2021 CAS Annual Meeting

Airway Management

(Abstracts and Case Report/Series)

Contents

ACE Inhibitor-Mediated Angioedema Triggered by LMA Placement

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Introduction: ACE inhibitor (ACEi)-mediated angioedema (ACEi-AE) affects 0.1-0.7% of treated patients.[1] It is the most common cause of angioedema, representing 38-68% of cases; its mortality rate is 11%.[2] Risk factors include ethnicity (African-descents and Hispanics > Caucasians), female gender, smoking, elderly, history of drug-induced rash, seasonal allergies and use of immunosuppressive therapy.[1] It manifests as nonpitting edema of the face, lips, tongue, uvula, and/or upper airway without urticaria or pruritus, and in severe cases may require emergency airway management.

Case Presentation: Patient consent was obtained for publication of this case. A 76 year old man with hypertension, hyperlipidemia and anxiety presented for elective removal of an infected urethral sling. Medications included cephalexin, quinapril (held on the day of surgery), atorvastatin, amitriptyline and alprazolam. He denied any allergies. Following anesthesia induction, insertion of an LMA (i-Gel®, Intersurgical Ltd, Berkshire, UK) initially met mild resistance against the tongue, but was uneventful on subsequent attempt. There were no ventilation issues noted during the 3-hour procedure during which the patient was maintained on pressure-support ventilation under sevoflurane. Upon surgical completion, the LMA was removed and the patient transferred to the recovery room. Three hours later, he developed progressive slurred speech and respiratory distress. Initial assessment revealed rapidly progressive tongue swelling, prompting the anesthesiologist to perform an emergency awake fiberoptic nasal intubation. The extreme swelling was seemingly restricted to the tongue (Fig. 1). Hemodynamics and oxygenation were maintained throughout. There were no wheezing or rash; tryptase levels were normal. He was transferred to intensive care where his trachea was extubated 3 days later.

ACEi-AE is rare and may take years to develop, however a single episode requires ACEi therapy to be discontinued due to high recurrence rates with reportedly increasing severity at each episode. Controversy exists surrounding the safety of angiotensin-receptor blockers for patients who have developed ACEi-AE. Pathophysiology involves accumulation of bradykinin (which is normally metabolized by ACE), and marked bradykinin local release triggered by seemingly minor trauma[3] (e.g., LMA insertion). Attacks are self-limiting, resolving after 48-72 hours. Pharmacologic treatment with antihistamines, steroids and epinephrine remains debatable. While tranexamic acid, fresh frozen plasma, and C1-inhibitor concentrate infusion have shown some therapeutic efficacy,[1,4] icatibant (a bradykinin b2-receptor antagonist) has shown conflicting results.[1]
Perioperatively, ACEi-AE can be triggered by airway manipulation and/or surgical trauma from head and neck procedures including oral surgery, carotid endarterectomy, and cervical laminectomy.[3] A previous case of ACEi-AE following LMA insertion has been reported; management was expectant with no need for airway intervention.[5]

Conclusion: ACEi-AE is a potentially life-threatening complication that must be included in the differential diagnosis of perioperative slurred speech, upper airway edema, and/or respiratory

failure since prompt recognition and airway management are paramount to ensure a favorable outcome.

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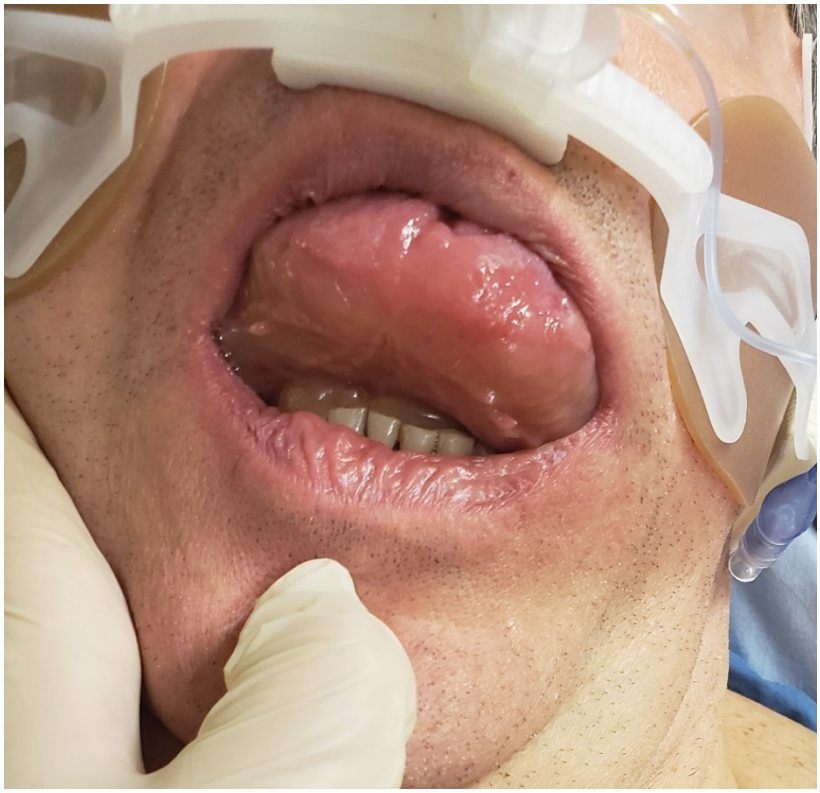
Figure 1



Comparison of Three Airway Management Techniques for Restricted Access in a Simulated Pediatric Motor Vehicle Entrapped Scenario – Direct Laryngoscopy Versus Video Laryngoscopy Versus Supraglottic Device

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Introduction / Background: Emergency pediatric airway management during restricted access to the head is challenging. The need for face-to-face airway management may relate to an entrapped motor vehicle trauma casualty but also applies to lost airways in sitting or prone position operative cases. All three of direct laryngoscopy, video laryngoscopy and supraglottic airways have separately been described to facilitate face-to-face airway management. We hypothesized that video laryngoscopy might be superior to direct laryngoscopy or supraglottic device use to establish ventilation during face-to-face airway management, studied in a simulated pediatric entrapped motor vehicle scenario.

Methods: Ethics approval was obtained from local REB. With their consent, 45 experienced airway practitioners (staff anesthesiologists and anesthesia residents with greater than 300 intubations) managed the airway of a pediatric manikin representing a 6 year old (SimJunior). With a cervical collar applied and in the sitting position, the manikin's head was only accessible from the left anterolateral side. Using the device in the right hand, a standardized demonstration of face-to-face use of a Macintosh #2 blade (DL), a Storz C-MAC® D-Blade (VL) and a #2.5 LMA Supreme™ (SD) was provided. Participants managed the airway with all 3 devices, randomized to start with DL, VL or SD. Outcomes included overall success rate, time to ventilation (TTV), percentage of glottic opening (POGO) for DL and VL and ease of use on a 10-point Likert scale (VAS). Data was analysed using analysis of variance for TTV and VAS and t-test for POGO. Statistical significance was deemed at $P<0.05$. Data are presented as median and interquartile range.

Results: Success rate was 95% (43/45) for both DL and SD and 93% (42/45) for VL. TTV was significantly less with SD compared to DL and VL (Figure). TTV was 31 sec (28, 35) for DL, 46 sec (31, 62) for VL and 20 sec (17, 24) for SD. POGO was significantly improved with VL compared to DL - 100 % (100, 100) for VL and 80% (60, 100) for DL. Participants rated SD significantly easier to use than VL (VAS 8 [6,9] SD vs. 6 [3.5,8] VL), but not easier than DL (VAS 7 [5.5,8]). Ease of use did not differ significantly between DL and VL.

Discussion: All three techniques have high success rates. Time to establish ventilation with the SD was significantly faster compared to DL and VL and participants rated SD easiest to use. The utility of face-to-face VL was limited due to significantly longer time to ventilation, despite significantly improved view compared to DL, similar to adult studies. Since both time and success are clinically important, this study suggests that supraglottic devices should be considered for primary emergency pediatric airway management in situations with restricted access to the head.

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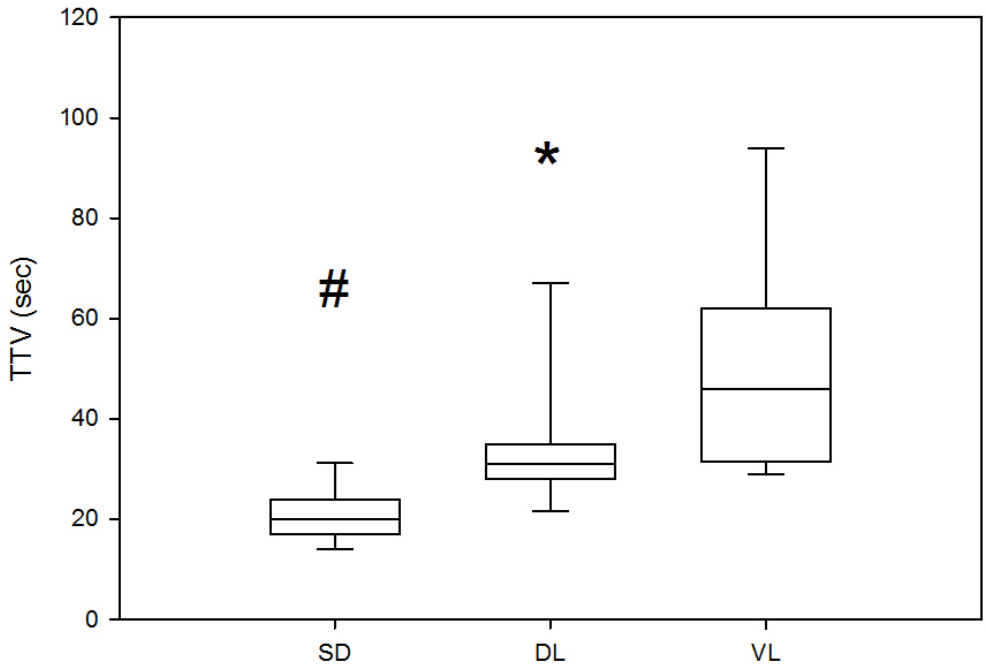
Time to ventilation in seconds for supraglottic device, direct laryngoscopy and video laryngoscopy.
Data are presented as Median and interquartile range (Min, Max).
SD versus DL and VL, P<0.001
* DL versus VL, P<0.05



Emergency Airway Management in a Tertiary Trauma Centre: A 1-year Prospective Longitudinal Study

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Introduction: Emergency airway management can be associated with difficulties that can result in complications ranging from transient adverse events to long term neurological injury, need for surgical airway and death. (1) A series of Canadian multi-centre studies showed that adverse events are common in emergency airway management and that that they are associated with poor patient outcomes. (2,3) Multiple attempts at laryngoscopy are associated with increased complications. (1,2,3) At the study site, a tertiary care trauma centre, there is a paucity of data regarding emergency airway management. The objectives of this study are:

1. To enumerate the number of emergent intubations that occur annually
2. To quantify the incidence of first pass success
3. To quantify the incidence of adverse events associated with emergency airway management
4. To identify predictors of successful first pass intubation
5. To identify predictors of adverse events

Methods: Ethics approval was obtained from the local REB. We performed a single centre, prospective, observational study, including all adult patients (>17 years old) intubated in the Emergency Department, Intensive Care Units (ICU), in-patient wards or a diagnostic imaging suite. The Respiratory Therapy Department assists at all intubations, as such, the Respiratory Therapist (RT) liased with the physician responsible for the intubation to complete the data collection sheet. We collected additional data via chart review retrospectively. Data collection was shortened to 7-months due to the COVID-19 pandemic.

Results: In a 7-month period, there were 416 emergency intubations and a first pass success rate of 73.08%. First pass success rates varied widely between locations; ward intubations were the lowest with 57.5% completed successfully, followed by 66.1% in the ICU's and 84.3% in the Emergency Department. Hypotension and hypoxemia occurred in 57 (13.7%) and 48 (11.5%) patients, respectively. Direct laryngoscopy (DL) was used as the primary technique in 199 patients (47.8%) but varied significantly by location; Emergency Room (35.0%) compared to on the ward (89.4%). Failure of first pass intubation was associated with inexperienced operator (OR: 2.06, CI: 1.30 – 3.24), use of paralysis (OR: 0.36, CI: 0.23 – 0.56), direct laryngscopy (OR: 1.74, CI: 1.12 – 2.70), physiologic difficult airways (OR: 2.04, CI: 1.25 – 3.32) and location (any vs. ER). Paralysis was used in 260 (62.5%) of patients and was not associated with hypoxia (OR: 1.15, CI: 0.60 – 2.20) or hypotension (OR: 0.99, CI: 0.54 – 1.81).

Discussion: Emergency intubation is a frequently performed life-saving procedure. First pass success is associated with a number of modifiable factors and the rate of success varies

significantly between locations at the study hospital. Operator experience, choice of medications, and equipment used are associated with first pass success and are potential targets for efforts to improve rates of successful first pass emergency airway management.

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First-Pass Success Rate of Endotracheal Intubation in Anesthetized Adults Comparing Video Laryngoscopy Using a Standard Blade to Direct Laryngoscopy - A Multicentre, Randomized Controlled Clinical Trial

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Introduction/Background: First-pass intubation success has long been an important goal, with multiple attempts at laryngoscopy associated with airway trauma and potential morbidity[1]. The COVID-19 pandemic has reinforced the importance of first-pass success (FPS) to increase patient and healthcare worker safety[2]. Video laryngoscopy (VL) has been reported to reduce the incidence of failed intubations. However, the impact of VL on FPS remains unclear[3]. We hypothesized that using the McGrath MAC VL (McG; Medtronic®, Dublin, Ireland) for routine intubation in the operating room would result in a higher FPS compared to conventional direct laryngoscopy (DL).

Methods[4]: Ethics committees of participating centres approved this international multicentre randomized controlled trial prior to patient recruitment. Adults for elective surgery under general anesthesia requiring endotracheal intubation, without predictors of difficulty, were consented and randomized to either DL or McG. The primary outcome was FPS; secondary endpoints were the influence of the provider experience, time to ventilation, and adverse events (e.g., hypoxia or soft tissue injury). Multiple logistic regression analysis of subgroup factors allowed assessing factors affecting successful first-time intubation comparing McG to DL. A chi-squared test was used to compare FPS between the two groups. Data are expressed as median (interquartile range [IQR]). $p < 0.05$ was considered to be statistically significant.

Results: A total of 3323 patients were assessed for eligibility. 2047 consented and were enrolled in the trial (McG n=1021; DL n=1026). FPS was higher with the McG (955/1021, 93.5%), compared with DL (839/1026, 82%; p<0.0001). Overall, 1011/1021 (99%) of the McG and 983/1026 (96%) of DL attempts were successful after two attempts. Years of anesthesia experience had a positive effect on the probability of FPS (p<0.001). Lack of experience had a stronger effect on failure when using DL (OR = 0.889, 95% CI = [0.859; 0.940]), compared to McG (OR=0.992, 95%CI=[0.951;1.034]). Time to ventilation was shorter with DL (34 s, IQR [26-45]), compared to McG (36 s, [26-48]; p<0.01). Overall, no differences in intubation-associated adverse events between groups were observed (p=0.19). However, soft tissue lesions were more frequent with DL (25/1026, 2%) than McG (12/1021, 1%; p=0.03).

Discussion: In this large randomized multicenter trial, using a video laryngoscope with a Macintosh blade improved the intubation first-pass success rate in adults under routine general anesthesia. Less experienced anesthesiologists were more likely to be successful with the McG, compared to DL. Intubation time was slightly shorter using DL, but this was not clinically relevant. Based on these results, video laryngoscopy using a Macintosh-shaped blade can be recommended as a first-choice instrument to improve FPS in patients without predictors for

difficult airway management. These findings are highly relevant during the ongoing COVID-19 pandemic.

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