American Journal of Emergency Medicine 33 (2015) 1606–1611

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

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

Original Contribution

Effects of sniffing position for tracheal intubation: a meta-analysis of randomized controlled trials☆,☆☆

Yuki Akihisa, MD [a], Hiroshi Hoshijima, PhD [b,1], Koichi Maruyama, PhD [a,*], Yukihide Koyama, PhD [c,2], Tomio Andoh, PhD [a]

[a] University Hospital Mizonokuchi, Teikyo University School of Medicine, Kawasaki 213-8507, Kanagawa, Japan
[b] Division of Dento-Oral Anesthesiology, Tohoku University Graduate School of Dentistry, Sendai, 980-8575 Miyagi, Japan
[c] Department of Anesthesiology and Critical Care Medicine, Yokohama City University Graduate School of Medicine, Yokohama 236-0004, Kanagawa, Japan

ARTICLE INFO

Article history:
Received 16 May 2015
Accepted 20 June 2015

ABSTRACT

Background: The purpose of this meta-analysis was to validate the efficacy of the sniffing position in the performance of intubation with direct laryngoscopy.
Methods: We searched MEDLINE, the Cochrane Central Register of Controlled Trials, Embase, and Web of Science. Six randomized controlled trials comprising 2759 adult participants were analyzed. The DerSimonian-Laird method was used to calculate pooled relative risk (RR) and the 95% confidence interval (CI) of Cormack-Lehane classification, Intubation Difficulty Scale, success rate of the first intubation, and weighted mean difference of intubation time.
Results: Compared with the other head positions, the sniffing position did not improve glottic visualization, success rate of the first intubation, or intubation time. However, the sniffing position was significantly associated with better Intubation Difficulty Scale compared with the simple head extension position. (RR,1.28; 95% CI, 1.15-1.42; $p<0.0001$)
Conclusions: Although patients do not benefit from the sniffing position in terms of glottic visualization, success rate of the first intubation, or intubation time, the sniffing position can still be recommended as the initial head position for tracheal intubation because the sniffing position provides easier intubation conditions.

1. Introduction

The sniffing position (SP) has been recommended as the optimal head position for direct laryngoscopy with the Macintosh laryngoscope [1]. This position was first described by Sir Ivan Magill [2] in 1936 as "sniffing the morning air," with which the best glottic visualization was obtained in direct laryngoscopy. Later, Bannister and Macbeth [3] introduced the 3 (oral, pharyngeal, and laryngeal) axes alignment theory and provided the theoretical rationale for the SP. Beside the glottic view, several studies reported that the SP provided better pharyngeal airway patency, wider interincisor distance, and less force for laryngoscopy than the simple head extension position [4–7]. However, the clinical effectiveness of the SP for tracheal intubation had not been established. Instead, the superiority of the SP over that of the other head position for optimization of the glottic view has been challenged, and uncertainty about the efficacy of the SP for aligning the 3 axes was raised in the previous 2 decades [8–11]. Not surprisingly, the advantages of the SP over the simple head extension position were not mentioned in a textbook, except for patients with limited extension at the occiput [12].

Recently, studies exploring the efficacy of the SP in the performance of tracheal intubation have accumulated [13–16]. Therefore, we conducted a systematic review and meta-analysis to compare factors of intubation performance including glottic visualization in the SP with those of the other head position.

2. Methods

We conducted this systematic review and meta-analysis of randomized controlled trials (RCTs) evaluating the efficacy of the SP for glottic visualization and intubation performance in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis guidelines [17].

2.1. Systematic search

We searched MEDLINE, the Cochrane Central Register of Controlled Trials, Embase, and Web of Science up to August 30, 2014. We included the prospective RCTs that compared intubation using direct laryngoscopy in the SP vs the other head position in adult patients and that contained

☆ Sources of support: None.
☆☆ The name of organization and the date of assembly: N/A.

* Corresponding author. Department of Anesthesiology, University Hospital Mizonokuchi, Teikyo University School of Medicine, 3-8-3 Mizonokuchi, Takatsu-ku, Kawasaki 213-8507, Kanagawa, Japan. Tel.: +81 44 844 3333; fax: +81 44 844 0468.
E-mail addresses: ypegtj25@yahoo.co.jp (Y. Akihisa), hhoshi6@gmail.com (H. Hoshijima), maru555md@yahoo.co.jp (K. Maruyama), yukihidekoyama1008@gmail.com (Y. Koyama), psdelico06@yahoo.co.jp (T. Andoh).
[1] Department of Anesthesiology, Saitama Medical University, 38 Morohongo, Irumagun Moroyamamachi, 350-0451 Saitama, Japan.
[2] Department of Anesthesia, Fujisawa Shounandai Hospital, 2345 Takakura, Fujisawa 252-0802, Kanagawa, Japan.

http://dx.doi.org/10.1016/j.ajem.2015.06.049
0735-6757/

any outcomes of interest. The search parameters used in PubMed were as follows: "anaesthesia"[All Fields] OR "anesthesia"[MeSH Terms] OR "anesthesia"[All Fields]) AND ("intubation"[MeSH Terms] OR "intubation"[All Fields]) AND ("head"[MeSH Terms] OR "head"[All Fields]) AND "position"[All Fields] AND ("randomized controlled trial"[Publication Type] OR "randomized controlled trials as topic"[MeSH Terms] OR "randomized controlled trial"[All Fields] OR "randomized controlled trial"[All Fields]). We also conducted manual searches of the references from the studies, reviews, and the Web. We did not put any restriction on language. After we excluded duplicate publications, 3 of the authors (M.K., K.Y., H.H.) independently scanned the title and abstract of each of the studies. The same authors read the full text of the potentially useful studies to assess them for inclusion, and 2 of the authors (M.K., H.H.) extracted available data associated with the tracheal intubation performance as follows: Cormack-Lehane classification (grade 1 vs grade ≥2) [18], success rate of intubation (successful intubation on the first attempt vs multiple attempts), intubation time, and the Intubation Difficulty Scale (IDS) score (score between 0 and 5 intubations vs >5). The IDS consists of 7 parameters: the number of supplementary intubation attempts, the number of supplementary operators, the number of alternative intubation techniques, Cormack-Lehane classification, the lifting force applied, laryngeal pressure applied, and vocal cord mobility [19]. In the studies included in this meta-analysis, an IDS score of greater than 5 defined an intubation of moderate to major difficulty. Thereafter, we evaluated any risk of bias in accordance with the Cochrane Handbook for Systematic Reviews of interventions, using the following domains: adequacy of sequence generation, allocation concealment, blinding of participants, personnel and outcome assessors, incomplete outcome data, and selective outcome reporting [20]. We contacted the authors of the studies when further information was required, and disagreements were solved by discussion.

2.2. Statistical analysis

We evaluated the clinical and methodological heterogeneity of the enrolled studies. We also tested statistical interstudy heterogeneity by using the Cochran *Q* statistic (χ^2 value), with the significance level set at a $P < .10$, and quantified it by using the I^2 statistic, in which a value of at least 50% indicates substantial heterogeneity.

We combined data using the random-effect model (DerSimonian-Laird method). We compared the results using a fixed-effect model and the random-effect model to perform the sensitivity analysis. In addition, we performed subgroup analysis to explore heterogeneity. We determined relative risk (RR) with the 95% confidence interval (CI) for categorical variables and the weighted mean difference with the 95% CI for continuous variables. A *P* value less than 0.05 was deemed statistically significant. We assessed publication bias using funnel plot asymmetry with Begg test. A *P* value less than 0.1 was considered as positive for publication bias [21]. All statistical analyses were performed with EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan), which is a graphical user interface program for R (The R Foundation for Statistical Computing, Vienna, Austria). More precisely, it is a modified version of R Commander designed to add statistical functions frequently used in biostatistics [22].

3. Results

3.1. Study description

After discarding all duplicates, we identified 78 studies from the 4 databases and other sources (Fig. 1). After assessing the full text of these potentially useful studies, we included 6 studies with 2759 participants (Fig. 1) [8,13–15,23,24]. All 6 trials were prospective, randomized, and controlled, and provided data on glottic visualization and one or more data associated with intubation performance. Each of 3 studies compared the success rate of intubation [14,15,24], the intubation time [15,23,24], and IDS score [8,13,15]. Four studies compared intubation in the SP to that in the simple head extension position, and 2 studies compared intubation in the SP to the so-called "ramp" position [23,24] (Table 1). The risk of bias is summarized in Table 2. We found no statistical heterogeneity for either the IDS ($I^2 = 0\%$, $P = .40$) or intubation time ($I^2 = 0\%$, $P = .63$), whereas significant statistical heterogeneity did exist for the Cormack-Lehane classification ($I^2 = 94.8\%$, $P < .0001$) and the success rate of intubation ($I^2 = 84.2\%$, $P = .0018$). Therefore, we performed subgroup analysis for the primary outcome of Cormack-Lehane grading, the success rate of intubation, and intubation time, according to the head position of the controlled group (simple head extension vs ramp position). However, the small number of studies precluded some of the intended subgroup analysis, that is, the success

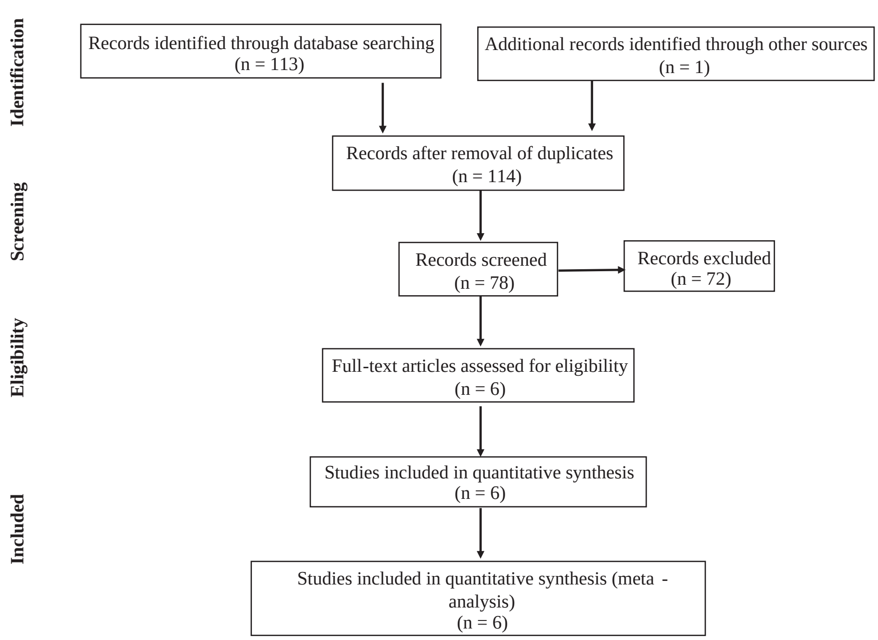

Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses flow diagram of the identification, screening, eligibility, and inclusion process.