Semi-recumbent Position in ICU

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Abstract

Purpose: Positioning mechanically ventilated patients in an adequate semi-recumbent position is a low cost and apparently easy applied measure to prevent new VAP. We performed an unannounced audit to compare the actual backrest angle with the target backrest angle of 30-45 degrees, assess whether compliance was better in patients whose bed had a built-in bedside protractor, and document difficulties reported when failing to achieve the target backrest angle.

Methods: From 1/3/2007 to 30/6/2007, unannounced ad hoc inspections were made on patients receiving mechanical ventilation in the intensive care unit. During inspections, the angle of elevation of bed was formally measured by a manual technique using a hand-held protractor. The nurse at bed-side was also asked to estimate the angle of elevation of bed without referring to the built-in protractor and interviewed with a structured questionnaire.

Results: From 1/3/2007 to 30/6/2007, inspections were made on 295 occasions. The median angle of backrest elevation was 25 degrees (interquartile range [IQR]: 20 to 30 degrees). The median angle of elevation estimated by the nurse at the bed-side was 30 (IQR: 20 to 30 degrees), (p <0.001). Semi-recumbent positions meeting the 30 degree minimum target angle were observed on only 120 (41%) occasions. Reasons provided for failing to achieve the target angle included incorrect estimation of the backrest angle and interference of the semi-recumbent position with nursing procedures and nursing inconvenience.

Conclusions: This audit showed that the minimum target semi-recumbent position of 30 degrees was achieved only 40% of the time in an academic intensive care unit. Nurses at bedside consistently overestimated the angle of elevation of bed, and the presence of a built-in bedside protractor was not associated with a greater compliance with the target backrest elevation angle. Strictly enforced protocols, education programs for nurses and doctors and regular audit may improve compliance with backrest elevation targets.

Key words: “mechanical ventilation”, aspiration, “ventilator-associated pneumonia”, education, protocol.

Introduction

Ventilator-associated pneumonia (VAP) is a common complication occurring in patients in intensive care units. Positioning mechanically ventilated patients in an adequate semi-recumbent position is a low cost and apparently easy applied measure to prevent new VAP. Randomised controlled trials have demonstrated that, compared with supine position, mechanically ventilated patients positioned in the
A semi-recumbent position has been found to improve physiological parameters, reduce VAP rates, and improve patient comfort in mechanically ventilated patients. Surveys indicate an increase in the use of the semi-recumbent position since 2000, with high compliance rates reported in recent studies. However, there is limited data on the degree of compliance with guidelines.

Our ICU has a standing order to target a semi-recumbent position with a backrest angle of 30-45 degrees. To promote compliance, ICU beds are equipped with built-in protractors. An audit was conducted to measure the actual backrest angle, assess compliance, and document difficulties in achieving the target angle.

**Methods**

The Prince of Wales Hospital ICU is a 22-bed mixed medical and surgical unit. The medical staffing includes six intensivists, three intensive care trainees, and several junior trainees from other departments. Nurse staffing is one nurse per bed during the day and eighteen nurses for 22 beds at night. There are approximately 1400 admissions per year, with an average admission APACHE II score of 16.8 and a standardized mortality ratio (SMR) of 0.62. Since 2001, there has been a standing order to nurse all patients in the 30-45 degree head up position unless there are specific physician orders to the contrary.

**Statistics**

All analyses were performed using SPSS version 14.0. Comparisons were made using the Mann-Whitney U test, and statistical significance was defined as p ≤0.05.

**Results**

During the audit period, from 1/3/2007 to 30/6/2007, 295 inspections were conducted on patients receiving mechanical ventilation. The median angle of elevation measured by the hand-held protractor was 25 degrees, with an estimated angle of 30 degrees. Compliance with the target angle was only achieved on 120 occasions (41%). The nurse at the bedside was interviewed to assess difficulties in achieving the target angle.
with a built-in protractor. There was no significant difference in the measured angle of elevation with or without built-in protractor in patient's bed. The majority of observations 185 (63%) were made when patients were receiving enteral feeding. Although there was a trend towards a higher bed elevation in patients receiving enteral feeding, this difference did not reach statistical significance (p =0.13).

The frequency distribution of all observations is shown in Figure 1. The median angles of elevation measured by hand-held protractor in various patient groups are shown in Table 1. The main reasons provided by nurses for not achieving the ideal semi-recumbent position are shown in Table 2.

Discussion

This audit showed that the minimum target semi-recumbent position of 30 degrees was achieved only 40% of the time in our intensive care unit. Nurses at bedside consistently overestimated the angle of elevation of bed, and the presence of a built-in bedside protractor was not associated with a greater compliance with the target elevation angle. The presence of enteral feeding was also not significantly associated with an improved angle of bed elevation.

While the results of this unannounced audit are disappointing, they are not dissimilar to reported results from a recent randomized controlled trial of backrest elevation. In this study, the target backrest angle was 45 degrees, however, despite regular reminders from dedicated research nurses and labels at bedside, in the target semi-recumbent position could only be achieved 15% of the time [10]. The median angle of elevation achieved in our audit (25 degrees) was similar to that achieved in the intervention group of this study (28.1 and 22.6 degrees at day one and seven respectively). Although the control group was not supine, but inclined at 10 degrees or more, it is interesting to note that in contrast to a previous randomized controlled trial [2], this study did not show a difference in VAP rates between the intervention and control groups.

It appears surprising that despite documented guidelines, an apparently simple manoeuvre like a target semi-recumbent position is so difficult to achieve. There are however, several reasons that may explain this finding. Our nurses reported that the angle of elevation was often not achieved because of need for nursing procedures, perceived patient discomfort and technical reasons, such as concern regarding the use of femoral intravascular catheters. While there may be legitimate indications for the supine position, such as acute lumbar spinal injury or hypovolaemia in the acute phase, none of the reasons provided during the audit were considered medically justified by the audit officer and medical supervisor and this suggests that perceived nursing inconvenience is an important impediment to correct positioning. Nurse inconvenience has also been reported by others as being responsible for a failure to implement the semi-recumbent position [7], and this suggests that providing, or improving, explicit and detailed nurse education may have an impact on compliance.

Other barriers to achieving an appropriate head up position have also been identified. In a two recent studies it was reported that doctors tended to think that backrest position was the result of the preference of nurses whereas nurses tended to think that doctors were responsible for determining the patient’s position [7,11]. Other reported barriers include risk of decubitus ulcers, perceived haemodynamic instability, fear of the patient falling out of bed and a lack of beds suitable for facilitating the head up position [7,11]. A number of nurses could not provide any specific reason for not being able to maintain their backrests in semi-recumbent position. This might reflect lack of awareness of importance of semi-recumbent position for prevention of VAP and again stresses the probable need for educational intervention.

Another potential reason for the failure to achieve an adequate backrest position is that the angle of elevation was frequently overestimated by nurses at bedside. Two previous studies have also reported that angle of elevation was often overestimated by nurses and doctors in absence of proper measuring tool [12,13]. It is interesting that, in our audit, the target semi-recumbent position was not achieved more frequently even when there was built-in protractor in patient’s
bed. This finding is difficult to explain, but might reflect that our nurses were either not sufficiently aware of the importance of meeting the target backrest position or were unaware of the importance of use of objective measuring tool to ensure proper semi-recumbent position. To facilitate accurate measurement a recent study proposed the use of a novel device for the continuous electronic measurement of angle of backrest elevation [14].

The results of our audit also suggest that a standing order without a strict and supervised protocol for implementation does not ensure compliance with a target semi-recumbent position. A recent study showed that addition of standardized order for nurse to put patient in semi-recumbent position in computerized clinical information record system, requirement of the nurse to acknowledge the order electronically every 6 hours, and a nurse and doctor education program improved backrest angle compliance [15].

It should be noted that there is some debate about the best angle of backrest elevation to prevent VAP. While some degree of elevation from zero degrees is almost certainly required, the minimum elevation required to prevent VAP is uncertain. Although it is possible that a smaller angle is sufficient, currently a target of 30-45 degrees appears reasonable and in keeping with expert recommendations [4-6]. The frequency distribution of our observations suggests that we did not meet the minimum recommended backrest angle of 30 degrees in the majority of our patients (Figure 1).

Given the worrisome results of this audit and the results of other studies, how can we improve the rate of compliance with a target semi-recumbent position? It appears that simple measures such as standing orders and even the provision of built-in bedside protractors are not sufficiently effective, and therefore it is likely that a multi-dimensional program including education, protocol, audit and feedback is needed. This might include regular educational seminars that should be provided for nurses and doctors stressing the importance of achieving the target semi-recumbent position to maximize the prevention of ventilator-associated pneumonia. Formal protocols to guide the process of achieving target elevations should include the requirement to regularly use a measurement device such as a protractor for measuring angle of elevation. Regular documentation of angle of elevation on charts and need for handover the angle of elevation achieved during change of shifts should be enforced. Computerized clinical information systems may help in this situation. Audit in the form of unannounced inspections and feedback to individual health-care workers who fail to comply with protocols may also be important.
**Figure 1.** THE FREQUENCY DISTRIBUTION OF ALL OBSERVATIONS OF BACKREST ANGLE

![Frequency distribution of backrest angle](image)

**Table 1.** ANGLE OF BACKREST ELEVATION IN DIFFERENT PATIENT GROUPS

<table>
<thead>
<tr>
<th></th>
<th>Number of observations</th>
<th>Median of angle of elevation (Interquartile range)</th>
<th>Range of angle of elevation</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>295</td>
<td>25° (20°-30°)</td>
<td>10°-44°</td>
<td></td>
</tr>
<tr>
<td>Observations with protractor present</td>
<td>230</td>
<td>25° (20°-30°)</td>
<td>10°-44°</td>
<td>0.338</td>
</tr>
<tr>
<td>Observations with protractor absent</td>
<td>65</td>
<td>25° (20°-30°)</td>
<td>20°-30°</td>
<td></td>
</tr>
<tr>
<td>Observations on patients receiving enteral feeding</td>
<td>185</td>
<td>25° (20°-30°)</td>
<td>10°-44°</td>
<td>0.130</td>
</tr>
<tr>
<td>Observations on patients not receiving enteral feeding</td>
<td>110</td>
<td>25° (20°-30°)</td>
<td>10°-30°</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2.** NURSES’ EXPLANATIONS FOR NOT ACHIEVING AN ADEQUATE BACKREST ANGLE

<table>
<thead>
<tr>
<th>Main reasons</th>
<th>Number</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Incorrect estimation of angle of elevation</td>
<td>46</td>
<td>(26%)</td>
</tr>
<tr>
<td>Inconvenient because of need for nursing procedures</td>
<td>25</td>
<td>(14%)</td>
</tr>
<tr>
<td>No specific reason given</td>
<td>25</td>
<td>(14%)</td>
</tr>
<tr>
<td>Nurses perceived that patients were uncomfortable in semi-recumbent position</td>
<td>19</td>
<td>(11%)</td>
</tr>
<tr>
<td>Nurses believed that inserting pillows was adequate to achieve “semi-recumbent” positions</td>
<td>16</td>
<td>(9%)</td>
</tr>
<tr>
<td>Position contra-indicated because of use of femoral intravascular catheter</td>
<td>11</td>
<td>(6%)</td>
</tr>
</tbody>
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References