Remote Airway Imaging to Supplement Pre-anesthesia Assessment

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Abstract

Pre-operative physical exam is critical to safely providing anesthesia to patients. This is done in a face to face session with the patient. The patient is asked to widely open their mouth and stick their tongue out. The airway is then 'graded' according to the classification of Mallampati. Sometimes an anesthesia provider is not immediately available to make this assessment. We examined remote assessment of patient airways. Ten non-patient volunteers were studied. Each was examined in person. Each subject also separately had a close-up picture of their mouth open using a cell phone camera equipped with a built in flash. This picture was transmitted and then graded in a blinded fashion by the same experienced anesthesiologist. In eight of ten subjects, the in person scoring agreed with the cell phone flash picture scoring. Thus remote airway assessment may be helpful when providers are physically remote.

Keywords: CPR, Cellular phone, Bystander CPR, Dispatcher assistance, Emergency medical services, Guidelines, Videoconference

1.0 Introduction

Pre-operative physical exam and assessment of the airway are critical to safely providing anesthesia to patients. This is traditionally done in a face to face session with the patient. Specifically, the patient is asked to widely open their mouth and stick their tongue out. The airway is then 'graded' according to the classification of Mallampati. Mallampati described a numerical rating of airways from Class I to Class IV when the patient opens their mouth and sticks their tongue out without saying “ahhh.” (Mallampati, 1983) In a Class I airway, the tongue, soft palate, anterior and posterior tonsillar pillars and entire uvula are visible. In a Class II airway, the tonsillar pillars and the base of the uvula is obscured by the tongue. In a Class III airway, none of the uvula is visible and only the soft palate is visible. In a Class IV airway, the soft palate is not visible.

The importance of this relates to a rough prediction of problems with intubation. A Class I airway will usually lead to a relatively easy oral intubation with an endotracheal tube. Worse grading (higher numerical Mallampati score) alerts the anesthesia team to plan for a more challenging intubation. This allows for obtaining additional equipment, possibly preparing the patient differently, and recruiting additional staff to assist with the process.

1.1 Goals

The goal of this small study was to examine the feasibility of Telemedicine to allow for remote airway assessment. This would be very useful in settings where the person doing the pre-operative assessment of the patient had no familiarity with anesthesia or in grading an airway. By identifying a potentially difficult airway in advance, alternative techniques can be planned for and equipment obtained. This enhances patient safety.

1.2 Design

Ten non-patient volunteers were studied. Each was examined by an experienced anesthesiologist in person and their airway graded as described above. Each subject also separately had an experienced anesthesia provider take a close-up picture of their mouth open using a cell phone camera equipped with a built in flash. This picture was transmitted and then graded in a blinded fashion by the same experienced anesthesiologist.

1.3 Results

In eight of ten subjects, the in person scoring agreed with the cell phone flash picture scoring. In one case, the cell phone picture assessment of the airway was a grade better than the in person assessment, and in another case, the cell phone picture assessment was a grade worse than the in person assessment.

1.4 Discussion

Remote enhancement of other medical care has been studied. Deakin et al explored the use of telephone guidance of CPR resuscitation. Both ventilations and compressions are important for victims of prolonged cardiopulmonary resuscitation (CPR) and asphyxial arrest. Dispatch assistance increases bystander CPR, but the quality of dispatcher-assisted CPR (DA-CPR), especially rescue breathing, remains unsatisfactory. The aim of telephone-cardiopulmonary resuscitation (CPR) advice is to increase the quantity and quantity of bystander CPR. Bystander CPR is one of the few interventions shown to improve outcome in cardiac arrest. They evaluated a current pediatric telephone protocol to assess the effectiveness of verbal CPR instructions in pediatric cardiac arrest. They found that telephone CPR was accepted by 64.7% of callers. Subsequent analysis of the calls indicated there significant delays in interventions. The median time to open the airway was 126 seconds, while the time to deliver the first ventilation was 3 minutes. The time to first chest compression was 280 seconds. They concluded that while telephone CPR improves the numbers of children whom get bystander CPR, the efficacy is limited by the significant delays in delivering the basic life support. (Deakin, 2010)

Bystander cardiopulmonary resuscitation (CPR) has been shown to significantly improve outcome in sudden cardiac arrest in children. In view of this, most emergency medicine services deliver telephone instructions for carrying out CPR to laypeople who call the emergency services. Little is known as to whether laypeople carrying out these instructions deliver effective CPR. Dawkins studied adult volunteers who had no previous experience of CPR. They were presented with a scenario and asked to perform CPR for 3 min on a training manikin according to the instructions they were given by telephone. Tidal volume, compression rate and depth, time to the beginning of CPR and hand positioning were recorded. None of the subjects identified correctly that the manikin was not breathing and achieved a level of CPR performance that was consistent with all of the current guidelines. Median tidal volume of rescue breaths was 38 mL. Only 23% of subjects delivered rescue breaths of optimal volume (40–50 mL) and 23% delivered no effective breaths at all. Chest compressions were performed at a median rate of 95 min^{-1} with 37% delivering compressions at the optimum rate of 90–110 min^{-1}. None of the volunteers performed telephone-CPR at a level consistent with current guidelines. (Dawkins, 2008)

Johnsen reported on how the addition of video impacted dispatcher assisted cardio-pulmonary resuscitation, compared to plain voice-only calls. Dispatchers were interviewed after they used video-calls versus traditional phone calls to guide rescuers in resuscitation.

Video-calls influenced the information basis and understanding of the dispatchers. The dispatchers experienced that (1) video-calls are useful for obtaining information and provides adequate functionality to support CPR assistance; (2) their CPR assistance becomes easier; (3) the CPR might be of better quality; but (4) there is a risk of "noise".

Video calls may provide a new basis for dispatcher assistance. Video-calls may improve rescuer compliance. The role and content of telephone-directed protocols used by dispatchers may need adjustments when video-calls are used for medical emergencies. They conclude that video communication can improve the dispatchers' understanding of the rescuer's situation, and the assistance they provide.
(Johnsen, 2008)

Both ventilations and compressions are important for victims of prolonged cardiopulmonary resuscitation (CPR) and asphyxial arrest. Dispatch assistance increases bystander CPR, but the quality of dispatcher-assisted CPR (DA-CPR), especially rescue breathing, remains unsatisfactory. Yang assessed the impact of adding interactive video communication to dispatch instructions on the quality of rescue breathing in simulated cardiac arrests. In this simulation-based study, adults without CPR training within 5 years were recruited and randomized to receive dispatch assistance with either voice instruction alone or interactive voice and video instruction via a video cell phone. The quality of rescue breathing was evaluated by reviewing the videos and mannequin reports.

Subjects in the video group were more likely to open the airway correctly (95.3% vs. 58.5%, $P<0.01$) and to lift the chin properly (95.3% vs. 62.3%, $P<0.01$), but had similar rates of head-tilt (95.3% vs. 84.9%, $P=0.10$). Volunteers in the video group had larger volume of ventilation (median volume 540 ml vs. 0 ml, $P<0.01$), greater possibility to sustain an open airway (88.4% vs. 60.4%, $P<0.01$) and a tendency towards better nose-pinch (97.7% vs. 86.8%, $P=0.06$). The video group spent longer time to open the airway (59 s vs. 56 s, $P<0.05$) and to give the first rescue breathing (139 s vs. 102 s, $P<0.01$).

Adding video communication to dispatch instructions improved the quality of bystander rescue breathing, including higher proportion of airway opened, and larger volume of ventilation delivered, in simulated cardiac arrests. (Yang, 2008)

Sparrow studied the use of telemedicine in improving compliance with CPAP (Continuous Positive Airway Pressure) in OSA (Obstructive Sleep Apnea) patients. They found improved compliance in the telemedicine group. (Sparrow, 2010)

Fox also described the use of telemedicine to optimize CPAP treatment of OSA patients. Patients were randomized to either standard care with an auto titrating CPAP machine or an auto titrating CPAP machine that transmitted physiologic information daily to a website that could be reviewed. If problems were identified from information from the website, the patient was contacted by telephone as necessary. They found CPAP adherence can be improved with the use of a web-based telemedicine system at the initiation of treatment. (Fox, 2012)

Telemedicine has been applied in the pre-operative evaluation of urology patients: Park describes the establishment of a Telemedicine Urology Clinic at the VA Medical Center in Omaha, Nebraska to serve an underserved veteran population in rural Nebraska. Results from patient satisfaction surveys show that both the patient and the healthcare provider benefit from the telemedicine encounter for both the preoperative and the postoperative setting. (Park, 2011)

1.5 We report the use of Telemedicine pictures for remote airway assessment. Results indicate that in 80% of subjects in this pilot study, cell phone pictures with flash agree with professional in person airway assessment. This indicates a future role for Telemedicine in the remote evaluation of patients for anesthesia in cases where there is no on-site anesthesia provider to assess the airway. Through Telemedicine, remote patients can benefit from earlier recognition of challenging and difficult airways. Further research is needed in a larger group of subjects before these results can be generalized.

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