Journal of Clinical Anesthesia (2015) **27**, 153–158

ELSEVIER

Journal of Clinical Anesthesia

Original Contribution

Head elevation improves laryngeal exposure with direct laryngoscopy☆

Mohammad I. El-Orbany MD (Professor of Anesthesiology)[a,*], Yohannes B. Getachew MD (Attending Pediatric Anesthesiologist)[b,c], Ninos J. Joseph BS (Research Consultant)[d], M. Ramez Salem MD (Attending Anesthesiologist)[e,f], Michael Friedman MD (Chair)[g,h]

[a]*Medical College of Wisconsin, Milwaukee, Wis,*
[b]*Geisinger Medical Center, Danville Pa*
[c]*Clinical Associate Professor of Anesthesiology, Temple University, Philadelphia, Pa*
[d]*Chicago ENT, Chicago, Ill*
[e]*Advocate Illinois Masonic Medical Center, Chicago, Ill*
[f]*Clinical Professor of Anesthesiology, University of Illinois, Chicago, Ill*
[g]*Section of Head and Neck Surgery, Department of Otolaryngology, Advocate Illinois Masonic Medical Center, Chicago, Ill*
[h]*Professor of Otolaryngology, Rush University, Chicago, Ill*

Received 10 March 2014; revised 16 September 2014; accepted 17 September 2014

Keywords:
Sniffing position;
Direct laryngoscopy

Abstract

Study objective: The aim of this study was to examine the effect of changing head position on the laryngeal view in the same subject.

Design: Prospective, randomized, crossover comparison of laryngeal views.

Setting: Operating suite at a university-affiliated, community hospital.

Patients: One hundred sixty-seven consenting adult patients scheduled to undergo elective surgery with general anesthesia.

Interventions: After anesthesia induction and muscle relaxation and the head in extended position, the laryngeal view was graded in 3 different head height positions. A special inflatable pillow was placed under the subject's head before induction and was deflated to produce no head elevation or inflated to produce either 6.0 cm (sniffing position), or 10.0 cm elevation (elevated sniffing position) in random order.

Main results: The incidence of difficult laryngoscopy (grade ≥ 3) was 8.38% with no head elevation, 2.39% in the sniffing position, and 1.19% in the elevated sniffing position. Head elevation was not associated with a worse grade in any single patient.

Conclusions: Sniffing position improves glottic exposure when the laryngoscopic grade is greater than 1 in the head-flat position. The elevated sniffing position improves the view to a better grade in some patients. Because head elevation was not associated with a worse grade in any subject, the elevated sniffing position should be considered as the initial head position before direct laryngoscopy when a difficult exposure is anticipated.

☆ Sources of financial support: Departmental fund only.
* Corresponding author at: Department of Anesthesiology, Medical College of Wisconsin, 9200 West Wisconsin Ave., Milwaukee, Wis 53226.
E-mail address: elorbany@mcw.edu (M.I. El-Orbany).

http://dx.doi.org/10.1016/j.jclinane.2014.09.012
0952-8180/

1. Introduction

The sniffing position (SP) has been recommended before direct laryngoscopy (DL) in adults [1]. To achieve an SP, the neck should be flexed onto the chest (by head elevation) and the head slightly extended at the atlanto-occipital joint [2]. The superiority of SP over simple head extension in the head-flat position has, however, been questioned [3,4]. Moreover, the anatomical soundness of the 3 axes alignment theory that justifies its use has also been challenged [5,6]. Conversely, SP and head elevation were associated with better glottic visualization in patients with poor initial laryngoscopic views [7,8]. The goal of the study was to establish the optimal head position that yields the best laryngeal exposure and can, thus, be recommended as a starting head position before DL in adults.

2. Methods

After approval from the Illinois Masonic Medical Center Institutional Review Board, signed written informed consents were obtained from 170 adult patients with American Society of Anesthesiologists physical status 1-3 who were scheduled for elective surgery requiring endotracheal intubation. Patients who had history of difficult intubation, poor dentition, gastroesophageal reflux disease, severe/morbid obesity (body mass index [BMI] greater than 35 kg/m^2), or at risk of aspiration were excluded from the study. During the preanesthetic airway evaluation, the following parameters were recorded: BMI, mouth opening, thyromental distance, range of neck movement, and modified Mallampati classification [9,10]. American Society of Anesthesiologists' standard monitors were applied, premedication with intravenous midazolam (2 mg) and fentanyl (1.5 μg/kg) was administered, and preoxygenation for 3 to 5 minutes was performed using tidal volume breathing via a tight-fitting facemask. A special inflatable pillow, designed to yield various degrees of head elevation, was placed under the patient's head. The pillow when fully inflated could produce 10-cm occiput elevation, and when fully deflated, no head elevation (head-flat position). Anesthesia was induced using intravenous propofol (2.0 mg/kg) followed by rocuronium (0.6 mg/kg), and manual facemask ventilation commenced until the evoked adductor pollicis responses to ulnar nerve stimulation were completely abolished, indicating adequate muscle relaxation.

Laryngoscopy was then performed using a Macintosh blade, size 3 or 4, to assess the laryngeal view in 3 different positions in random order (Fig. 1A-C):

1. No head elevation when the pillow is fully deflated and only slight head extension was applied.
2. Sniffing position: 6.0 cm occiput elevation (approximately 35° neck flexion) with slight head extension.
3. Elevated sniffing position (ESP): 10.0 cm occiput elevation (>35° neck flexion) with slight head extension.

The same degree of head extension was applied in all 3 positions. An assistant looking at the profile view of the head helped in standardizing the same face-plan in the 3 studied positions.

With the head in the preselected initial viewing position, the laryngoscope blade was inserted and the view was assessed. With the blade in situ, the pillow was adjusted to the other 2 positions in preselected order, and the views were reassessed. The SP and the ESP were accomplished by inflating the pillow to the desired elevation, and a ruler was used to verify the height.

Randomization of the sequence of pillow height was performed by assigning computer-generated random numbered sealed envelopes containing card 1 of 6 possible sequences at the time that patient consent was obtained. During preoxygenation, the envelope was opened, and the sequence of head elevation for any particular patient was known. To grade the laryngeal view, Benumof's modification [11] of the Cormack and Lehane's grading system [12] was used.

1. Grade 1a: all of the vocal cords, including the anterior commisure, can be visualized
   Grade 1b: when only part (not all) of the vocal cords are visualized. The score may range from 1.1 (when 90% of the cords are seen) to 1.9 (when only 10% are seen)
2. Grade 2: only arytenoids are seen, and no parts of the vocal cords can be visualized
3. Grade 3: only epiglottis is seen
4. Grade 4: epiglottis could not be visualized.

The view was graded without any external laryngeal manipulation (ELM). The 3 laryngoscopists who conducted the study had a prestudy period of training to use the same lifting force on the laryngoscope blade throughout the study. On the basis of this training, a faithful attempt was made by the laryngoscopists to maintain the same lifting force in the 3 positions. If ELM or an increase in the lifting force deemed necessary for better visualization (grade 3 or 4 in all positions), these maneuvers were only performed after grading the view in the 3 positions. A flexible fiberoptic scope and a difficult airway cart were always available in the room in case they were needed. The use of ELM, the need for an intubating stylet or an introducer, the need to increase the lifting force, and the need for fiberoptic visualization were all recorded. The incidence of difficult laryngoscopy (defined as grade 3 or 4 laryngoscopic views) with each head position was documented.

2.1. Statistical analysis

G-Power software version 3.1 was used to perform sample size analysis [13]. All other statistical analyses were performed using SPSS software version 19.0 (SPSS, Chicago, Ill). An a priori power analysis suggested that a