Endotracheal intubation is done many times a day in hospitals for patients who have or may have a problem with their airway. Once a patient is intubated, maintenance of the endotracheal tube is essential. In critical care units, the task of maintaining tube patency and placement is the responsibility of nursing and respiratory care professionals. For as long as patients have been intubated, the potential for unplanned removal of the endotracheal tube has been a source of concern. This concern has led nurses and other medical professionals to search for ways to decrease the occurrence of unplanned extubation.

Unplanned extubation is defined as any accidental or purposeful removal of the endotracheal tube by a patient.3 Because of a high rate of unplanned extubations—2.14% in the medical intensive care unit (MICU)/coronary care unit (CCU) and 2.32% in the surgical ICU (SICU)—at a tertiary care hospital in north central Wisconsin, a quality control committee was formed to address methods for decreasing the unplanned extubation rate and increasing awareness of the rate of unplanned extubations. The committee consisted of staff from respiratory therapy, clinical nursing, and nursing administration and a physician champion. As information and data were evaluated, the committee determined that although sedation and restraint were intermittently contributing factors to unplanned extubation, the techniques used for securing endotracheal tubes were the one factor that was consistently a problem. Staff members were using several different techniques to secure patients’ endotracheal tubes. Some patients had tube holders from other facilities that were unfamiliar to the staff; other patients had different methods of taping and products used. Some patients had their tube secured around their head; others had tape adhered to their bare skin.

Because of the identified inconsistencies, the committee developed a plan to educate the nursing and respiratory care staff. The education consisted of training in new securing techniques, heightening awareness of patients’ activity levels, and improving knowledge about patients’ readiness for extubation. In this article,
we address issues associated with unplanned extubations and how to decrease the occurrence of unplanned extubation by using a consistent securing technique.

Literature Review

A review of the literature revealed many studies\textsuperscript{1,3-9} that expanded on old knowledge of unplanned extubation. Several studies\textsuperscript{1,10-12} addressed factors that contributed to unplanned extubation and complications associated with those factors. Published reports\textsuperscript{3,4,14} indicated that the frequency of unplanned extubation ranged from a low of 0.7\% to a high of 25\%.

Quality improvement and education both played an important role in significantly decreasing rates of unplanned extubation.\textsuperscript{11,12} Although some authors discussed techniques actually decrease the frequency of unplanned extubation in critical care populations also was not discussed.

Methods

St. Joseph’s Hospital is a 500-bed, rural, tertiary care center. The subjects for this project were a convenience sample of all patients who had an unplanned extubation in the SICU and the CCU/MICU in a 2-year period.

An intensivist, the respiratory care staff, and the nursing staff all perceived a high frequency of unplanned extubations in the adult critical care units during a 6-month period. The policy for securing endotracheal tubes was due for an update. Additionally, the products and techniques used to secure endotracheal tubes had changed, and those changes had not been incorporated into the policy and procedure. Therefore, staff members did not know how to use and secure endotracheal tubes properly.

The committee thought that extubations could have been avoided if different techniques and possibly different products had been used to secure endotracheal tubes. To test this theory, the quality control committee developed a tool to track factors related to unplanned extubations (Figure 1). For each unplanned extubation, nurses in the critical care units were asked to enter information on the form. They were also required to complete an incident report, which was submitted to the quality control group and the risk management department at the hospital.

Using incident reports, the tool developed by the committee, and the number of days that patients received mechanical ventilation, the committee was able to determine the frequency of unplanned extubations. Each quarter, the group met to discuss the unplanned extubations and determine a course of action to decrease the frequency of unplanned extubations in adult patients. Upon reviewing the data, the committee deemed the frequency of unplanned extubations to be too high, 2.32\% in the SICU and 2.14\% in the CCU/MICU. A review of the literature did not reveal any nationally accepted standard. Therefore, a goal was set to reduce the frequency of unplanned extubations to less than 0.8\%; the committee thought that doing so would indicate a higher quality of care. To meet this goal, the quality control group investigated different tube holders in an effort to improve the security of the endotracheal tube. Evaluation of the tube holders required staff to receive instruction to ensure proper use of each holder.

When this investigation was done, several manufacturers were producing endotracheal tube holders. The committee examined each of the holders available, looking at design, securability, ease of application, and durability once in place. They also wanted a device that allowed easy movement of the tube from side to side in order to maintain the integrity of the oral mucosa. Another feature important to the committee was that the holder maintain skin integrity beneath the area of application. This evaluation helped the committee narrow the field of prospective devices to 2, 1 (Hollister oral endotracheal attachment device) manufactured by Hollister, Inc (Libertyville, Ill) and 1 (Comfit) manufactured by Ackrad Laboratories, a CooperSurgical Company (Cranford, NJ). These 2 types of holders were tried by the staff of each unit.

After determining which devices were to be evaluated, the committee created a teaching plan to prepare the nursing and respiratory staff to use the new devices. A new policy that included instruction in using each device was created and put into use. The existing policy and procedure for taping were updated to provide an alternative choice for securing endotracheal tubes. Hands-on instruction about each holder and the taping technique was provided to all staff members along
with written information and posters demonstrating proper use of the tube holders. Instruction was offered for 2 weeks, with times dispersed over all shifts to facilitate staff compliance.

During the in-service training sessions, the nursing and respiratory care staff were taught the manufacturers’ recommended application technique for the 2 tube holders. The staff were also taught a method of taping, using cloth tape circling behind the head and secured directly to the tube. A piece of tape was torn to a length that extends around the back of the patient’s head, with adhesive ends long enough to wrap around the endotracheal tube and make the tube secure. An adhesive skin preparation was applied to the cheek area and the endotracheal tube to give a sticky base to which the tape could adhere. The upper loose ends were then wrapped around the endotracheal tube with the lower loose ends being brought up, over, and across the patient’s upper lip to the opposite cheek. The current policy and procedure for using tape as a securing device was taught and a new policy was created to describe the use of the new tube holder in order to maintain consistency among staff members when choosing and using securing devices.

Once the training was complete, each device was evaluated for separate 3-month periods to allow for an application learning curve to level out. With each evaluation, the education provided for that securing device was reinforced.

Results

The focus of this project was education and process change. In order to show the change as effective, data were collected by using a tool developed by the quality improvement committee (Figure 1), assessing the factors thought to contribute most to unplanned extubation. The factors most cited in the literature were physical restraint, level of sedation, and activity and mental status of the patient at the time of unplanned extubation.1,5,10,12 In the initial evaluation, the factor most commonly associated with unplanned extubation in the SICU and CCU at St. Joseph’s was the technique used to secure the endotracheal tube. The tool used during data collection addressed the other common factors described in published reports and securing technique. When the data were analyzed, no pattern indicated that any of the other factors was a significant contributor to unplanned extubation. We decided to begin the education program with a single focus on securing the endotracheal tube and then branch out to educate staff members about the other factors once the staff had mastered securing. With this arrangement, we could be more certain that the extubations that were occurring were due to the level of sedation or restraint and not to use of poor technique to secure the tube.

During this project, the unplanned extubation rates for 2 6-month periods were compared to determine whether the frequency of unplanned extubations decreased after extensive changes in the process of securing endotracheal tubes were coupled with intensive education about the changes. When the first 6 months preceding staff education was compared with the 6 months after staff education, an improvement in the rate of unplanned extubation was apparent among all patients studied (Figure 2).

During the first 6 months before the education, for the 2 units (SICU and CCU/MICU) combined, a total of 495 patients were intubated for 1154 days. The next year, during a comparable 6-month period after the education, 523 patients in the 2 units were intubated for 1689 days. Pearson chi-square analysis indicated a significant decrease in the rate of unplanned extubation after extensive education. In the CCU/MICU, the unplanned extubation rate decreased from 2.14% (9 extubations in 421 days) before to 0.87% (6 extubations in 689 days) after the education. In the SICU, the unplanned extubation rate decreased from 2.32% (17 extubations in 733 ventilator days) before to 1.0% (10 extubations in 1000 days) after the education (Figure 2). Pearson chi-square analysis of the number of extubations before and after the education program indicated a significance of .03 for the CCU/MICU and .002 for the ICU (P < .05). At the same time that the frequency of unplanned extubations decreased, the number of ventilator days increased (Figure 3).

Discussion

Unplanned extubation has been a problem for many institutions.1,2,7,8,10,12,13,15 It has been several years since anyone has reported new information about rates of unplanned extubation and the impact of quality improvement. In an attempt to increase the quality of care for our patients, a new method of securing endotracheal tubes was taught and implemented. Before the in-service training sessions, rates of unplanned...
**Figure 1** Unplanned extubation report form.

This form is not part of the patient's permanent medical record.

**Abbreviations:** ED, emergency department; ETT, endotracheal tube; gtt, infusion; L, left; MSO₄, morphine sulfate; OR, operating room; PICU P&P, pediatric intensive care unit policy and procedure; prn, as needed; Pt, patient; R, right; RN, registered nurse; RT, respiratory therapist.

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extubation for the 2 units combined were as high as 2.34%. After staff education, unplanned extubation rates plummeted to 0.95% for the 2 units combined, indicating that education and attention to detail and quality can improve care of intubated patients. While the rate of unplanned extubations was decreasing, the facility instituted a new trauma service, which significantly increased the number of ventilator days in the critical care units. Although the number of ventilator days increased, the number of extubations decreased significantly (Figure 3).

Limitations of the Study

One limitation of this study is the method used to complete the data collection sheet. Although 1 person was responsible for collating collected data, all nursing and respiratory therapy staff were required to understand the use of the tool and use it appropriately. Each time an unplanned extubation occurred, the staff person involved was required to complete an incident report and a collection tool. At times the tool was not completed but an incident report was generated. Inconsistent data collection required the review of charts to fill in missing data. If documentation was not complete, it was difficult for the collator to go to the chart and fill in retrospective data.

Another limitation of this study is that the committee did not use a formal database to collate information but rather tallied all results by hand. Because of this practice, only patients who had an unplanned extubation were followed up; therefore, patients having planned extubations could not be compared with patients who had an unplanned extubation. If a formal database had been used, all intubated patients might have been included in order to compare some of the interventions that were used successfully for patients who stayed intubated versus patients who had unplanned extubations. Sedation and/or use of...
restraints, oral versus nasal intubation, and the need for reintubation after unplanned extubation also could have been compared in patients who remained intubated versus patients with unplanned extubations. Use of a formal database would have kept information together, with better accessibility for future comparisons and research.

Conclusion

For as long as patients have been intubated, the potential for unplanned removal has been a source of concern. This concern has led nurses and other medical professionals to search for ways to decrease the occurrence of unplanned extubation.

In this project, a perceived problem was assessed, and a tool for data collection was created. The tool was used to collect data on unplanned extubation and was then used to clarify perceptions and assumptions, steps that led to a change in practice. This change was of great benefit to the patients and the staff, because it provided consistency for a method of securing endotracheal tubes, which led to better quality of care for the patients. The tool has been used consistently for some time. We plan to try to build a database in which information can be stored and collated to allow comparison of methods and types of sedation and to develop protocols for fast-track weaning parameters and alternatives for restraint; our hope is to further decrease the number of unplanned extubations.

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References

Unplanned Extubation in Adult Critical Care: Quality Improvement and Education Payoff
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