

INPLASY PROTOCOL

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Effect of Endotracheal Tube Cuff Modification on the prevention of Ventilator-associated Pneumonia: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Review question / Objective: Microaspiration of subglottic secretion is a major pathogenic mechanism of ventilator-associated pneumonia (VAP). Traditional cuffs are susceptible to form folds, which become channels for the secretion to move down. The purpose of cuff modification is to avoid the shortcomings of traditional cuff; however, the effect is not clear. We conducted this systematic review and meta-analysis to evaluate the effect of cuff modification on the prevention of VAP. Studies were screened using the PICOS criteria as follows: (1) Participants (P): adult critically ill patients receiving mechanical ventilation (aged ≥ 18 years); (2) Intervention (I): the conical cuff, PU cuff or other new types of cuffs; (3) Control (C): the traditional cuff; (4) Primary outcome: VAP incidence; (5) Study design (S): RCTs.

Information sources: We performed a literature search using PubMed, Embase, and Cochrane Library from inception to April 2022. The medical subject headings (MeSH) and entry terms were used for the structured search and the following words were searched: endotracheal tube cuff, polyurethane cuff, tapered cuff, conical cuff, conventional cuff, traditional cuff, pneumonia, ventilator-Associated. No restrictions were placed on the language of publication. We also conducted manual searches of the references from reviews, studies, and the Web.

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 04 May 2022 and was last updated on 04 May 2022 (registration number INPLASY202250018).

INTRODUCTION

Review question / Objective:
Microaspiration of subglottic secretion is a

major pathogenic mechanism of ventilator-associated pneumonia (VAP). Traditional cuffs are susceptible to form folds, which become channels for the secretion to move

down. The purpose of cuff modification is to avoid the shortcomings of traditional cuff; however, the effect is not clear. We conducted this systematic review and meta-analysis to evaluate the effect of cuff modification on the prevention of VAP. Studies were screened using the PICOS criteria as follows: (1) Participants (P): adult critically ill patients receiving mechanical ventilation (aged ≥ 18 years); (2) Intervention (I): the conical cuff, PU cuff or other new types of cuffs; (3) Control (C): the traditional cuff; (4) Primary outcome: VAP incidence; (5) Study design (S): RCTs.

Condition being studied: Tracheal intubation destroys the normal physiological structure of the respiratory tract and directly exposes the relatively sterile respiratory tract to the external environment. The oropharyngeal secretions containing several colonizing bacteria enter the lower respiratory tract through the space between the tracheal intubation tube and the trachea, thereby increasing the risk of VAP. The function of the endotracheal tube cuff is to seal the trachea and reduce the downward movement of secretions. However, the conventional cuff is made of polyvinyl chloride (PVC), which is susceptible to forming folds that act as channels for secretions to flow down. In recently years, modification to the design of the endotracheal tube cuff has been the focus of intervention to reduce the risk of aspiration around the cuff and thus reduce the risk of VAP.

METHODS

Participant or population: Adult critically ill patients receiving mechanical ventilation (aged ≥ 18 years).

Intervention: The conical cuff, PU cuff or other new types of cuffs.

Comparator: The traditional cuff.

Study designs to be included: RCTs.

Eligibility criteria: No restriction was placed on the method of pneumonia diagnosis or

incidence measurement. We also excluded data from retrospective studies, case reports, observational studies, animal studies, letters to the editor and reviews. Through discussion with a third reviewer, any disagreement between the two reviewers on whether the trial met the inclusion or exclusion criteria was resolved.

Information sources: We performed a literature search using PubMed, Embase, and Cochrane Library from inception to April 2022. The medical subject headings (MeSH) and entry terms were used for the structured search and the following words were searched: endotracheal tube cuff, polyurethane cuff, tapered cuff, conical cuff, conventional cuff, traditional cuff, pneumonia, ventilator-Associated. No restrictions were placed on the language of publication. We also conducted manual searches of the references from reviews, studies, and the Web.

Main outcome(s): Primary outcome is the incidence of VAP; Secondary outcomes include ICU mortality, the duration of mechanical ventilation, length of ICU stay, and length of hospital stay.

Quality assessment / Risk of bias analysis: Two independent reviewers conducted the quality assessment after the final selection of literature using the risk of bias assessment method recommended by the Cochrane Collaboration. All selected studies were appraised based on the following seven methodological criteria: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and another bias. No funnel plot was applied because of the small number of included studies.

Strategy of data synthesis: All data were analyzed using the Review Manager (version 5.3, Cochrane Collaboration). For binary variables, the Mantel-Haenszel model was used to obtain relative ratio (RR) and 95% confidence interval (CI). The I² and chi-square tests were used to evaluate

the heterogeneity between studies, and $I^2 > 50\%$ or $P < 0.1$ represented significant heterogeneity. When heterogeneity was present, several sensitivity analyses were conducted to identify potential sources. A P value of <0.05 was considered to be statistically significant.

Subgroup analysis: Subgroup analysis was performed according to different types of cuffs.

Sensitivity analysis: Sensitivity analysis was not performed in this study.

Country(ies) involved: China.

Keywords: Intensive care unit, Ventilator-associated pneumonia, Intubation, Endotrachealcuff.

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