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SCIENTIFIC ARTICLE

Effectiveness of the C-MAC video laryngoscope in the management of unexpected failed intubations

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KEYWORDS

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Abstract

Background and objectives: The purpose of this study was to review the experiences of an anesthesiology department regarding the use of a C-MAC videolaryngoscope in unexpected failed intubation attempts.

Methods: Data were analyzed from 42 patients whose intubation attempts using Macintosh direct laryngoscopes had failed, and on whom a C-MAC videolaryngoscope was utilized as the primary rescue device. The success rate of C-MAC in intubation was assessed, and laryngeal views from both devices were compared.

Results: The Cormack and Lehane score was III in 41 patients, and IV in one patient, with the Macintosh laryngoscope, while Cormack and Lehane score was I in 27 patients, II in 14 and III in one with CMAC. Tracheal intubation with CMAC was successful on the first attempt in 36 patients (86%), and on the second attempt in 6 patients (14%). No complications were observed other than minor damage (blood on blade) in 8 patients (19%).

Conclusion: These data provide evidence for the clinical effectiveness of C-MAC videolaryngoscope in managing the unexpected failed intubations in routine anesthesia care. The C-MAC videolaryngoscope is efficient and safe as a primary rescue device in unexpected failed intubations.

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Introduction

Two capabilities that an anesthesiologist must possess are accurate assessment and efficient control of the airway.

Despite the strategic advancements in predicting difficult airway, the efficacy of routine preoperative tests is still limited.

Unexpected difficult laryngoscopy and failed tracheal intubation are among the major causes of morbidity and mortality associated with anesthesia.^{1,2} In addition to the low success rates of multiple intubation attempts, complications such as airway trauma, hypoxia, tachycardia,

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increase in blood pressure and intracranial and intraocular pressure, aspiration, and cardiac arrest may arise.³ The American Society of Anesthesiologists (ASA) has limited repeated use of the same technique for the prevention of complications in difficult airway, and recommends the utilization of alternative techniques.⁴ Videolaryngoscopes introduce a potential solution that enables better imaging of the larynx when conventional laryngoscopes fail.⁵

The C-MAC[®] videolaryngoscope (Karl Storz, Tuttlingen, Germany) features standard Macintosh blade designs with an external light source and small digital camera at the distal third of the blade that extend to a video display monitor.⁶ Unlike videolaryngoscopes with acute angulated blades, it is possible to see the glottis in two ways: the first is the direct view of the glottis with the naked eye, and the second is the indirect view from the monitor with the help of a miniature camera at the tip of the blades.

Studies have shown that the limited laryngeal view improved with C-MAC following direct laryngoscopy.^{6,7} Successful applications of a C-MAC in expected difficult laryngoscopy settings have also been reported.⁸ However, there is insufficient knowledge on the efficacy of C-MAC and potential complications in emergencies during everyday clinical practices, such as unexpected (unpredicted) failed intubation.

A C-MAC is used as the primary emergency airway device in unexpected failed intubation cases in our department, and these cases are recorded using a standardized form. The purpose of this retrospective review was to evaluate the utility of a C-MAC that is used after failed intubation attempts with a conventional Macintosh laryngoscope.

Methods

Setting

This study analyses the recorded data on the difficult airway forms from patients who underwent tracheal intubation under general anesthesia in the operating room. In our operating room practices, we use C-MAC whenever suitable, if primary conventional laryngoscopy attempt reveals a difficult intubation and we are able to provide enough ventilation using a mask. However, a C-MAC is not used in every difficult laryngoscopy case since a number of our 24 operating rooms are located in different blocks, and we have only 1 videolaryngoscope (C-MAC) with a no. 3 blade in our department. Moreover, familiarization with how to use the newly acquired C-MAC in our department has not yet been fully achieved. Therefore, some anesthesiologists do not use the C-MAC because it is not available or because they are not trained. In cases of difficult laryngoscopy, a semi-rigid stylet is used to guide the endotracheal tube. The C-MAC is used by anesthesiologists with prior training and over 20 clinical use experiences, whenever possible.

In our department, information on unexpected failed intubation cases, applied techniques and results are recorded in a prepared standardized form. This form includes the following information: patient characteristics (including age, gender, ASA status), anesthesia technique, difficult facemask ventilation, device(s) used for intubation, person(s) who performed the intubation, the number of

intubation attempts, use of stylet, external laryngeal manipulations, success of intubation, complications.

The best laryngeal views obtained on consecutive attempts were recorded as Cormack and Lehane (CL) grade.⁹ An attempt was defined as insertion of the endotracheal tube into the oropharynx. Retraction of the tube or unintended esophageal intubation is defined as "failure". The completion of the unexpected failed intubation forms is triggered by the anesthesiology specialist's clinical decision.

Study design

After receiving approval from the institutional review board, the recorded difficult airway assessment forms for patients, who underwent general anesthesia between the dates of April 2011 and 2012, were retrospectively reviewed. Information regarding cases, in which a C-MAC videolaryngoscope was used following a failed orotracheal intubation attempt with a Regular Macintosh laryngoscope (Heine instruments Germany), was analyzed.

From these records, patients over the age of 18, who had no history of difficult intubation or difficult airway, had a Mallampati score of ≤ 2 , and normal airway examination, but had a failed intubation attempt following induction of anesthesia, were specified. Emergency surgery, obstetric cases, and cases in which direct laryngoscope was simultaneously used with a C-MAC by different anesthesiology specialists were excluded from the study.

Outcome measures

The primary outcome measure was the intubation success of C-MAC in direct laryngoscopy and unexpected difficult intubation cases. The second outcome measures were the Cormack-Lehane views through direct laryngoscopy and C-MAC.

Statistical analysis

Statistical analysis was carried out with the 16.0 version of the SPSS programme for Windows (SPSS Inc., Chicago, IL). The Wilcoxon signed-rank test was used for the comparison of data obtained from the same patient using two separate devices. Normally distributed numerical data were presented as mean, standard deviation, and range (minimum–maximum). Categorical variables were presented as counts and percentages. *p*-Values of less than 0.05 were accepted as significant.

Results

During the study period in our department, endotracheal intubation was performed on 5774 patients whose preoperative airway examinations were normal. Tracheal intubation attempts using Macintosh laryngoscope failed in 53 patients (0.91%), and a C-MAC laryngoscope was used as the primary emergency airway device. Out of these patients, 11 were excluded from the study either because they fit the exclusion criteria or the anesthesiology specialist using the C-MAC did not have sufficient experience (Fig. 1).

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