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First-Attempt Endotracheal Intubation Success Rate Using A Telescoping Steel Bougie

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Abstract

Background

There has been a renewed interest in using the plastic intubation bougie to facilitate first-attempt endotracheal intubation success. The sterile single-use telescopic steel bougie (AIROD) was invented to overcome the limitations of the plastic bougie which is easily deformed during storage.

Methods

This is a retrospective study involving critically ill patients who were intubated with the AIROD in the intensive care unit at a single institution. The purpose of this case series is to compare the success rate of the AIROD to the generally accepted success rate for the traditional plastic bougie of 96%.

Results

A total of 54 patients were enrolled at a single ICU over a 10 months period. All patients were critically ill with 76% having a difficult airway, Cormack-Lehane grade view 2 or greater in 60%, and ARDS secondary to COVID-19 in 54%. The primary outcome of first-attempt intubation success in critically ill patients intubated in the ICU with the AIROD was 97% with a 95% confidence interval of 0.89 to 0.99. The average time for intubation of all airway classifications was 15 seconds.

Conclusion

The AIROD first-attempt intubation success rate was found to be similar to the rate for the traditional plastic bougie.

Key Words: bougie, AIROD, intubation, ICU, success rate, difficult airway, complications, time, first-pass, COVID-19,

Introduction

The BEAM (Bougie Use in Emergency Airway Management) trial, renewed interest

in the use of a bougie rather than a stylet (1). In the BEAM trial, first-attempt endotracheal intubation success using a plastic bougie was compared to a stylet during laryngoscopy in an emergency department. First-attempt success was achieved in 98% compared to 87% in all patients. In patients with at least one difficult airway characteristic, first-pass

success using a plastic bougie was 96% compared to 82% using a stylet. In 2019, the sterilized single-use telescopic steel bougie, AIROD (AIRODMedical; FL,

USA), was introduced to the USA market (Figure 1).

Figure 1. A: AIROD closed. B: AIROD open. C: AIROD with an endotracheal tube loaded on the distal end.

The thin surgical steel construction of the AIROD allows it to bend slightly while maintaining its integrity to help manipulate oropharyngeal tissue without causing trauma. The AIROD can guide a 6.5 mm or larger endotracheal tube into the trachea. To do so, the AIROD is introduced into the oropharynx alongside a laryngoscope, either direct or video, and advanced just past the vocal cords. An endotracheal tube is then slid down over the AIROD and into the trachea securing the airway to allow for mechanical ventilation. The AIROD telescopes from one foot when closed to two feet when opened, offering many storage options.

Several publications have demonstrated that the AIROD is a safe and effective tool for endotracheal intubation (2-5). In this manuscript we extend those observations.

Methods

A retrospective analysis of all endotracheal intubations that were performed with the AIROD in the ICU at a single institution

(Mercy One Hospital in Sioux City, IA) between October 18, 2020 and January 1, 2020 were included.

A successful first-attempt intubation was defined as the placement of an endotracheal tube into the trachea upon the initial insertion of the laryngoscope into the oropharynx. If the laryngoscope had to be removed and a second-attempt performed, it was considered a failure. Airways were graded using the Cormack-Lehane grade view (Appendix 1).

A difficult airway was defined as the presence of body fluids obscuring the laryngeal view, airway obstruction or edema, obesity, short neck, small mandible, large tongue, facial trauma, stiff neck or the need for cervical spine immobilization (2). Intubation time was defined as the time from insertion of the laryngoscope to placement of an endotracheal tube with its cuff inflated.

Results

Patient characteristics are shown in Table 1.

Table 1. Characteristics and outcomes of the critically ill patients intubated with the AIROD in the ICU.

Patient	Age	BMI	Sex	Cormack-Lehane Grade View	Difficult Airway	First-pass Success	Time (secs)	COVID-19	Assistance	Bronchoscopy
1	54 Yo		M	4	Yes	Yes		No	Yes	
2	48 Yo		M	2	Yes	Yes		No	Yes	
3	71 Yo	27.3	F	2	Yes	Yes	10	No	Yes	
4	83 Yo	30.2	M	1	Yes	Yes	10	No	No	No Airway Trauma
5	52 Yo		M	3	Yes	No		Yes	No	
6	60 Yo	26.5	F	4	Yes	Yes	12	Yes	No	No Airway Trauma
7	67 Yo	31.4	F	1	Yes	Yes	11	No	Yes	No Airway Trauma
8	83 Yo	51.1	F	4	Yes	Yes	18	No	Yes	
9	73 Yo	27.5	M	1	No	Yes	9	No	Yes	
10	79 Yo	15.3	M	1	No	Yes		No	Yes	No Airway Trauma
11	83 Yo	40.3	F	4	Yes	Yes		No	Yes	No Airway Trauma
12	19 Yo	38.3	M	2	Yes	Yes	13	No	Yes	
13	72 Yo	40.2	M	1	Yes	Yes	10	Yes	Yes	
14	51 Yo	60.9	M	3	Yes	Yes		No	Yes	
15	43 Yo	27.5	M	2	No	Yes	17	No	No	
16	72 Yo	28.6	M	1	No	Yes		No	No	
17	60 Yo	24.5	F	1	No	Yes		Yes	No	
18	60 Yo	33.1	F	1	Yes	Yes		Yes	No	
19	54 Yo	28.5	M	2	No	Yes	10	Yes	No	
20	71 Yo	31.9	M	1	Yes	Yes	19	Yes	No	No Airway Trauma
21	55 Yo	20.3	M	1	No	Yes		Yes	No	
22	60 Yo	25.6	F	2	Yes	Yes	38	Yes	No	
23	85 Yo	26.6	M	1	Yes	Yes	11	Yes	No	
24	64 Yo	26.4	F	1	Yes	Yes	12	Yes	No	
25	66 Yo	38.2	F	1	Yes	Yes	10	Yes	No	
26	55 Yo	31.1	M	1	Yes	Yes		No	No	
27	52 Yo	25.3	F	2	Yes	Yes		Yes	No	
28	55 Yo	42.8	F		Yes	Yes		No	No	
29	82 Yo	38.2	M	4	Yes	Yes		Yes	No	No Airway Trauma
30	50 Yo	24.1	F	1	Yes	Yes	19	Yes	No	
31	49 Yo	32.8	F	2	Yes	Yes		Yes	No	
32	57 Yo		M	3	Yes	Yes		Yes	No	
33	64 Yo	36.0	M	2	Yes	Yes		Yes	No	
34	70 Yo	25.3	M	2	Yes	Yes		No	No	
35	35 Yo	34.1	M	2	Yes	Yes	28	No	No	
36	64 Yo	24.1	M	2	No	Yes	20	?	No	
37	73 Yo	29.0	F	2	No	Yes	16	Yes	No	
38	58 Yo	23.1	M	1	No	Yes	12	No	No	
39	66 Yo	39.8	M	4	Yes	Yes		Yes	No	
40	77 Yo	27.3	F	1	No	Yes	12	Yes	No	No Airway Trauma
41	82 Yo	29.1	M	2	No	Yes	19	Yes	No	
42	28 Yo	31.5	M	4	Yes	No		No	No	
43	62 Yo	37	M	4	Yes	Yes	25	No	No	
44	63 Yo	27.4	M	2	Yes	Yes	17	Yes	No	
45	82 Yo	22.7	F	1	No	Yes	18	Yes	No	
46	88 Yo	30.9	M	1	Yes	Yes	16	Yes	No	
47	88 Yo	26.8	M	3	Yes	Yes	16	No	No	
48	39 Yo	31.3	M	2	Yes	Yes	23	Yes	No	
49	84 Yo	33.8	F	1	Yes	Yes	13	No	No	
50	84 Yo	32.2	M	4	Yes	Yes	10	Yes	No	
51	74 Yo	28.7	F	4	Yes	Yes	17	No	No	
52	67 Yo	33.2	M	3	Yes	Yes		Yes	No	No Airway Trauma
53	26 Yo	28	F	1	Yes	Yes	11	Yes	No	
54	69 Yo	30	M	4	Yes	Yes	15	No	No	

A total of 54 patients with an average age of 62 years were included in the study. All patients were in critical condition. The average patient was obese with a BMI of 31.2 kg/m². A difficult airway was present in 76% of the patients and 54% of the patients had COVID-19 infection. In total, 63% of the patients were male and 37% were female. Using the Cormack-Lehane grade view: 20% had a grade 4 view, 10% had a grade 3 view, and 30% had a grade 2 view.

Intubation first-attempt success rate was 97%. Subgroup analysis of first-attempt intubation success using the AIROD to intubate in patients with a difficult airway was 96%. The average intubation time in the patients that were timed was 15 seconds (33/54 patients were timed). Of the patients with a difficult airway, the average time to intubate was also 15 seconds.

A bronchoscopy performed on 17% of the patients just after intubation revealed no evidence of tracheobronchial trauma.

Discussion

The patients intubated with the AIROD in the ICU had a first-attempt success rate of 97%. The first-attempt success rate for endotracheal intubation of the critically ill has been reported at only 70% (6,7). This corresponds to an absolute risk reduction of 27% in failure to intubate patients during the first-attempt with the use of the AIROD during the intubation of patients in critical condition.

Even when compared to patients who were not critically ill and were intubated with a plastic bougie in the emergency department in the BEAM trial (1), the first-attempt

success rate with the AIROD was 97% vs. 98. In those patients who were critically ill and also had a difficult airway, the first-attempt intubation success rate with the AIROD was at 97% vs. 96% in all patients (not just the critically ill) with a difficult airway.

In this study, the average time to intubation in all critically ill patients was 15 seconds using the AIROD. For those patients who were critically ill and had a difficult airway, the time to intubation was also 15 seconds. A previous publication on consecutive COVID-19 patients with ARDS intubated using the AIROD also had an intubation time of 15 seconds (2). In the BEAM trial, the median time to intubation using the plastic bougie in all types of patients intubated in the emergency department was 38 seconds (1). In all critically ill patients, the AIROD was 23 seconds faster. Intubation with the AIROD took 40% of the time in those patients who were critically ill, including those with a difficult airway, as opposed to the plastic bougie. The decrease in time securing the airway may have an impact on overall decompensation and possible outcomes of the disease process. Further studies between low intubation time and disease outcome remain an area to be studied in the future. The decrease in intubation time using the AIROD was not accompanied by adverse events such as cardiac arrest or tissue damage.

During multiple intubations, the AIROD was used to lift the epiglottis and move the oropharyngeal tissue that was obscuring the vocal cords out of the way, improving the view of the vocal cords and allowing for successful tracheal intubation. The AIROD was also able to move copious secretions blocking the view of the glottis in a few patients including those patients receiving chest compressions. Even during blind intubation, including one time when the light on the laryngoscope failed, the AIROD

provided tactile sensation to the tracheal rings known as “tracheal clicks” that helped ensure correct tracheal placement of the endotracheal tube (2).

This study is limited by its small sample size and retrospective nature, and by that fact that not all intubations were timed because of the emergent nature of some of the intubations. The inventor of the AIROD did most of the intubations and others might not achieve equal results. A prospective trial on the timing of first-pass intubation success using the AIROD would be most useful to confirm the findings in this study.

In conclusion, the AIROD first-attempt intubation success rate was found to be similar to the rate for the traditional plastic bougie. Direct inspection of the oropharynx during intubation confirmed no significant trauma occurred during intubation.

Conflicts of Interest

Evan D. Schmitz, MD is the inventor of the AIROD and was the primary operator for most of the intubations mentioned in this study. No financial assistance was provided for this study. The AIROD instruments were donated to the hospital from AIRODMedical.com.

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