

Nurses' accuracy in estimating backrest elevation



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Background. The Centers for Disease Control and Prevention (CDC) have recommended that the head of the bed of mechanically ventilated patients be elevated to between 30° and 45° to decrease the risk of ventilator-associated pneumonia (VAP). Compliance with this recommendation may be affected by nurses' knowledge of the recommendation and their accuracy in estimating the backrest elevation.

Objectives. To determine the difference between nurses' estimation of backrest angle and the actual measured angle; to determine the relationship between nurses' demographic characteristics and the accuracy of estimation; to determine nurses' knowledge of why this recommendation has been made.

Methods. A convenience sample of 39 nurses working in the selected ICUs of the study hospital was used. The angles of elevation were preselected in each area. Estimated angles were correlated with measured angles and this was correlated with demographic characteristics.

Results. Forty-two per cent of the nurses were accurate in their estimation of bedrest angle (correlation, 0.6232). Demographic characteristics had little effect on accuracy.

Conclusion. Nurses could benefit from assistance in accurately estimating backrest elevation angle, as well as from education regarding strategies to decrease the incidence of ventilator-associated pneumonia.

Elevating the backrest of ventilated patients has been associated with a decreased incidence of ventilator-associated pneumonia (VAP).¹ Backrest elevation is defined as the angle of the backrest height above the horizontal position.² Nurses play an important role in patient positioning but, as most intensive care units (ICUs) have no measurement instrument available, the degree of backrest elevation is usually determined by subjective assessment.

VAP is defined as pneumonia occurring more than 48 hours after endotracheal intubation. This affects 8 - 28% of mechanically ventilated patients.³ VAP independently contributes to morbidity and mortality, prolonged duration of mechanical ventilation, prolonged intensive care stay, and increased health care costs.⁴ Aspiration of gastric contents is thought to be a major mechanism in the development of VAP,⁵ and can even occur when the cuff of the endotracheal tube is inflated.⁶ A randomised trial evaluating the effect of

semirecumbent positioning on the risk of developing VAP demonstrated a threefold increase in patients treated in the supine position as opposed to those who were semirecumbent.¹ Pneumonia in the control group (supine) was strongly associated with the simultaneous administration of enteral feeding. In critically ill patients with an intact gastrointestinal tract, early initiation of enteral feeding has become standard practice as it is thought to preserve gut integrity and is associated with less nosocomial infection and shorter ICU stay.⁷

Having considered the study results of Draculovic *et al.*,¹ the Centers for Disease Control and Prevention (CDC) recommended that the head of the bed of mechanically ventilated patients be elevated between 30° and 45° in order to decrease the risk of aspiration and therefore of VAP.⁸ Van Nieuwenhoven *et al.*,⁹ in an attempt to validate the findings of the Draculovic *et al.*¹ study, compared an intended backrest elevation of 45°

with the standard backrest elevation of 10° and found that the rates of VAP between the two groups did not differ. These findings raised questions not only about the optimal angle of backrest elevation for ventilated patients, but whether the desired elevation had actually been achieved in the previous trial. Despite its being a relatively simple intervention, many studies have shown that the recommended elevation is often not achieved.⁹⁻¹¹ Until conclusive evidence about optimal angle of backrest elevation is available, it has been suggested that nurses maintain mechanically ventilated patients at the highest elevation possible.¹²

The angle of backrest elevation may be influenced by the nurses' knowledge as to why the recommendation was made and their accuracy in estimating the elevation. In addition to this, individual characteristics of the nurses responsible for patient positioning could play a role, such as the level of nursing education and years of ICU experience. The aims of this study were:

- to describe nurses' accuracy of subjective assessment of backrest elevation
- to correlate the accuracy of assessment with the individual characteristics of the nurses in this study.

The objectives were:

- to determine the difference between the nurses' estimation of the backrest elevation angle and the actual measured backrest elevation angle
- to determine the relationship between the nurses' demographic characteristics and the accuracy of their estimation of backrest elevation angle
- to determine nurses' knowledge of why the CDC made the recommendation that the backrest of ventilated patients be elevated.

Research methodology

A prospective, cross-sectional, descriptive study was undertaken to assess the accuracy with which nurses working in the ICU estimate the backrest elevation of the beds of mechanically ventilated patients.

Setting and sample

The study was conducted in selected ICUs of an academic hospital in Johannesburg.

Purposive sampling was used to select intubated patients being treated in the semirecumbent position. A convenience sample of nurses working in the selected ICUs on the study days was used.

Methodology

Ethics approval for the study was obtained from the Ethics Committee of the University of the Witwatersrand prior to commencing the study.

Permission to conduct the study was then granted by the hospital, the heads of the selected ICUs and the nursing managers of these units. All ICU nurses who were responsible for positioning mechanically ventilated patients were invited to take part in the study. Following an explanation of the purpose of the study, the nurses consenting to participate received an information letter and gave signed consent. It was decided to exclude from the study any estimations that were inaccurate by more than 45°.

Data were collected between 11h00 and 12h30 on the study days as routine procedures such as endotracheal suctioning and dressings had usually been completed by this time. The backrest angle of purposively selected mechanically ventilated patients was measured at the breakpoint of the bed frame using an angle finder. Backrest elevation was defined as the angle that the head of the bed was elevated above horizontal and was expressed in degrees. All bed frames chosen were horizontal as measured with a spirit level. The measurements were taken by only one investigator to ensure consistency. The backrest angle was recorded on the data capture sheet as the actual measurement of backrest elevation. The participants' estimation of backrest elevation was then recorded together with their reason/s for the recommendation that the backrest of mechanically ventilated patients be elevated to between 30° and 45°. Accuracy of bed angle to within 5° was accepted by the researchers, as the clinical significance of absolute accuracy is questionable.

The researchers undertook to give feedback to the ICUs that participated in the study

Data analysis

Descriptive statistics were used to summarise the characteristics of the study participants, the accuracy of participants' estimations and the reasons why patients should be treated in the semirecumbent position. Inferential statistics in the form of correlational analysis was performed to examine the relationship between participants' accuracy of estimation and their demographic data. All data were entered on an Excel spreadsheet.

Results

Thirty-nine nurses participated in the study. As presented in Table I, the years of ICU experience of the nurses ranged from 1 month to 23 years with the mean being 5.5 years of experience. One participant failed to fill in her years of ICU experience. Thirty-two participants (82%) were employed by the study hospital and 7 (18%) were employed by private nursing agencies. Sixteen (41%) of the participants were ICU/trauma trained, 17 (44%) were registered nurses without ICU/trauma training and 6 (15%) were enrolled nurses. No auxiliary nurses took part in the study.

Table I. Demographic characteristics of the participants	
Characteristic	Finding
Years of ICU experience	
Range	1 month - 23 years
Mean	5.5 years
Employment	
Hospital	32 (82%)
Agency	7 (18%)
Qualifications	
ICU/trauma trained	16 (41%)
Registered nurses	17 (44%)
Staff nurses	6 (15%)

Three nurses were eliminated from the first part of the study as their estimation of angle of bed elevation was inaccurate by more than 45°. Fifteen participants (42%) were accurate in their estimation of backrest elevation to within 5° of the actual measurement. The constrained error average (i.e. accuracy to within 5° of measured angle was considered as zero error) was 10° (SD 10.05). All 21 (58%) participants who were inaccurate by more than 5° overestimated the angle of backrest elevation. The overall correlation (*r*) between the actual backrest angle and the estimated angle was 0.6232. There was a poor correlation between accuracy of estimation and years of ICU experience (*r* = 0.0990). Nursing staff permanently employed by the study hospital were more accurate in their estimations compared with those employed by private nursing agencies (*r* = 0.6883 v. *r* = 0.4783). There was a negative correlation between nursing qualification and accuracy of assessment. Those with the lowest qualification were more accurate than those with higher qualifications, i.e. staff nurses were more accurate than the registered nurses who were in turn more accurate than the ICU/trauma-trained nurses (*r* = 0.8413, 0.7490 and 0.2650 respectively) (Table II).

The responses of all 39 participants as to why the CDC had recommended that, unless contraindicated, the

backrest elevation of mechanically ventilated patients be maintained at between 30° and 45° were included in the study. Eleven participants (28%) indicated that the CDC recommendation was to prevent aspiration. Only one of these participants (3%) added that this requirement may decrease the risk of VAP.

Discussion

Thirty-six of the 39 participants were included in estimating the backrest angle. Fifteen (42%) nurses were able to accurately estimate the backrest angle to within 5° of accuracy. The remaining 21 nurses (58%) overestimated the backrest angle by more than 5° but less than 45°. In a study by Dillon *et al.*¹³ the majority of participants were able to accurately assess the angle of backrest elevation. This is in contrast to a more recent study by Peterlini *et al.*² where 85.1% of the angles of elevation were either over- or underestimated. Their study found that the majority of participants (61.6%) overestimated the angle of elevation. In our study, all of those who were inaccurate overestimated the angle of elevation. This may result in mechanically ventilated patients being maintained at angles lower than those recommended by the CDC, thus increasing the risk of aspiration and VAP. Maintaining patients at a lower than recommended angle appears to be a common finding.⁹⁻¹¹

The accuracy of estimation of backrest angle was not affected by the years of ICU experience or qualification of the participants, However, those permanently employed by the study hospital were more accurate in their assessments than the agency-employed nurses. These findings are consistent with the findings of both Dillon *et al.*¹³ and Peterlini *et al.*² where accuracy of estimation was not affected by the demographic characteristics of the participants. In both studies, this information included years of ICU experience.

The responses of all 39 participants pertaining to the reason for elevating the head of the bed in mechanically ventilated patients were analysed. Although 11 (28%) participants stated that maintaining mechanically ventilated patients at higher backrest elevations was to

Table II. Overall correlation between participant characteristics and their accuracy in estimating backrest elevation	
Variable	Correlation with accuracy
Years of ICU experience	<i>r</i> = 0.0990
Qualification	
• Registered nurses with ICU/trauma qualification	<i>r</i> = 0.2650
• Registered nurses with general training	<i>r</i> = 0.7490
• Staff nurses	<i>r</i> = 0.8413
Employment status	
• Permanent hospital staff	<i>r</i> = 0.6883
• Agency staff	<i>r</i> = 0.4783

prevent aspiration, only 1 said that this could decrease the incidence of VAP. Demographic data were not correlated with reasons given for elevating the head of the bed.

These results show that the nurses in this study could benefit from assistance in accurately estimating backrest elevations, as well as from education regarding strategies to decrease the incidence of VAP. This would allow evidence-based decisions to be made regarding the positioning of mechanically ventilated patients. Feedback to the ICUs included not only the results of the study but also help with identifying angles and distribution of literature regarding backrest elevation. A wooden template indicating a 45° angle was shown to the nurses in each unit. It was suggested that physicians prescribe the backrest elevation angle for the patient¹¹ and that a place be provided on the patient's chart where the nurse can record backrest elevation while doing routine observations.^{11,13} Furthermore, in-service training programmes could be organised to promote the awareness of ICU nursing staff to the benefits of the backrest angle intervention, particularly for those patients receiving enteral feeding, provided that there are no contraindications.

Introducing clinical recommendations requires modification of behaviour and the implementation strategy thus becomes as important as the recommendation itself.¹¹ Nurses, being the primary caregivers, require knowledge about clinical recommendations regarding patient care.

Limitations of this study include the relatively small sample of nurses and inability to generalise the study findings because data were collected in selected ICUs of only one hospital.

Conclusion

The aim of this study was to determine the accuracy with which nurses working in an ICU could estimate

the backrest elevation of mechanically ventilated patients and to assess whether they knew why these patients should be treated with a backrest elevation of between 30° and 45° as recommended by the CDC. The correlation between the actual measured angle and the ICU nurses' estimations of the backrest angle indicates that nurses working in the ICUs of the research hospital require assistance to enable them to accurately estimate backrest elevation. Although patient positioning is largely the domain of the bedside nurse, other medical personnel have a role to play in ensuring that patients are appropriately positioned. Furthermore, ICU nurses need to be encouraged to keep up to date with recommendations regarding patient care. It is to be hoped that this will result in patients receiving optimal care based on the best available evidence.

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