Background: Leakage of oropharyngeal secretions past the endotracheal tube (ETT) cuff can cause ventilator-associated pneumonia (VAP). A polyurethane-cuffed (PUC) ETT can decrease this leakage in vitro and the incidence of VAP in selected populations. Our objective was to determine if use of a PUC ETT would result in a decrease in VAP rates.

Methods: We replaced conventional ETT with a PUC-ETT (Microselect, Kimberly Clark Corp., Roswell, GA) from July 2006–June 2008. We then returned to use of the conventional ETT and continued to collect data regarding VAP for the next three months and compared the rate of VAP before, during, and after the intervention year by interrupted time-series analysis. Inclusion criteria were all intubated patients in our hospital from July 2006–September 2008.

Results: During the year prior to the intervention, there were 37 episodes of ETT-associated VAP in 6,986 ventilator days, a rate of 5.3/1,000 ventilator days. During the year of use of the PUC-ETT, there were 21 episodes of VAP in 7,645 ventilator days, a rate of 2.8/1,000 ventilator days (p = 0.0138). During the first three months after return to the conventional ETT, there were 2 episodes of VAP in 7,175 ventilator days, an incidence of 1.7% and a rate of 3.0/1,000 ventilator days. Rates of VAP before and after the intervention year were compared and found not to be statistically significant; the rates were combined and compared to the rate of VAP during the use of the PUC-ETT. Use of the PUC-ETT was associated with a 43% decrease in the rate of VAP in our institution. Rates of ETT-associated VAP were also compared to rates of tracheostomy-associated VAP during the same time period, and the significance was persisted.

Conclusions: Use of the Microselect PUC-ETT was associated with a 43% decrease in the rate of VAP in our study.

BACKGROUND

One mechanism for the development of VAP may be the leakage of oropharyngeal secretions past the endotracheal tube cuff into the lower respiratory tract [1-3]. Oropharyngeal secretions can leak around the inflated polyvinyl chloride cuff of conventional ETTs through channels created by the folds in the cuff. A polyurethane cuffed endotracheal tube (PUC-ETT) has been shown to decrease leakage of oropharyngeal secretions in vitro [1, 4]. The tracheal tube cuff has a thinner wall (7 microns vs. more typical 50 microns) and creates a better tracheal seal at generally accepted safe cuff inflation pressures. The creation of smaller channels which impede drainage of oropharyngeal secretions past the tracheal tube cuff.

We studied the effect of replacing the conventional polyvinyl chloride cuffed endotracheal tube (PVC-ETT) with a PUC-ETT as our default ETT on the incidence of VAP in patients throughout our intensive care units.

METHODS

Study Location and Patients

Inclusion criteria:
• All adult patients intubated for mechanical ventilation in five intensive care units between July 2006 and September 2008.
• Data on patients with tracheostomy tubes were collected to serve as an internal control population.

The characteristics of each included intensive care unit are summarized in Table 1.

Data Collection and Definitions

• Data regarding VAP routinely collected prospectively by Infection Control within for internal quality assurance.
• Diagnosis of ETT associated VAP (ETT-VAP) defined as per guidelines of the American Thoracic Society and the Infectious Diseases Society of America (ATS/IDSA) [5].
• Only the first diagnosis of VAP included.
• Rates calculated per unit per 1,000 ventilator days at risk.

Statistical Analysis

Using interrupted time-series methodology.

• Compared rates of ventilator-associated pneumonia for the year before intervention (baseline year), the year of intervention, and the first three months after return to the conventional ETT. Post-intervention period:
• Rates of tracheostomy-associated VAP (TR-VAP) were calculated and compared for the same time periods.
• During the intervention year, 50 patients intubated with a conventional PVC-ETT for tracheostomy patients.

Contemporaneous rates of tracheostomy-associated VAP adjusted for using Poisson regression.

All statistical analyses done with Stata 12.

RESULTS

From July 2006 and September 2008: 3,207 patients intubated for mechanical ventilation, 16,223 ventilator days:
• Baseline year: 37 episodes of VAP; yielding 5.3/1,000 ventilator days.
• Intervention year: 21 episodes of VAP; yielding 2.8/1,000 ventilator days (p = 0.0138).

Unadjusted analysis combined baseline year and post intervention period.

No statistical difference in VAP (p = 0.3243) between baseline year and post intervention period.

Unadjusted analyses combined baseline year and post intervention period (Non PUC-ETT).

No significant difference in rates of VAP during the period of the use of the PUC-ETT (0.39/1,000 CI -0.340 to 0.139, with a rate reduction of 28%/95% CI 17%/66% /Table 2).

ETT-VAP rate compared to rate of VAP in patients with tracheostomy (TR-VAP) to adjust for any non-systematic changes in infection control practice.

• Baseline year: 27 TR-VAP; yielding 3.7/1,000 ventilator days.
• Intervention year: 19 TR-VAP; yielding 3.2/1,000 ventilator days.
• Post intervention period: 4 TR-VAP; yielding 4.0/1,000 ventilator days.

No significant difference in TR-VAP rate between baseline year and post intervention period.

No statistically significant difference in rates of TR-VAP during the period of the use of the PUC-ETT (0.39/1,000 CI 0.340 to 0.139, with a rate reduction of 28%/95% CI 17%/66% /Table 2).

REFERENCES