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S.A.F.F.E.R. airway management: Evaluating the effectiveness of checklist implementation on reducing peri-intubation complications in an air medical transport service

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S.A.F.F.E.R. airway management: Evaluating the effectiveness of checklist implementation

on

reducing peri-intubation complications in an air medical transport service

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By

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Abstract

Background: Advanced airway management via endotracheal tube placement in the critically ill and injured is tenuous and presents a multitude of challenges that threaten patient safety. The potential for procedure-associated hypoxia, hypotension, and cardiac arrest during the peri-intubation period can be detrimental to overall patient outcomes.

Purpose: The purpose of this project is to evaluate the effectiveness of the Standardized Airway Flow For Engineered Resuscitation (S.A.F.F.E.R.) checklist in reducing peri-intubation complications and provider perception of checklist implementation when performing advanced airway procedures.

Methods: A case-control analytical observational design study which included retrospective and prospective electronic medical record review to determine if the incidence of peri-intubation complications decreased following checklist implementation and a qualitative survey of providers to determine perceptions regarding checklist usage.

Results: This study identified no statistically significant decrease in peri-intubation complication following the implementation of the S.A.F.F.E.R. Airway Checklist. Provider perceptions toward checklist usage were overall positive; however, no strong themes regarding checklist usage were identified.

Conclusion: While no statistically significant results were derived from the study, this study provides foundational data to support additional research by identifying surface level outcome variables and the resulting limitations when attempting to determine effectiveness of a checklist.

Acknowledgements

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Introduction

The use of Rapid Sequence Intubation (RSI) for emergent airway management in the adult patient presents a multitude of challenges for the pre-hospital air medical provider. The associated danger of hypoxia, hypotension, and cardiac arrest during the peri-intubation period can be detrimental to patient outcomes (Mosier, 2019; De Jong et al., 2017). The added stressors of an unpredictable and unstructured environment, coupled with pressure to reduce on-scene time, create an opportunity for clinical oversight when performing critical procedures. Checklist utilization in the hospital setting has shown benefit by improving evidence-based care bundle compliance (DuBose et al., 2008) and reducing surgical complications (Weiser et al., 2010). While the concept of unloading mental real estate in clinical providers performing rapid sequence intubation is not a new notion (Mommers & Keogh, 2015; Davidson, Utarnachitt, Mason, & Sawyer, 2017; Sherren, Tricklebank, & Glover, 2014), evaluation of the effectiveness of checklist implementation in the United States pre-hospital setting is limited.

Background and Significance

Patients who experience intubation-associated cardiac arrest have an immediate mortality rate of almost 29%, increasing to an astounding 71% mortality rate at 28-days (Mosier, 2019; De Jong et al., 2017). With approximately 2-4% of Intensive Care Unit (ICU) patients undergoing endotracheal intubation experiencing cardiac arrest and an unknown amount of pre-hospital peri-intubation cardiac arrests, the need for shifting pre-hospital clinician attention to identifying and mitigating risk factors for peri-intubation complications is compulsory (Mosier, 2019). In the pre-hospital setting, advanced airway management via endotracheal tube placement is just one critical component of the resuscitation cascade

(Conroy, Weingart, & Carlson, 2014). Due to the often emergent requirement for airway management in the patient in extremis, hypotension and hypoxia frequently exist at the time of patient presentation. The occurrence of such physiologic derangements during the peri-intubation period is associated with an increased risk for complications including cardiac arrest; therefore, resuscitative intervention prior to rapid sequence intubation (RSI) procedure performance is suggested to reduce peri-intubation complications (Mosier, 2019; De Jong et al., 2017).

Inadequate pre-procedural resuscitation and environmental constraints in the pre-hospital setting introduce an opportunity for quality improvement in advanced airway management through the use of checklists. In pre-hospital medicine, checklists have shown improvement in compliance with care guidelines, procedural safety, and documentation quality (Kerner et al., 2017; Mommers & Keogh, 2015; Weiser et al., 2010). By unburdening the clinician memory and providing current best evidence, the checklist is thought to offset gaps in attention that can lead to procedure failure (Klinger et al., 2019). The utilization of checklists for pre-hospital airway management has gained popularity in foreign countries such as Sweden, Great Britain, and Australia (Klingber et al., 2019, Lockey et al., 2017; Mommers & Keogh, 2015); however, there are limited U.S. studies on the effectiveness of checklist implementation in the pre-hospital setting.

Purpose/Objectives

The purpose of this DNP project was to evaluate the effectiveness of the Standardized Airway Flow For Engineered Resuscitation (S.A.F.F.E.R.) checklist (Baca, 2018) in reducing peri-intubation complications and to determine provider perception of checklist implementation.

Gap analysis prior to project implementation identified a limited amount of research involving checklist use to reduce patient harm and improve clinical outcomes in the pre-hospital setting. The objectives of this study were to evaluate pre and post-procedure hemodynamics, before and after checklist implementation, to determine if checklist usage directly impacted procedural outcomes, improved first-pass intubation success rates, and reduced the incidence of peri-intubation cardiac arrest. Evaluating provider perception of checklist implementation was explored to identify barriers to checklist usage in the field, assess the impact of checklist implementation on provider workflow, and identify trends in checklist components most commonly utilized and/or omitted by clinicians.

Theoretical Model

Lewin's Change Theory informed the theoretical framework for this project. Kurt Lewin proposes organizational change is accomplished when equilibrium is established between the driving forces that support a need for change and the restraining forces that oppose change. According to Lewin's theory, change occurs in three phases: unfreezing, moving, and refreezing. In the unfreezing phase, the need for change is identified and driving forces supporting change are strengthened. In this stage, opposing forces are also identified and efforts made to lessen their impact on the change goal. The moving phase consists of implementing the planned change with a forward momentum that accomplishes the final, refreezing phase. The refreezing phase occurs when the organization has achieved equilibrium and the change is adopted (Lewin, 1951).

In the context of this project, the unfreezing phase consisted of identifying the need for change in airway practices to improve patient safety at the study site. Opportunities for discussion regarding current airway practices prepared clinical staff for the notion of impending practice change. During the unfreezing phase, opposing forces to change were also identified. These included items such as ease of checklist accessibility, impact on workflow, and need for additional training resources. In the moving phase, the pre-procedural checklist was implemented and policy change requiring use of checklist for all advanced airway attempts occurred. To mitigate identified opposing forces, laminated pocket cards (Appendix B) were developed for ease of access and high-fidelity simulation was provided to model the appropriate use of the checklist. The goal of the refreezing phase was to maintain improvements that resulted from checklist implementation. As this study sought to evaluate the effectiveness of checklist implementation, the refreezing phase was under investigation.

Literature Review

A review of literature was performed using CINAHL and Google Scholar databases. Key words included checklist and pre-hospital, checklist and advanced airway, pre-procedure checklist, pre-hospital and airway, pre-hospital intubation, and pre-hospital RSI. Study inclusion criteria included, completion of study in the United States, adult population, use of checklist specific to endotracheal intubation procedure, and studies performed in the pre-hospital setting. Studies performed in the emergency department, intensive care unit, and operating room were also reviewed. Studies that focused on a pediatric population and/or checklist usage for airway procedures other than endotracheal intubation were excluded.

Improving the safety of advanced airway management in the pre-hospital setting remains a prime focus for quality improvement within the emergency medicine system (Klingberg et al., 2019; Lockey, et al., 2017; Mommers & Keogh, 2015). The austere, unstructured, and frequently dangerous environments where patient care is rendered by helicopter emergency medical services (HEMS) providers, are situations underrepresented throughout the literature; thus, making it difficult to extrapolate results from studies aimed at improving the safety of rapid sequence intubation performed within a controlled, safe hospital setting with adequate resources available to HEMS. Exploration of the literature reveals a gap in knowledge regarding the effectiveness of checklist use for advanced airway management in HEMS; thereby, validating the requisite of this study.

Checklist implementation has repeatedly proven successful in reducing the incidence of adverse events by improving adherence to evidence based care-bundle components, surgical procedures, and advanced airway management in the ICU and emergency department (DuBose et al., 2008; Kerner et al., 2017; Mommers & Keogh, 2015; Weiser et al., 2010). Numerous studies highlighting the implementation and success of checklists for in-hospital advanced airway management; however, studies evaluating checklist use for pre-hospital airway management yield diminutive results (Klingberg et al., 2019; Lockey et al., 2017; Kerner 2017). No studies evaluating the effectiveness of pre-procedural checklist use in adult advanced airway management in HEMS were appreciated, further solidifying the necessity for this study.

With the gap in literature identified, the aim of this study was to evaluate the effectiveness of a pre-procedural checklist in reducing harm measures within the specific pre-hospital structure of HEMS. In the hospital setting, peri-intubation cardiac arrest occurs at a rate of 2-4% (Mosier, 2019). The literature has identified hypoxia and hypotension as the strongest physiologic predictors associated with an increased risk for peri-intubation arrest (Mosier, 2019; De Jong et al., 2017). With an immediate mortality rate of 29%, alleviating the associated peri-intubation cardiac arrest risk factors is essential to patient harm reduction strategies. Standardizing procedural technique through the use of checklists and care-bundles mitigates the risk for patient harm through the removal of individual provider preference; thereby, renouncing the opportunity for human error (Sherren, Tricklebank, & Glover, 2014). With the objective of optimizing mental capacity by removing the encumbrance of memorization and alleviating the pressure for quick, accurate recall in the disorder of an unstructured environment, checklists have become an effective instrument in quality improvement initiatives (Klinger et al., 2019).

Methods

Design

This study used a case-control analytical observational design. The study was approved by the University Institutional Review Board and letter of support was obtained from study site. A waiver of documentation of informed consent was approved from the University of Kentucky Institutional Review Board for this study. Data was collected through retrospective chart review 6-months prior to intervention (January 2019-June 2019) and 1-year post-intervention (July 2019-July 2020). A voluntary, anonymous survey was completed by clinical care providers at a single site.

Setting

The clinical site chosen for this study is a private air medical service, which operates independent and traditional (hospital-affiliated) programs across the country. For data collection purposes, this study focused on evaluating checklist effectiveness for intubations performed at 4 programs established in Kentucky. These rotor-wing (helicopter) programs operate 24-hours a day, 7 days a week under the traditional HEMS structure and respond to both interfacility transport requests and EMS scene calls dispatched through a call center.

Organizational Mission and Stakeholders

This study sought to determine the effectiveness of checklist implementation on patient safety by reducing the incidence of the selected outcome measures. With an emphasis on quality improvement, this study aligned with the air medical transport service's mission to maintain a high level of safety while delivering measurable benefits.

Site Specific Facilitators and Barriers

The core value of utilizing evidence-based practice is an intrinsic driving force identified this study, as the study site environment encourages quality improvement initiatives and process inquiry projects that will further the program mission. At the time of study, work congruent with the unfreezing phase of change (Lewin, 1951) had been completed, as the S.A.F.F.E.R. checklist (Baca, 2018) education and role-out had been provided all programs included in study. The impact of the study on daily operational workflow was nominal as checklist usage was already required by company policy; therefore, no additional tasks were added to clinician workload. The think map and pocket card distributed for clinical crew member use has been included in the appendix. The most significant barrier to project completion was the unpredictable HEMS environment, which lead to a wide variation in sample size, characteristics, and conditions present at time of airway procedure.

Sample

The primary sample consisted of 115 electronic medical records from January 1, 2019 to July 31, 2020 with a documented advanced airway management procedure performed in the pre-hospital environment by study site clinicians. Inclusion criteria for the primary sample included adult patients greater than 18 years old and less than 99 years old, induction drugs administered prior to airway placement attempt, procedure performed by study site clinicians, and procedure performed outside of hospital/facility. Exclusion criteria included patients less than 18 years of age, patients with hypoxia, hypotension, and cardiac arrest in the absence of an advanced airway procedure attempt, advanced airway procedures that occurred in a controlled environment (i.e. hospital), and patients with advanced airway management performed by a provider not employed at the selected study site.

For the secondary sample, a convenience sample of 5 clinical providers from a single program were given an opportunity to complete an anonymous survey with 3 responses returned by the end of the data collection period. Inclusion criteria for survey invitation included nurses and paramedics that provide direct clinical care and exclusion criteria included nurses, paramedics, pilots, and/or mechanics who participate in patient transport but do not provided direct patient care.

Procedures

Exempt Study approval from the University of Kentucky Institutional Review Board (IRB) and a letter of support from the air medical service was obtained prior to data collection. Data collection occurred in two phases. The first phase included a retrospective electronic medical record review pre-checklist implementation (January 2019- June 2019) and the second phase a prospective electronic medical record review post-checklist implementation (July 2019-July 2020). The air medical service's Clinical Services Manager and National Clinical Standards provided the primary investigator (PI) with a list generated from the electronic documentation system of record numbers for transport events that met study inclusion criteria of patient greater than 18 years of age and advanced airway procedure performed. Each chart was then reviewed by the PI to ensure all study inclusion criteria were met.

Of the original 171 electronic medical records provided, 30 patient records from the pre-checklist implementation timeframe and 85 patient records post-checklist implementation timeframe met all study inclusion criteria for a total sample of 115 patient records. The 115 selected medical records were then assigned a unique de-identifier to maintain patient confidentially and recorded in a spreadsheet. The demographic variables collected included age, gender, and race. The outcome variables collected included pre-procedural hypoxia (SpO2 <90%), pre-procedural hypotension (SBP <90mmHg), post-procedural hypoxia (SpO2<90%), post-procedural hypotension (SBP <90mmHg), number of intubation attempts, and cardiac arrest.

IRB approved provider survey (Appendix A) was distributed to the convenience sample electronically with type-written responses returned anonymously by participants submitted to locked filing cabinet. Consent for participation was implied with completion of the voluntary survey. Of the 5 surveys distributed, 3 responses were received and included in this study. Responses were reviewed for common themes which were recorded and paper responses were destroyed via paper shredder.

Data Analysis

Patient age was described using descriptive statistics via mean and standard deviation. A two-sample t-Test was performed for comparison of mean age between the pre-checklist and post-checklist samples. A Chi-square test of association was utilized to evaluate the pre and post-checklist implementation difference in gender and race sample demographics. A Chi-square test of association was also utilized to evaluate the pre and post-checklist implementation difference in the selected outcome variables of pre-procedure hypoxia, pre-procedure hypotension, post-procedure hypoxia, post-procedure hypotension, number of intubation attempts, and occurrence of cardiac arrest. Results were considered statistically significant at a p-value less than or equal to .05. All data analysis was performed using IBM SPSS Statistics software version 27. Provider survey responses were reviewed in their entirety and responses analyzed for common themes.

Results

Demographics

The sample population included 115 patient records, 30 patient records with advanced airway procedures performed prior to checklist implementation and 85 patient records with advanced airway procedures performed post checklist implementation. Demographics recorded were summarized and reported in Table 1. The median age for the primary study sample was 49.8 years of age pre-checklist and 53.8 years of age post-checklist with Caucasian males representing the majority both pre and post-checklist implementation. Airway type was also recorded with intubation via oral endotracheal tube representing the most common type of advanced airway procedure both pre and post-checklist. Age, gender, or race had no impact on the incidence of hypoxia, hypotension, cardiac arrest, or first pass success rate, as there was no statistically significant difference appreciated among the sample demographics. Demographics were not collected for the survey component of the study to maintain anonymity of participants due to the use of a small convenience sample. Of the 5 surveys distributed, 3 type-written responses were returned.

Outcome Variables

The outcome variables recorded were summarized and reported in Table 2. The presence of pre-procedure hypoxia and/or hypotension was more prevalent in the pre-checklist implementation sample (n=30) at 26.7% and 16.7% versus post-checklist implementation (n=85) at 15.4% and 10.6%; however, there was no statistically significant difference found between the two groups. A potentially inverse relationship between pre-procedure hypoxia and post-procedure hypotension was noted with an increase in post-procedure hypotension following checklist implementation at 23.8% (17.2% pre-checklist) and a decrease in hypoxia at 8.8% (13.8% pre-checklist). Despite a potential correlation, the increase and decrease seen in post-procedure hypotension and pre-procedure hypoxia was not statistically significant. The incidence of cardiac arrest and failure to achieve first pass success were also found to be not statistically significant between the pre and post-checklist implementation groups (Table 2).

S.A.F.F.E.R. Checklist Survey

Survey responses were reviewed to identify clinician perception of checklist usage, workflow impact, and barriers to use in practice. Overall, clinician perception regarding checklist usage was positive with improved organization during procedure performance being the most frequently cited benefit. Delineation of tasks via provider specific roles identified as “Crew 1” and “Crew 2” on the checklist (Appendix B) was also identified as a benefit of checklist usage by clinicians. Responses for the most common elements from the checklist to be utilized were unable to be extrapolated due to variation in response. Some of the elements consistently used included patient positioning and passive oxygenation via 15 liters nasal cannula, while one clinician reported elements chosen varied according to patient condition. The most commonly omitted element of the checklist was the setup and use of suction. Two of the three clinicians surveyed noted no barriers; however, one clinician expressed lack of crew knowledge regarding the existence of a physical pocket card and crew level of experience as barriers to usage in practice.

Discussion

The aim of this study was to evaluate the effectiveness of checklist implementation on reducing peri-intubation complications in an air medical service. While research regarding the utilization of checklists for pre-hospital airway management is available in foreign countries (Klingber et al., 2019, Lockey et al., 2017; Mommers & Keogh, 2015), research in the United States evaluating the effectiveness of checklist usage in the pre-hospital environment remains significantly limited making comparison to current literature difficult. Despite results lacking statistically significant findings in the selected outcome variables (Table 1) pre to post-checklist implementation, this study contributed foundational information for expansion of research in this area by identifying the need for exploration of additional contributory factors to determine the impact of patient condition pre-procedure on outcomes versus simple checklist usage.

Interestingly, this study mimicked findings of a similar study performed by a Swedish air medical provider in that the incidence of post-procedure hypotension increased with checklist usage; however, the Swedish study results results were also not statistically significant when comparing the checklist and non-checklist groups (Klingber et al., 2019). The finding of increased post-procedure hypotension in the S.A.F.F.E.R study is likely multi-factorial in etiology; however, this study simply acknowledged the presence or absence of hypotension, hypoxia, cardiac arrest, and first pass failure. Additional parameters such as induction medication selection, stable patient condition versus unstable patient condition at time of intervention, and variation in clinician practices not documented in electronic medical records would need to be explored for correlation.

First pass success rate was high at 93.3% (pre) and 94.1% (post) respectively across the primary sample. There was not a statistically significant improvement in intubation first pass success rates following checklist implementation in this study. Of the two failed first pass attempts in the pre-checklist sample (n=20), 1 (3.3%) patient was successfully intubated on the second pass attempt with only 1 (3.3%) patient requiring the use of an alternate (non-definitive) airway. In the post-checklist sample (n=85), 5 (4.7%) failed first pass attempts resulted in successful intubation on a second pass attempt with only 1 (1.2%) patient requiring the use of an alternate airway. This finding was anticipated given the experience level of a typical air medical clinician. A typical entry-level clinician in this specialty has a required minimum of 3-5 years of experience; however, most have greater than 5 years at time of entry into the specialty.

A portion of the checklist under evaluation during this study focuses on adequate resuscitation to optimize hemodynamics prior to initiation of advanced airway procedures. The think map educational piece and checklist (Appendix B) promotes pre-oxygenation, perfusion support via blood, crystalloids, and/or vasopressors to achieve pre-procedure goal target ranges, and adjustments in medication dosing aimed at reducing peri-intubation complication and cardiac arrest. Although not statistically significant, it is worth noting that the incidence of pre-procedure hypoxia and hypotension were higher in the pre-checklist implementation sample at 26.7% and 16.7% versus 15.4% and 10.6% (Table 2). There is potential that improved clinician awareness regarding the increased risk for complications in the absence of adequate resuscitation contributed to this reduction in pre-procedural hypoxia and hypotension.

In the literature, hypoxia and hypotension have been identified as the strongest physiologic predictors of peri-intubation arrest (Mosier, 2019; De Jong et al., 2017). While this study appreciated a decrease in peri-intubation cardiac arrest from 6.7% in the pre-checklist sample to 3.5% in the post-checklist sample (Table 2), this finding was not statistically significant. Due to the chosen outcome variables and method of data collection, it is unclear whether a correlation exists between the pre-procedure presence of hypoxia and/or hypotension and peri-intubation arrest. It is possible that factors such as patient condition at time of presentation, environmental factors, and limitations in the transport environment were contributory to cardiac arrest versus the performance of an advanced airway procedure.

A significant gap in research regarding clinician perceptions on checklist usage exists. The survey of clinicians in this study yielded vague, limited responses resulting in difficulty identifying strong themes. Overall, clinicians placed value in the checklist citing improved procedural organization, efficiency, and skill execution. All three responses reported different elements from the checklist that were used or omitted consistently, with one response reporting patient condition dictated element selection. While responses were submitted anonymously, only one response referenced over-estimation in clinician skill level as a barrier to checklist usage. No additional barriers were reported. Vague responses may have been attributed to fear of retribution due to policy violation, expression of personal opinion, or lack of knowledge.

Implications for Practice

While no statistically significant results were derived from this study, the baseline data provided by this study may support future research endeavors that aim to evaluate checklist usage in the pre-hospital setting. The most interesting finding, an increased incidence of post-procedure hypotension following checklist implementation, was also identified in a similar study (Klingber et al., 2019); however, further study is needed to investigate contributory factors such as, patient condition pre-procedure, choice of induction medications, and post-procedure sedation practices. This study also highlighted the need for further exploration in hemodynamic parameter documentation, patient condition resulting in need for advanced airway management, checklist utilization documentation, and medications chosen for procedure execution to determine if checklist usage improved patient outcomes. Additionally, this study may serve as a foundation for exploring clinician perceptions on checklist utilization in a pre-hospital environment. Further research is recommended to evaluate the benefit of checklist usage for reducing peri-intubation complications in the pre-hospital environment.

Limitations

This study had several limitations. The relatively small sample size of medical records evaluated (n=115) and the minuscule amount of clinician survey responses received (n=3) makes extrapolation of data difficult. In the absence of documented hemodynamic variables, it was assumed that the condition (hypotension, hypoxia, etc.) was present, potentially skewing statistical analysis. While checklist usage is mandated via policy within the air medical transport service, documentation of checklist usage is variable and ultimately impacted by the individual clinicians performing the procedure. Although survey responses were anonymous, clinicians surveyed were derived from a small convenience sample at a single site, which may have contributed to the wide variability in responses and resulting inability to identify significant themed results.

Conclusion

The aim of this study was to evaluate the effectiveness of checklist implementation on reducing peri-intubation complications in an air medical transport service. While the difference in incidence of peri-intubation complications were not found to be statistically significant between the pre-checklist and post-checklist samples, this study did identify an increase in post-procedural hypotension following checklist implementation. This finding was also noted in a similar research study by Klingber et al. (2019) and presents an interesting opportunity for further investigation. This study also provides foundational data by identifying surface level outcome variables and the resulting limitations when attempting to determine effectiveness of a checklist. Clinician perception regarding checklist usage was overall positive and the predominant theme of responses cited improved procedural organization, efficiency, and skill execution. Further studies are recommended to determine if utilizing additional physiologic outcome variables, exploring patient condition at time of presentation, documentation of checklist usage, and medications selected for procedure performance would influence study results.

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Table 1. *Demographics*	**Pre (*n* = 30)** n (%) or mean (SD)	**Post (*n* = 85)** n (%) or mean (SD)	***p*-value**
Age	49.8 (20.0)	53.8 (18.7)	.33
Sex			
Male	19 (63.3%)	53 (62.4%)	
Female	11 (36.7%)	32 (37.6%)	.92
Race			
Caucasian	21 (70%)	47 (55.3%)	
African American	0 (0%)	2 (2.4%)	
Not Documented	9 (30%)	36 (32.4%)	.30
Type			
Intubation	28 (93.3%)	84 (98.8%)	
Alternate airway	2 (6.7%)	1 (1.2%)	.14

Table 2

Outcome Measures

Hypoxia Pre-Procedure			
NO	22 (73.3%)	66 (84.6%)	
YES	8 (26.7%)	12 (15.4%)	.18
Hypoxia Post-Procedure			
NO	25 (86.2%)	73 (91.3%)	
YES	4 (13.8%)	7 (8.8%)	.48
Hypotension Pre-			
Procedure	25 (83.3%)	76 (89.4%)	
NO	5 (16.7%)	9 (10.6%)	.52
YES			
Hypotension Post-			
Procedure	24 (82.8%)	64 (76.2%)	
NO	5 (17.2%)	20 (23.8%)	.46
YES			
Cardiac Arrest			
NO	28 (93.3%)	82 (96.5%)	
YES	2 (6.7%)	3 (3.5%)	.60
Failed Attempts			
NO	28 (93.3%)	80 (94.1%)	
YES (ET tube)	1 (3.3%)	4 (4.7%)	
YES (Alt. Airway)	1 (3.3%)	`1 (1.2%)	.71

Appendix A

S.A.F.F.E.R. Checklist Survey

<u>**Instructions:**</u>

Please provide a typed response to the following questions. Your responses will be anonymous, please do not include your name on this document. When completed, print document and submit to CQI/Chart filing cabinet in the 'S.A.F.F.E.R. Checklist Survey' file folder.

1. **What elements of the SAFFER checklist do you find helpful to your practice?**

2. **From the new protocol, what elements of the checklist do you consistently implement during advanced airway procedures?**

3. **From the new protocol, what elements of the checklist do you rarely or never use?**

4. **How has use of the SAFFER checklist impacted your workflow when performing advanced airway procedures?**

5. **What barriers prevent use of any or all portions of the SAFFER checklist?**

Appendix B

S.A.F.F.E.R. Checklist

Airway CREW 1

V. 5.0
06/30/2017

YOUR ACTIONS	AS PARTNER DOES…
Set Up	**Monitor**
-Immediate mask control	
-PHI BVM, PEEP, ETCO2, HME, mask	
-PEEP @ 10-15	-Nasal cannula 15 LPM
Mask Control	**Access & perfusion**
-**P**osition ear 2 sternal notch (if no C-spine?)	
-**R**aise mandible	
-**O**PA NPA(s)	
-**T**humbs down masking	
-**E**TCO2 every breath	
-**C**heck O2 & PEEP (15 – 15 – 15)	
-**T**ension / distension?	
Optimize ventilation	**Tubes & suction**
-Adequate resps? BVM squeeze / no squeeze?	
-Focus on Zoll & mask control	
Observe 4 difficult airway	**Therapeutic prep**
-**L**ook 4 airway difficulty	-**E**valuate 3-3-2
-**M**allampati	-**O**bstructions
-**N**eck mobility	-ID & plan coms w/ assistant
Oxygenate	**Emergency plan Rx admin**
-ID timekeeper	**3-min. mindful DENITROGENATION**
Tube delivery	**Safety**
-Suction LEADS blade	
-ID & say "I see uvula–epiglottis–arytenoids–glottis"	
Hold	**Safety**
-Keep view during stylette/bougie pull & cuff inflation	

Appendix B

WE ARE PERFORMANCE.
S.A.F.F.E.R.
Standardized Airway Flow For Engineered Resuscitation
V 3.2
AIR MEDICAL
BEYOND THE CALL
Crew 1 Steps
S.M.O.O.O.T.H.
Crew 2 Steps
M.A.T.T.E.R.S.
SET UP
OUR
BVM
PEEP valve
ETCO2 & filter
Nasal cannula
MONITOR
COMBATIVE? DSI NOW
4 mg / kg IM Ketamine
OR
1-2 mg / kg IV Ketamine
MASK CONTROL
Position ear 2 sternal notch
Raise mandible
OPA / NPA
Thumbs down masking
ETCO2 every breath
Check O2 & PEEP
Tension / distension
ACCESS & PERFUSION
Treat ↓ BP pre-induction
Shock Index ≥ 0.9? Anticipate ↓ BP
Give fluids / blood or
Bolus dose epi 1:10 - 1 cc in 9cc NS
0.5 - 2 ml = 5-20 mcg IVP
OPTIMIZE VENTILATION
Assess spontaneous breathing
Direct BVM squeeze or NO squeeze
Assure good ETCO2 EVERY breath
TUBES & SUCTION
ETT w/ bougie +
ETT w/ stylet +
i-gel & cric Kit
OBSERVE FOR DIFFICULT AIRWAY
Look
Evaluate 3-3-2
Mallampati
Obstructions
Neck mobility
THERAPEUTIC PREP
Ketamine 2 mg / kg
(1/4 to 1/2 dose if ↓ BP or SI ≥ 0.9)
Rocuronium 1 mg / kg
NO FULL DOSE KETAMINE
If fluids / pressors needed
CROSS CHECK MEDICATIONS
OXYGENATE
3 min
EMERGENCY PLAN COMMUNICATION
2 unsuccessful ETI attempts + GOOD SPO2 = i-gel
SPO2 < 90% despite good BLS = IMMEDIATE CRIC
RX ADMINISTRATION
Sedative SLOW then IMMEDIATE paralytic
WAIT
45 Sec
TUBE DELIVERY
Blade
ALWAYS
FOLLOWS
Suction
ANOUNCE ANATOMY
I see… Uvula
…Epiglottis
…Arytenoid notch
…Glottis
Head elevation
ELM
Look 4 epiglottis, arytenoids, glottis
Push / pull blade
Rotate bougie
SAFETY
AIRWAY MANIPULATION
DON'T Allow
< 93%
HOLD
MAINTAIN GLOTTIC VIEW TILL
Cuff inflated
Bougie / stylet removed
First + ETCO2 breath
25 cmH2O
SAFETY
TUBE CONFIRMATION
Bougie click and stop
ETCO2
AXILLARY lung sounds bilat
No epigastric sounds
State depth
NO CAPNOGRAM post intubation?
Immediate VL re-exam 2+ sets of eyes
CROSS CHECK TUBE PLACEMENT AND DEPTH CAPNOGRAPHY AND GLOTTIC VISUALIZATION TRUMP LUNG SOUNDS!!!
Airway success hinges on NO HYPOXIA, NO HYPOTENSION, and FIRST PASS SUCCESS