). Also, the 84 patients who received a paralytic agent at least
once during the study period were turned less often than were the 200 who received no paralytic agents ($P < .001$). Patients with nasally inserted tubes were turned significantly more often than were patients with orally inserted tubes ($P = .05$). Possibly, the type of illness or injury influenced this finding; for example, 70.6% of the patients with orally inserted tubes had actual or suspected head injuries. The difference in frequency of turning between patients with nasally or orally inserted tubes and patients with gastrostomy tubes was not significant ($P = .24$).

**Patients who received paralytic agents were turned less often than were patients who did not receive paralytic agents.**

**Strengths and Limitations of the Study**

The major strength of the study was the large number of observations ($n = 13,632$) made on the 284 patients during the 3-day study period. A limitation was our inability to observe the frequency of turning between midnight and 8 AM. However, because the bedside nurses all worked 12-hour shifts, we were able to observe the evening nurses’ patterns of turning during the first 5 hours of their shifts. Most likely, these patterns were representative of their turning patterns during the 8 hours of missed observations. Another limitation was lack of precision in the CPIS in diagnosing pneumonia. Although many investigators have found the CPIS useful in clinical studies, others have cautioned that it has low diagnostic accuracy when compared with quantitative cultures of bronchoalveolar lavage fluid. Despite our efforts to control for the effect of selected clinical conditions on the relationship between frequency of turning and development of pneumonia, important interactions might have been missed. Finally, caregivers’ knowledge of patients enrolled in the study may have influenced the frequency with which turning was performed. However, because comparisons were limited to patients enrolled in the study, this factor most likely had no effect on the findings.

**Conclusions**

Findings from this study support the premise that the more frequently a critically ill patient is turned, the less likely pneumonia is to develop. Although turning is contraindicated in critically ill patients in some situations, most likely most patients can tolerate (and profit from) a regular turning schedule. Additional studies are needed to assess the most desirable frequency of manual turning to minimize pneumonia in critically ill tube-fed patients receiving mechanical ventilation. To reduce complications of immobility, critical care nurses need to address the barriers to turning.

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