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Review

Update on video laryngoscopy in the emergency environment: The most important publications of the last 12 months

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1. Introduction

The use of video laryngoscopes has increased over the last years significantly for many pre-hospital and in-hospital emergency situations. Whereas their use was limited to elective intubations, especially for the anticipated difficult airway, they are used today for a broad spectrum of indications. In general, it seems that the learning curve for video laryngoscopes is very steep and especially beginners may benefit from their use. However, both experienced anaesthesiologists and beginners have usually a high success rate for tracheal intubation when using video laryngoscopes.

This review presents and analyses recent publications and gives an oversight on published data on video laryngoscopes use in emergency environment. Identification of articles with a focus on video laryngoscopy for emergency situations was made in the MEDLINE database (<http://www.pubmed.org>) from August 1st, 2014 to August 1st, 2015. Articles were then independently screened and rated by each author for further analysis and, after consensus selected for inclusion.

2. Faster and more successful

Tracheal intubation is considered gold standard for securing the airway during cardiopulmonary resuscitation (CPR) or after the return of spontaneous circulation (ROSC) [1,2]. It is also considered the optimal method [3] and was associated with better outcomes in

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some recent CPR studies [4]. However, tracheal intubation during CPR is a high-risk procedure [5] and has a lower success rate [3] as compared with in-hospital tracheal intubation for anaesthesia which may be caused by adverse environmental factors [1,6]. Additionally, repetitive and prolonged tracheal intubation attempts by direct laryngoscopy may reduce CPR quality and prolong no-flow time [3] and, therefore, may be associated with poor outcomes for cardiac arrest victims [7]. Recent studies showed a higher success rate and faster intubation attempts when using video laryngoscopes in emergency medicine patients instead of conventional, direct laryngoscopy [6,8]. This effect might even be more significant with less training in tracheal intubation [9].

To analyse video laryngoscopy as compared with direct laryngoscopy during CPR, Park et al. [3] performed a historically controlled clinical study in a tertiary training hospital in Seoul to analyse the improvement of tracheal intubation performance during CPR in novice physicians. Eight first-year residents, with no clinical experience of tracheal intubation beforehand, participated in the study, which consisted of two different time-frames (May, 2011, to April, 2012, and May, 2012, to April, 2013). The success rate of the first attempt tracheal intubation was chosen as the primary outcome parameter. The authors analysed a total of 305 adult victims with out-of-hospital cardiac arrest (OHCA) during the two-year study period in which 83 tracheal intubations (34 vs. 49) were performed by direct laryngoscopy or GlideScope video laryngoscopy (Verathon, Bothell, WA, USA).

The overall success rate of the first tracheal intubation attempt was significantly higher in the video laryngoscopy group (91.8%) as compared with direct laryngoscopy (55.9%; $p < 0.001$). Congruently, the time to place the tracheal tube was significantly shorter when using a video laryngoscope (37 vs. 62 s; $p < 0.001$) and the number of oesophageal intubations was lower in the video laryngoscopy group (0 vs. 6). Concerning the quality of CPR, the use of a video laryngoscope resulted in significantly less interruptions of chest compressions (0 vs. 7; $p < 0.001$).

This study by Park et al. [3] is the first analysing several different quality parameters of tracheal intubation by direct laryngoscopy as compared with video laryngoscopy. The results of this study clearly show that using video laryngoscopy for ETI during CPR results in faster and more secure tracheal tube placement and a higher quality of CPR in novice physicians. Fastening tracheal intubation with a higher success rate is of utmost importance especially in less trained physicians and seems to be feasible when using video laryngoscopes. In contrast to conventional laryngoscopy, where 100–150 tracheal intubations are required to reach a success rate of >95% [9], the learning curve of video laryngoscopy is steeper. Additionally, video laryngoscopy has shown to facilitate tracheal intubation during frontal intubation [8] or in inconvenient intubating conditions [6]. Since the number of participants in the study was very low, future studies should focus on this aspect and validate the findings in both a larger cohort of patients and more skilled physicians.

3. In-hospital intubation success rate

Supplementary, Lee and colleagues [5] investigated the efficacy of video laryngoscopy for in-hospital tracheal intubation during CPR and, therefore, used a comparable approach to this topic.

Between January, 2011, and December, 2013, the authors prospectively collected data from 229 CPR patients for retrospective analysis. In their study, the initial laryngoscopy method was video laryngoscopy in 121 patients (52.8%) and direct laryngoscopy in 108 patients (47.2%) [5]. Video laryngoscopy was performed through GlideScope or Airway scope (Pentax Corporation, Tokyo, Japan), depending on the availability at the moment, but the precise type of

video laryngoscopy was not recorded. The rate of successful tracheal intubation at the first attempt was significantly higher with video laryngoscopy (71.9%) as compared with direct laryngoscopy (52.8%; $P = 0.003$). For experienced physicians, the rate of success at the first attempt was higher (73.0%) than for inexperienced operators, including residents (52.6%; $P = 0.001$). However, mortality at day 28 after CPR was not significantly different between patients with successful tracheal intubation at the first attempt and without (68.1% [98/144] vs. 67.1% [57/85]; $P = 0.876$).

In a multivariate logistic regression analysis, a predicted difficult airway (odds ratio, OR, [95% CI] = 0.22 [0.10–0.49]; $P < 0.001$), intubation by an experienced operator (2.63 [1.42–4.87]; $p = 0.002$), and the use of video laryngoscopy rather than direct laryngoscopy (2.42 [1.30–4.45]; $P = 0.005$) were independently associated with a successful tracheal intubation at the first attempt.

The present study [5], although not analysing OHCA but IHCA patients, found comparable results to the study by Park and colleagues [3]. Congruently, both studies found that the use of video laryngoscopy during CPR from in-hospital or out-of-hospital cardiac arrest was independently associated with successful tracheal intubation at the first attempt. Moreover, time to successful tracheal intubation was shorter and complications were less when using video laryngoscopy for tracheal intubation during cardiac arrest and CPR.

Although the authors found these relevant results for tracheal intubation, the study failed to demonstrate any difference in mortality when using either direct or video laryngoscopy. Since CPR quality may be directly associated with the outcome of patients it is curious why the study failed to show any benefit in mortality when using video laryngoscopes. The reason may be the retrospective approach to the data and concealed effects. Therefore, it seems to be desirable to analyse these effects by a randomized controlled trial in the future.

4. Video laryngoscopy for non-CPR cases

Besides advances in tracheal intubation during CPR by video laryngoscopes, analysis of their use in different emergency medical settings is required for a complete assessment. From recent studies, it is well known that out-of-hospital tracheal intubation may be associated with life-threatening complications [1] and that the incidence of difficult tracheal intubation in the out-of-hospital setting is higher than that seen in the operating room [10–12]. Data comparing direct and video laryngoscopy views simultaneously in the same patients in an out-of-hospital setting is scarcely being published.

Bjoern Hossfeld and colleagues from Ulm, Germany, analysed the effect of the C-MAC PM video laryngoscope (Karl Storz, Tuttlingen, Germany) in terms of laryngeal view and compared the data with direct laryngoscopy for estimating possible consequences for patient safety. They used an observational, single-centre study design for patients of the Helicopter Emergency Medical Service (HEMS) 'CHRISTOPH 22', Ulm, Germany [13].

Two-hundred and twenty-eight emergency patients were included undergoing airway management in the out-of-hospital emergency setting. Laryngoscopy and tracheal intubation were performed using C-MAC PM video laryngoscope. For all intubations, the HEMS physician used C-MAC PM as the first-line device and performed an initial direct laryngoscopy followed by a video laryngoscopy, without changing the laryngoscope blade. The difference in laryngeal view was recorded as well as the number of intubation attempts along with the success rate and difficulties in airway management. Improvement in glottic visualisation from Cormack and Lehane grade III/IV to I/II was rated as being clinically relevant.

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