
# CAS 2023 Annual Meeting

## Airway Management Abstracts

# Contents

# A Retrospective Review of the Role of Anesthesia Assistants at "Code Blue" Cardiopulmonary Resuscitation Events


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## INTRODUCTION

Anesthesia Assistants (AAs), who work under the supervision of anesthesiologists, are a valuable addition to the anesthesia care team. Over the past decade, the role of the Anesthesia Assistant has expanded from primarily technical support towards more delegated clinical responsibilities, including more tasks and responsibilities outside of the operating room (OR).[1] In some Canadian institutions, AAs are now members of the cardiac arrest ("code blue") team. Having AAs assist with care and tasks outside of the OR means that more anesthesiologists are available for redeployment to more complex care areas.[2]

**Objectives:** This study examined the roles and responsibilities of AAs during code blue events at a Canadian adult academic teaching facility.

## METHODS

The institutional REB waived the requirement for review of this retrospective QI study. A standardized administrative data form was completed by AAs after attending pre-code or code blue events at our two adult hospital sites from January to December 2022. The data collection form included details regarding the time, location and type of event and supporting or direct tasks performed by the AA. These tasks included airway management details, induction medications used, vasopressor requirements, vascular access, ACLS support and human factors regarding command and communication during the code. In total there were 25 line items on the data forms, with a mixture of check boxes and free text entry lines for hand written narratives. The data from each form was collated into a spreadsheet for analysis. Data was expressed as counts and percentages.

## RESULTS

A total of 84 completed data sheets were collected from code blue events throughout 2022. In total, 40 events occurred during daytime hours (0700-1700h) and 44 occurred at night (1700-0700h). In 37 (44%) of the code blue events AAs managed the airway. The AAs obtained vascular access (IV, arterial line, or Interosseous) in 22 events (26%), and they provided cognitive support to the code team for airway management and ACLS in 34 events (40%). Tracheal intubation was performed in 60 of the 84 (71%) events, with the AAs performing 25 of the intubations (42%). Three of these intubations were performed by direct laryngoscopy and 20 intubations employed video laryngoscopy. Vasopressor or ACLS medications were required in 31 (37%) events.

## DISCUSSION

This study characterizes the supporting roles that AAs can provide to code blue teams, specifically in the domains of airway management, vascular access, ACLS protocols and resuscitative medications. In addition to providing 24-hour in-house call to support Anesthesiologists in the operating rooms, AAs are well suited as members of the hospital code blue team. This study may help inform hospital administrators looking to expand the role of AAs and relieving some of the existing pressures on anesthesiologists.

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# A Reusable, Locally Manufactured, Half-Face Respirator Provides Better Protection than Fitted Disposable N95 Masks: Development and Quantitative Fit-Testing Comparison


## AUTHORS

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## INTRODUCTION

Health care workers (HCWs) face hazardous occupational exposures to infectious organisms, many of which are spread through airborne or aerosolized droplet routes[1]. To reduce the risk of infection, the Centers for Disease Control and Prevention (CDC) recommends the use of personal protective equipment (PPE): gowns, gloves, face shields, goggles and disposable N95 respirators. The COVID-19 pandemic has led to persistent supply shortages of respiratory protective equipment in many jurisdictions. Reusable industrial respirators have been proposed and deployed as an alternative, but also face severe supply limitations. In addition, these industrial respirators do not filter the user's expired breath, a major limitation in health care settings where bidirectional protection is required.

## METHODS

In this paper, we present the development and quantitative testing of a reusable silicone respirator that can be locally manufactured using low-cost desktop infrastructure under pandemic conditions. Using standardized quantitative fit-testing (QNFT) including resting and activity components according to CSA Z94.4-18) in a cohort of 41 healthcare workers (HCWs), we compared the performance of the mask to the individually fitted disposable N95 masks that the HCWs had been assigned by our institution.QNFT include seven testing activities performed by the participant, also referred to as "run". These include: normal

breathing, deep breathing, turning head side-to-side, nodding up-and-down, counting out loud, bending over, and ending with normal breathing again. A QNFT passing score for a half-face N95 respirator requires the subject to score an overall fit-factor of 100 or greater, with at least six individual run score fit factors of 100 or greater. All newly developed respirators must meet this international regulatory standard [8] [13].

**RESULTS**

| | Disposable-N95 | | Duo | | |
|---|---|---|---|---|---|
| | Fit-Factor Harmonic-Mean [95% CI] | Pass N (%) | Fit-Factor Harmonic-Mean [95% CI] | Pass N (%) | P-value* |
| Normal-Breathing | 86.7 [54.7-208.0] | 27 (65.9%) | 3936 [2959-5873] | 41 (100%) | P < 0.0001 |
| Deep-Breathing | 69.5 [41.9-202.3] | 22 (53.7%) | 4752 [3619-6915] | 41 (100%) | P < 0.0001 |
| Head-Side-to-side | 80.1 [50.9-188.7] | 28 (68.3%) | 4589 [3432-6923] | 41 (100%) | P < 0.0001 |
| Head-Up-and-Down | 79.0 [52.6 - 158.8] | 28 (68.3%) | 4432 [3288-6797] | 41 (100%) | P < 0.0001 |
| Talking-out-loud | 73.8 [57.3-103.7] | 21 (51.2%) | 1798 [1524-2192] | 41 (100%) | P < 0.0001 |
| Bending-over | 62.1 [42.0-119.2] | 23 (56.1%) | 2312 [1353-7949] | 41 (100% | P < 0.0001 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | ) | |
| Normal-Breathing | 100.2 [65.9-208.2] | 30 (73.2%) | 2087 [1165-10013] | 41 (100%) | P < 0.0001 |
| Overall | 77.4 [51.9-152.1] | 25 (61.0%) | 2959 [2228-4405] | 41 (100%) | P < 0.0001 |

## DISCUSSION

The surge in demand for N95 and comparable respirators during the current pandemic has repeatedly exceeded the capacity of manufacturing and supply chains. This has led to critical shortages even in traditionally well-resourced countries and has exacerbated the chronic shortages that are a reality for much of the world's population [17 18]. A reusable, locally-manufactured, half-face respirator provides better protection than fitted disposable N95 masks and can contribute to address the global supply systems disruption and allow a better response to future pandemics. The device requires further modification and testing to optimize exhalation flow resistance, and full conformance with technical standards required for regulatory approval.

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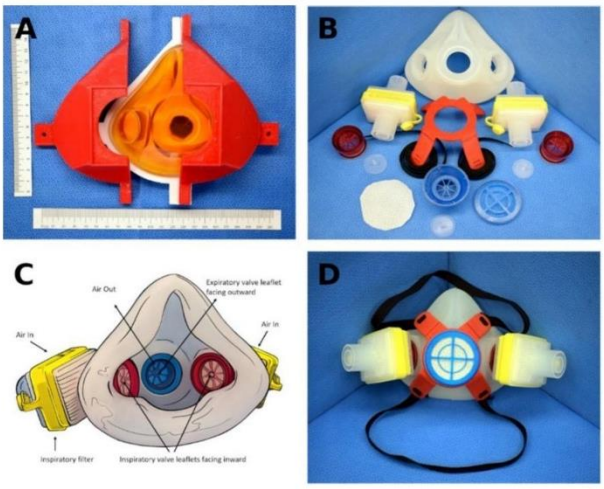


**Fig 1. Production process of the Duo silicone respirator**. A) The 4-part 3D-printed mold B) Complete set of components C) Valve assemblies D) Assembled Duo respirator.

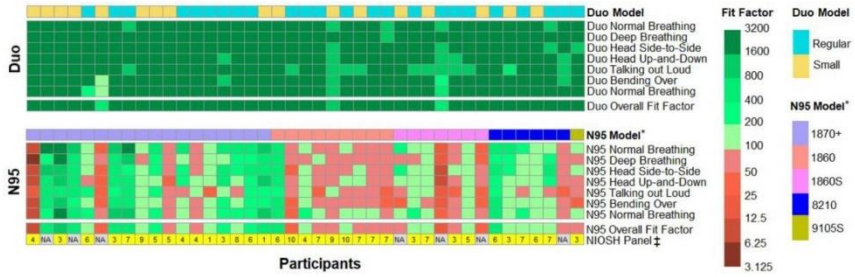


**Fig 2. Heat maps illustrating the results of quantitative fit testing (QNFT) for the Duo and disposable N95 masks.** The results for each participant are represented along each column with the Duo on top and Disposable N95 at the bottom. Rows represent the fit factors for each of the 7 maneuvers, overall fit factor, mask models (legends on left) as well as NIOSH morphometric panel number (bottom row). Participants have been ordered by their qualitatively fit-tested disposable N95 models. Fit factor values are colour coded with green values representing fit factors > 100, indicating a pass according to CSA Z94.4-18 and red boxes indicating failures.

# Can See Can't Pass: Methods to Improve Endotracheal Tube Advancement While Using Hyperangulated Video-Laryngoscope


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## INTRODUCTION

Video laryngoscopy (VL) has become increasingly popular and is especially useful to facilitate endotracheal intubation in patients with predictors of difficult intubation using direct laryngoscopy, or as a backup method when direct laryngoscopy has failed. However, despite its improved visualization of the vocal cords, passage of the endotracheal tube (ETT) with hyperangulated VL (HA-VL) remains to be a frequently encountered challenge. A recent Cochrane review showed that the first pass success is only 88%, and failure rate was 3%, when in common practice visualization of the vocal cords is nearly always achieved.[1] This study aims to evaluate modifications of ETT preparation and advancement on the success rate of HA-VL intubations.

## METHODS

This is a quality assurance study. Informed consent was waived by local research ethics board. Retrospective review of videos of ETT placement using HA-VL at our center were completed (standard technique, [ST]). Challenges encountered during intubations were identified and modifications to mitigate them were generated. Modifications include: pulling deflated ETT cuff opposite to HA-VL camera (to the right side) to avoid visual obstruction, reverse loading the styletted ETT, using a low profile HA-VL blade, intentionally restricted glottic view during laryngoscopy, slight left rotation of the HA-VL handle to obtain better visualization of cords and allow room for ETT entry on the right, advancing the ETT from the right corner of the mouth into the glottic opening from the right side, and placing ETT tip at mid-glottic opening during ETT advancement to avoid catching the cricoid ring. Anesthesia personnel prospectively performed tracheal intubations with HA-VL using modified technique (MT). All intubations were recorded internally by the intubation device and were reviewed by an independent reviewer. Outcome measures, including total time to intubation (TTI), percentage of first-pass success, ETT advancement problems, ETT rotation needed to facilitate passage, percent cuff obstructing view and percent failure rate, were analyzed and compared with the ST.

## RESULTS

One-hundred-eighty-eight videos of ETT placement (ST) were randomly obtained from the internal memory or the SD cards of the HA-VL devices (CMAC Dblade and Glidescope) and reviewed. Additional 65 HA-VL intubations using the MT performed by anesthesia residents and staff were recorded. All 65 MT videos were reviewed by an independent reviewer. Preliminary data analysis showed significantly improved outcomes with the MT with TTI

40.9 15 sec vs 48.4 29 sec (p=0.02), percent first pass success were 97.3% vs 96.9%, ETT advancement problems 38.3% vs 76.9%, ETT rotation needed were 12.3% vs 25.5%, percentage view obstruction by the cuff 1.5% vs 25.5%, and failure rates were 0% vs 3.7% for modified technique versus standard care respectively.

## DISCUSSION

Recent Cochrane review showed the need for improvement of first-pass success using HA-VL and ways to reduce failure rate. The results of our study suggest that the modifications of the HA-VL technique can improve both parameters. However, a large clinical study is needed to confirm the utility of these modifications of the HA-VL intubation technique.

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# Lazarus Phenomenon After Unilateral Auto-PEEP During Jet Ventilation for Rigid Bronchoscopy Debulking of an Airway Tumor


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## INTRODUCTION

The Lazarus phenomenon is defined as delayed return of spontaneous circulation (ROSC) after stopping cardiopulmonary resuscitation (CPR).[1] Auto-PEEP causing impaired venous return is considered during times of hemodynamic instability in patients undergoing positive-pressure ventilation (PPV), especially those with known obstructive airway disease.[2] This same dynamic hyperinflation is believed to be the dominant underlying physiology of the Lazarus phenomenon.[1] Other proposed etiologies include delayed action of resuscitation drugs, myocardial stunning, and transient asystole followed by a spontaneous return of a perfusing rhythm. A review of rigid bronchoscopy warns against air trapping during jet ventilation especially with obstructive disease.[3] Inequality in pulmonary compliance can cause areas of lung hyperinflation and areas of non-ventilation.[4] However, the possibility of unilateral air trapping leading to cardiovascular collapse has never been described. In this patient with endobronchial tumour obstruction and patent left maintstem bronchus, we experienced refractory hemodynamic collapse that resolved once resuscitative maneuvers were stopped.

## CASE PRESENTATION

An 86-year-old male required urgent rigid bronchoscopy for tumor debulking of a carinal mass causing stridor. Preoperatively, the patient was hemodynamically stable and on oxygen at 8 L/minute with normal oxygenation at rest but desaturation with speaking.

General anesthesia was induced with propofol and rocuronium and maintained using total intravenous anesthesia with propofol and remifentanil. Upon intubation with the rigid bronchoscope, the distal trachea had an occlusion of 90%, along with 100% and 50% occlusion of the right and left mainstem bronchi respectively. Ventilation was tenuously maintained using the Acutronic Monsoon® for automated jet ventilation. Quick debulking of the tumour was attempted, but rapid desaturation, severe bradycardia and hypotension ensued. Cardiopulmonary resuscitation was started, and epinephrine 1 mg IV was administered with return of spontaneous circulation (ROSC) after 2 minutes. The patient was hypertensive, and the procedure proceeded with oxygenation between 84 and 97%.

Despite normal oxygenation, the patient became hypotensive 14 minutes after ROSC.

Norepinephrine infusion was titrated up to 0.2 mcg/kg/min, with additional 100 mcg boluses of epinephrine to maintain blood pressure. The left mainstem bronchus was cleared of tumor, but after 30 minutes, oxygenation also became inadequate. A focused ultrasound examination showed normal contractility and normovolemia, and absence of pneumothoraces to explain the decline.

The rigid bronchoscope was withdrawn, and the patient was intubated, with an initial peak pressure of 33 $cmH_2O$. Following standard PPV, the patient stabilized hemodynamically, and oxygenation became adequate. The patient was extubated the next day and received radiation therapy for the tumor.

## CONCLUSION

Auto-PEEP can be detrimental to the right heart. It can decrease venous return, while hyperinflation of the lungs increases pulmonary vascular resistance, potentially overwhelming the right ventricle's ability to compensate for increased afterload.[2,5] Our patient's initial instability was hypoxic, with resolution after tumor debulking. The subsequent episode occurred with normal saturation, despite an open left mainstem bronchus. Jet ventilation likely caused unilateral air-trapping, leading to reduced venous return and subsequent right ventricular failure. This case is a reminder to consider intrathoracic airway obstructions as relative contraindications to jet ventilation and to revert to standard PPV in cases of persistent instability.[4]

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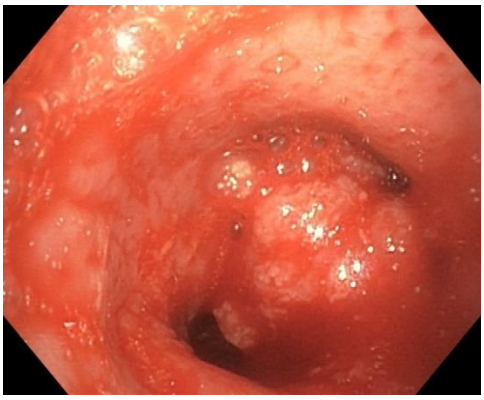

Figure 1