Injury, Int. J. Care Injured 48 (2017) 866–873

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

The influence of tracheostomy timing on outcomes in trauma patients: A meta-analysis

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ARTICLE INFO

Article history:
Accepted 22 February 2017

Keywords:
Early tracheostomy
Intubation
Trauma
Prognosis

ABSTRACT

Objective: This study aims to assess the influence of tracheostomy timing on outcomes among trauma patients, including mortality, medical resource utility and incidence of pneumonia.
Method: A systematic review of the literature was conducted by internet search. Data were extracted from selected studies and analyzed using Stata to compare outcomes in trauma patients with early tracheostomy (ET) or late tracheostomy (LT)/prolonged intubation (PI).
Result: 20 studies met our inclusion criteria with 3305 patients in ET group and 4446 patients in LT/PI group. Pooled data revealed that mortality was not lower in trauma patients with ET compared to those with LT/IP. However, ET was found to be associated with a significantly reduced length of ICU and hospital stay, shorter MV duration and lower risk of pneumonia.
Conclusion: Evidence of this meta-analysis supports the dimorphism in some clinical outcomes of trauma patients with different tracheostomy timing. Additional well-designed randomized controlled trials (RCTs) are needed to confirm it in future.

Introduction

Emergency translaryngeal intubation is commonly needed for trauma patients to rescue airway in an initial period of time, after which tracheostomy is customarily performed when patients require long-term ventilation and fail to remove the tracheal intubation in the near future. When considering whether to proceed with tracheostomy placement, a clinician must balance advantages with the potential risks of the procedure. Benefits attributed to tracheostomy include greater airway safety, better pulmonary hygiene, improved patient comfort, easier nursing care and reduced sedative requirements. Meanwhile, as an invasive procedure, tracheostomy is related to complications such as bleeding, wound infection, subcutaneous emphysema, laryngeal nerve or esophageal injury, pneumothorax and tracheal stenosis [1,2]. Challenging question also exists on the optimal timing of tracheostomy in trauma patients. Although some investigators reported improved outcomes in patients with early tracheostomy (ET) compared to that with late tracheostomy (LT) or prolonged intubation (PI) or no tracheostomy (NT) [3–18], some demonstrated no substantial differences [19–22].

A meta-analysis in 2006 tried to address the controversy, and indicated that ET had no influence on mortality, pneumonia, or laryngotracheal pathology rates in trauma patients [23]. Since then, an increasing number of studies have been published on this topic. Furthermore, widespread application of percutaneous dilatational technique (PDT) at the patients' bedside in recent years may also affect the timing choice for clinician to perform tracheostomy [24]. Consequently, we conduct this updated meta-analysis to determine the influence of tracheostomy timing on prognosis of trauma patients.

Patients and methods

Search strategy

This study was conducted by the recommendations of the Cochrane Handbook for Systematic Reviews of Interventions [25]. Literatures published in PubMed, Web of Science, Cinahl and

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http://dx.doi.org/10.1016/j.injury.2017.02.023
0020-1383/

Cochrane Library up to March 2016 were searched using a combination of Medical Subject Heading (MeSH terms) and keyword terms with synonyms: "tracheostomy" and "trauma or injury". The search was limited to published data, human subjects and English language. References cited by chosen articles and recent reviews were checked manually for any other potential study. To uncover "grey literature", we repeated our search with SciGlobe and National Institutes of Health website listings of ongoing trials, however, no such unpublished data were available.

Study selection and data extraction

Studies that fulfilled the following inclusion criteria were chosen for further analysis: (1) Population: adult patients with either blunt or penetrating trauma (2) Intervention: patients were assigned to ET or LT group, regardless of the tracheotomy technique used (surgical or percutaneous). PI or NT was also considered as the comparator of ET. ET was defined as a tracheotomy performed within 7 days after initiation of translaryngeal intubation. LT was any time thereafter. (3) Outcomes: the primary outcome was mortality while Injury Severity Score (ISS), Glasgow Coma Scale (GCS), length of stay in hospital (HLOS) or ICU (ILOS), mechanical ventilation days (MVD) and incidence of pneumonia were measured as the secondary outcomes. At least one outcome was reported. (4) Study design: randomized controlled trial (RCT) or non-RCT including prospectively observational study, retrospective cohort study and case-control study.

Descriptive studies without comparative data such as reviews were also excluded. For studies with overlapping population, only the one with the longest study period and the largest sample size was included.

Two investigators (Cai and Hu) independently reviewed the title and abstract of all potential articles and selected ones that met our inclusion requirements for full text analysis. Data extracted from these articles included the name of first author, publication year, inclusion/exclusion criteria, stratification methods, sample size, tracheostomy approach, study design and major conclusions. Any disagreement or doubt was resolved through discussion of all investigators.

Study quality assessment

The quality of included RCTs was assessed with the method recommended by the Cochrane Collaboration for assessing risk of bias [25]. A value of'high', 'low' or 'unclear' was assigned to the following items: sequence generation, allocation concealment, blinding, incomplete outcome data addressed, selective outcome reporting and other bias. A well-designed criteria by Taggart et al. was used to assess the quality of non-RCT studies in five aspects: participant selection, comparability groups, outcomes, sample size and cohort design [26]. Descriptions for each component were outlined in our previous studies [27,28].

Statistical analysis

Statistical analysis was performed with Stata/SE 12.0 (Stata Corporation, College Station, TX, USA). A kappa statistic was calculated for measuring agreement between the two authors in articles selection and quality assessment. The pooled effect of binary variables including mortality and incidence of pneumonia was evaluated as risk ratios (RR) with 95% confidence intervals (CIs), whereas weighted mean differences (WMD) with 95% CI were used for continuous outcomes including ISS, GCS, HLOS, ILOS and MVD. Heterogeneity across studies was evaluated with I^2 statistic, which defined as I^2 >50.0%. The combined effects were computed using either fixed-effects models or in the presence of heterogeneity, random-effects models [29]. Subgroup analyses, meta regression and sensitivity analysis were performed to explore the possible resources of clinical, methodological or statistical heterogeneity. The funnel plot was carried out with Begg's rank correlation test to evaluate publication bias. By convention, $p < 0.05$ was considered statistically significant.

Results

Our search strategy identified 2549 potentially relevant publications. Twenty-four of these publications met the inclusion criteria after the abstract review and entered full-text review. Upon closer investigation, three studies were ruled out for the following

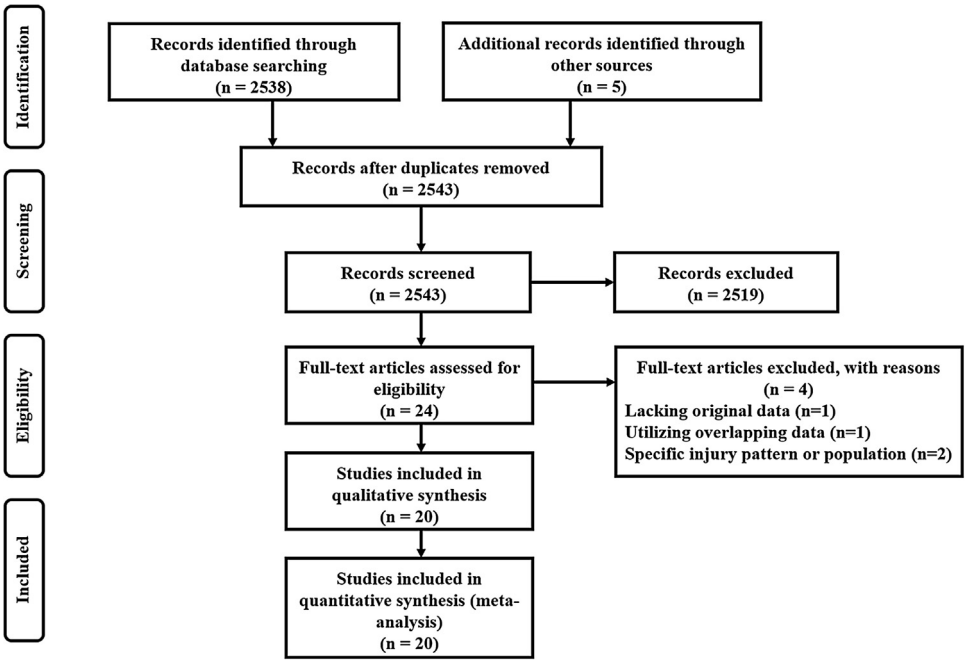

Fig. 1. Process of literature search and study selection.