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Brief Reports

COMPARISON OF METAL AND PLASTIC DISPOSABLE LARYNGOSCOPE BLADE WITH REUSABLE MACINTOSH BLADE IN DIFFICULT AND INHALATION INJURY AIRWAY SCENARIO: A MANIKIN STUDY

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□ Abstract—Background: Single-use plastic blades (SUPB) and single-use metal blades (SUMB) for direct laryngoscopy and tracheal intubation have not yet been compared with reusable metal blades (RUMB) in difficult airway scenarios. Objective: The purpose of our manikin study was to compare the effectiveness of these different laryngoscope blades in a difficult airway scenario, as well as in a difficult airway scenario with simulated severe inhalation injury. Methods: Thirty anesthetists performed tracheal intubation (TI) with each of the three laryngoscope blades in the two scenario manikins. Results: In the inhalation injury scenario, SUPB were associated with prolonged intubation times when compared with the metal blades. In the inhalation injury scenario, both metal laryngoscope blades provided a quicker, easier, and safer TI. In the difficult airway scenario, intubation times were significantly prolonged in the SUPB group in comparison to the RUMB group, but there were no significant differences between the SUPB and the SUMB. In this scenario, the RUMB demonstrated the shortest intubation times and seems to be the most effective device. Conclusions: Generally, results are in line with previous studies showing significant disadvantages of SUPB in both manikin scenarios. Therefore, metal blades might be beneficial, especially in the airway management of patients with inhalation injury. © 2016 Elsevier Inc. All rights reserved.

□ Keywords—difficult airway; inhalation trauma; laryngoscope blade; manikin study

INTRODUCTION

Complications arising from difficult or failed tracheal intubation (TI) remain a leading cause of anesthesia-associated morbidity and mortality (1). There is a higher incidence of difficult and failed laryngoscopy and high laryngeal grade views when patients were managed in a prehospital setting (2). Inhalation injury has become the most frequent cause of death in acute phase of burn patients, and can be associated with a difficult airway caused by acute upper airway obstruction and the presence of soot in the pharynx (3–5). Therefore, the equipment for TI in prehospital emergency care should meet the requirements for difficult intubation conditions, even in the presence of inhalation trauma. However, in prehospital emergency care, single-use plastic laryngoscope blades are often provided for TI for hygienic reasons. Dos Santos et al. described in their retrospective prehospital cohort study, conducted during two 3-year periods at a single university-based emergency medical services system, a plastic disposable blade intubation rate of > 40% (6). Several clinical studies suggested that the use of plastic disposable laryngoscope blades in prehospital emergency care decreases the success rate of TI when compared with reusable metal laryngoscope blades, which might have a distinct impact to difficult airway scenarios (6,7). However, disposable

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metal blades have not been compared with reusable metal and disposable plastic blades in difficult airway scenarios in a single study. The purpose of this study was to compare the effectiveness of a single-use plastic blade (SUPB), a single-use metal blade (SUMB), and a reusable metal blade (RUMB) in a simulated difficult airway scenario caused by a rigid cervical collar, as well as in a simulated inhalation injury airway scenario that combines a difficult airway and a limited view caused by a sooted pharynx.

MATERIALS AND METHODS

Thirty anesthetists with a median clinical experience of 3.5 years (interquartile range 2–6 years) voluntary participated in this randomized crossover trial. Data were anonymized and information on the performance of individual participants was not made available to anybody outside the research team. We notified local ethics committee of the University Erlangen-Nürnberg about the study. The ethics committee waived a formal submission for approval.

Each anesthetist performed TI with a SUMB (disposable Macintosh cold light laryngoscope blade, size 3, P.J. Dahlhausen & Co. GmbH, Cologne, Germany), a SUPB (disposable laryngoscope blade Macintosh, size 3, Intersurgical GmbH, Sankt Augustin, Germany), and a RUMB (reusable X-LITE Macintosh laryngoscope blade, size 3, Wirutec Rüsch Medical Vertriebs GmbH, Sulzbach, Germany) (Figure 1) in a difficult airway scenario manikin (Laerdal Medical AS, Stavanger, Norway), as well as an inhalation injury airway scenario manikin (Erlanger Inhalation Injury Manikin, a modified Laerdal Medical AS manikin) (Figure 2).

Figure 1. The three different laryngoscope blades used in this study. From top to bottom: single-use metal blade (disposable Macintosh cold light laryngoscope blade, size 3, P.J. Dahlhausen & Co. GmbH, Cologne, Germany), single-use plastic blade (disposable laryngoscope blade Macintosh, size 3, Intersurgical GmbH, Sankt Augustin, Germany), and the reusable metal blade (reusable X-LITE Macintosh laryngoscope blade, size 3, Wirutec Rüsch Medical Vertriebs GmbH, Sulzbach, Germany).

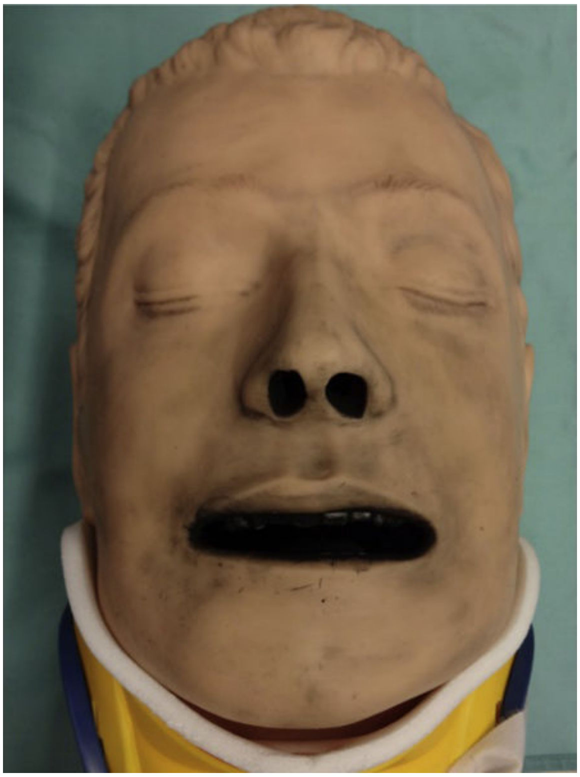

Figure 2. Erlanger Inhalation Injury Manikin, a modified Laerdal Medical AS manikin. The difficult airway is simulated by cervical immobilization applying a cervical collar. The pharynx is pigmented with activated carbon.

To simulate an inhalation injury, the pharynx of the Erlanger Inhalation Injury Manikin was pigmented with activated carbon (Figure 3). The neck of both manikins was fixed in a neutral position by a rigid cervical collar and thus the distance between the free edge of the upper and lower incisors (interdental distance) was limited. These conditions turned it into a difficult intubation model (8).

Figure 3. Oropharynx of the Erlanger Inhalation Injury Manikin. To simulate an inhalation injury, the pharynx is pigmented with activated carbon.

The order in which the manikins were tested was randomized by opening two sealed opaque envelopes containing the names of the manikins. The sequence of laryngoscope blade use was also randomized for each scenario by using three sealed opaque envelopes containing the names of the laryngoscope blades.

Thermal injury to supraglottic structures results in edema and can rapidly lead to upper airway obstruction (9). Therefore, all intubations were performed with a 6.0 mm cuffed endotracheal tube ([ETT]; Super Safetyclear endotracheal tube, internal diameter 6.0 mm; Wirutec Rüsch Medical Vertriebs GmbH, Sulzbach, Germany) and a laryngoscope handle with LED illumination (Heine Standard F.O., Heine Optotechnik GmbH & Co. KG, Herrsching, Germany). Before each intubation attempt, a reusable endotracheal tube introducer was inserted into the ETT. The cuff was lubricated with a silicone spray and the cuff was inflated and deflated with a 10-mL syringe.

In order to compare the different laryngoscope blades, the intubation process was divided into three different time episodes:

1. The duration of a successful intubation attempt was defined as the time from insertion of the blade between the teeth until the ETT was connected to a self-inflating resuscitation bag and the presence of lung inflation was confirmed ("time to ventilate").
2. The time to visualization of the glottis ("time to vocal cords") was defined as the time from insertion of the blade between the teeth until the glottis was visualized.
3. The time to TI ("time to intubate") was defined as the time from insertion of the blade between the teeth until the ETT was expected to be correctly positioned.

The primary endpoint was the "time to ventilate". Esophageal intubations, attempts requiring > 120 s, and more than two attempts, were recorded as failed intubation attempts. All time measurements were made by the same person by direct observation with a stopwatch to avoid interobserver error.

We recorded the rate of successful intubation, the number of intubation attempts, and the laryngeal view according to the Cormack−Lehane score. The number of optimization maneuvers (readjustment of the head position, application of external laryngeal pressure, and the need for assistance by a second person) and the number of audible dental click sounds indicating dental damage were recorded as 0, 1, and ≥2 times during the TI attempt. After completing the procedure, each anesthetist was asked to score the view, the rigidity of the blade, the intubation effort, the difficulty of use of each investigated device, and the overall impression using a numeric rating scale (0 to 100 mm, from excellent/very easy to poor/very difficult). After each scenario, the participants were asked to indicate their preferred laryngoscope blade.

Statistical comparisons were only made within the two airway scenarios. Data for the success of TI attempts were analyzed using the χ^2 test. Data for the number of intubation attempts, time to vocal cords, time to intubate, time to ventilate, number of optimization maneuvers, number of dental clicks, Cormack−Lehane score, view, rigidity of the blade, intubation effort, difficulty of use of each device, and overall impression were analyzed using the Kruskal−Wallis rank test with Bonferroni correction. All analyses were performed by Statistica 6 software (StatSoft GmbH, Hamburg, Germany). Statistical significance was accepted at $p < 0.05$. Continuous data are presented as mean (standard deviation), ordinal data were presented as medians (interquartile range), and categorical data were presented as percentages.

The sample size estimation was based on time to ventilate duration. After a pilot study period, we estimated that the time required for the successful intubation attempt would be 19 s for the RUMB, the gold standard for this study, with a standard deviation of 5 s, in the difficult airway scenario. We considered an absolute change of 25% in the duration of TI as a clinically significant change, in numbers, a reduction to 14 s or an increase to 24 s. With an α error of 0.05 and β error of 0.2, for an experimental design incorporating three equal-sized groups, we estimated that at least 22 participants would be required.

RESULTS

Participant Characteristics

Thirty anesthetists participated in the study (4 pre-registration house officers, 18 senior house officers, 7 specialist registrars and 1 consultant; 17 males and 13 females; mean age of 31 years).

Scenario 1: Difficult Airway

All anesthetists intubated the trachea successfully with all three different laryngoscope blades. There was no difference in the number of required TI attempts between the different laryngoscope blades. Each anesthetist intubated the trachea with a single attempt. There were no significant differences between SUPB and SUMB in the recorded intubation times. The time to visualize the glottis (time to vocal cords) (p = 0.020) and the time to ventilate (p = 0.044) were significantly shorter with the

RUMB compared with the SUPB. There were no differences for the severity of dental compression, the Cormack–Lehane score and the number of optimization maneuvers, with only one anesthetist requiring more than one optimization maneuver with the SUPB. The RUMB required less effort during TI ($p = 0.004$) and was judged as easier to use than the SUPB ($p = 0.002$). Although the SUMB was considered to be more stable compared with the SUPB ($p < 0.001$), the RUMB was considered to be even more stable than the SUMB ($p = 0.005$) and the SUPB ($p < 0.001$). Regarding the overall impression of the devices, the participants rated the RUMB best. Forty-three percent (95% confidence interval [CI] 26–62.3%) preferred the RUMB, followed by the SUMB (10%) (95% CI 2.6–27.7%). Forty-three percent (95% CI 26–62.3%) of the anesthetists would use the RUMB as well as the SUMB in the normal difficult airway scenario (Table 1).

Scenario 2: Inhalation Injury Airway

The rate of successful TI and the number of TI attempts were not significantly different between the groups. However, the failure rate was 3.3% (95% CI 0.2–19.1%) with the RUMB, as one attempt was requiring > 120 s, and 0% (95% CI 0–14.1%) with the SUMB and 10% (95% CI 2.6–27.7%) with the SUPB, respectively. Using the SUMB or the RUMB, the participants only required one attempt to intubate the trachea in the prescribed time. With the SUPB, 20% (95% CI 8.4–39.1%) of the anesthetists required more than one TI attempt. The time to visualize the glottis (time to vocal cords) ($p < 0.001$; SUPB vs. RUMB) ($p = 0.004$; SUPB vs. SUMB), the time to TI (time to intubate) ($p < 0.001$; SUPB vs. RUMB) ($p = 0.033$; SUPB vs. SUMB), and the time to ventilate ($p < 0.001$; SUPB vs. RUMB) ($p = 0.045$; SUPB vs. SUMB) were significantly shorter

Table 1. Tracheal Intubation Data for the Different Laryngoscope Blades in the Difficult Airway Scenario

Intubation Data	SUMB	SUPB	RUMB
Overall success rate, n (%) [95% CI]	30 (100) [85.9–100]	30 (100) [85.9–100]	30 (100) [85.9–100]
No. of intubation attempts, n (%) [95% CI]			
1	30 (100) [85.9–100]	30 (100) [85.9–100]	30 (100) [85.9–100]
2	0 (0) [0–14.1]	0 (0) [0–14.1]	0 (0) [0–14.1]
3	0 (0) [0–14.1]	0 (0) [0–14.1]	0 (0) [0–14.1]
Median (IQR)	1 (1–1)	1 (1–1)	1 (1–1)
Severity of dental compression, n (%) [95% CI]			
0	22 (73.3) [53.8–87]	23 (76.7) [57.3–89.4]	27 (90) [72.3–97.4]
1	5 (16.7) [6.3–35.5]	6 (20) [8.4–39.1]	3 (10) [2.6–27.7]
≥2	3 (10) [2.6–27.7]	1 (3.3) [0.2–19.1]	0 (0) [0–14.1]
Median (IQR)	0 (0–1)	0 (0–0)	0 (0–0)
No. of optimization maneuvers, n (%) [95% CI]			
0	27 (90) [72.3–97.4]	26 (86.7) [68.4–95.6]	27 (90) [72.3–97.4]
1	3 (10) [2.6–27.7]	3 (10) [2.6–27.7]	3 (10) [2.6–27.7]
≥2	0 (0) [0–14.1]	1 (3.3) [0.2–19.1]	0 (0) [0–14.1]
Median (IQR)	0 (0–0)	0 (0–0)	0 (0–0)
Time to vocal cords, s, median (IQR)	5.9 (4.5–8.4)	7.6 (6–10.4)†	5.7 (4.4–7.7)
Time to intubate, s, median (IQR)	12.1 (9.6–14.7)	11.9 (10.9–15.4)	10.6 (8.8–12.2)
Time to ventilate, s, median (IQR)	20.2 (16.6–24.3)	21.1 (19.2–24.8)†	18.4 (15.8–21.3)
View, cm, median (IQR)	2 (1–3)	2.5 (1–3.9)	1.9 (1–2)
Rigidity, cm, median (IQR)	2 (1–3)¶	5 (4–6)*§	0.5 (0–1)
Intubation effort, cm, median (IQR)	3.6 (2–5.8)	4.1 (2.9–6.1)‡	2 (1–4.9)
Overall impression, cm, median (IQR)	2 (1–3)‖	4.6 (3–6.9)*§	1 (0.1–2)
Difficulty of use, cm, median (IQR)	2.1 (2–4)	3.1 (2.1–5)‡	2 (1–3)
Cormack-Lehane score, median (IQR)	2 (1–2)	2 (1–2)	1.5 (1–2)
Preferred laryngoscope blade, n (%) [95% CI]			
RUMB	13 (43.3) [26–62.3]		
SUMB	3 (10) [2.6–27.7]		
SUMB and RUMB	13 (43.3) [26–62.3]		
No difference	1 (3.3) [0.2–19.1]		

CI = confidence interval; IQR = interquartile range; RUMB = reusable metal blade; SUMB = single-use metal blade; SUPB = single-use plastic blade.
Data are reported as median (IQR) or as n (%) [95% CI, including continuity correction].
* $p < 0.001$, plastic blade vs. metal blade.
† $p < 0.05$, plastic blade vs. Macintosh laryngoscope blade.
‡ $p < 0.01$, plastic blade vs. Macintosh laryngoscope blade.
§ $p < 0.001$, plastic blade vs. Macintosh laryngoscope blade.
‖ $p < 0.05$, metal blade vs. Macintosh laryngoscope blade.
¶ $p < 0.01$, metal blade vs. Macintosh laryngoscope blade.

with the SUMB and the RUMB, when compared with the SUPB. There were no significant differences in the severity of dental compression and the number of optimization maneuvers. However, using the SUPB, 20% (95% CI 8.4–39.1%) of the anesthetists required two or more optimization maneuvers and caused two or more dental clicks. The RUMB demonstrated advantages over the SUPB, including a better view of the glottis (p = 0.002) and a lower Cormack−Lehane score (p = 0.012). Both metal laryngoscope blades (RUMB and SUMB) required less effort during TI ($p < 0.001$; SUPB vs. RUMB) (p = 0.015; SUPB vs. SUMB) and were considered by the anesthetists to be more stable ($p < 0.001$) and easier to use ($p < 0.001$; SUPB vs. RUMB) (p = 0.034; SUPB vs. SUMB) when compared with the SUPB. Regarding the overall impression of the devices, the participants rated the RUMB and the SUMB higher than the SUPB ($p < 0.001$). There was no significant difference between the two metal laryngoscope blades. Fifty percent (95% CI 31.7–68.3%) of the participants preferred the RUMB, followed by the SUMB with 40% (95% CI 23.2–59.3%) in the inhalation injury airway scenario (Table 2).

DISCUSSION

Difficult or failed TI is not uncommon in a prehospital emergency setting. Airway management in patients with symptomatic inhalation injury poses significant challenges because of acute upper airway obstruction and decreased visibility due to soot in the oropharynx (3,10). Prior studies have demonstrated that in prehospital emergency care, the use of a plastic disposable laryngoscope blade decreases the success rate of TI, and that metal disposable blades are superior to single-use plastic blades at first attempt and the overall number of attempts to intubate (6,7). Evans and colleagues demonstrated that the use of plastic blades

Table 2. Tracheal Intubation Data for the Different Laryngoscope Blades in the Inhalation Injury Airway Scenario

Intubation Data	SUMB	SUPB	RUMB
Overall success rate, n (%) [95% CI]	30 (100) [85.9–100]	27 (90) [72.3–97.4]	29 (96.7) [81–99.8]
No. of intubation attempts, n (%) [95% CI]			
1	30 (100) [85.9–100]	24 (80) [60.9–91.6]	30 (100) [85.9–100]
2	0 (0) [0–14.1]	5 (16.7) [6.3–35.5]	0 (0) [0–14.1]
3	0 (0) [0–14.1]	1 (3.3) [0.2–19.1]	0 (0) [0–14.1]
Median (IQR)	1 (1–1)	1 (1–1)	1 (1–1)
Severity of dental compression, n (%) [95% CI]			
0	27 (90) [72.3–97.4]	24 (80) [60.9–91.6]	26 (86.7) [68.4–95.6]
1	1 (3.3) [0.2–19.1]	0 (0) [0–14.1]	1 (3.3) [0.2–19.1]
≥2	2 (6.7) [1.2–23.5]	6 (20) [8.4–39.1]	3 (10) [2.6–27.7]
Median (IQR)	0 (0–0)	0 (0–0)	0 (0–0)
No. of optimization maneuvers, n (%) [95% CI]			
0	24 (80) [60.9–91.6]	18 (60) [40.8–76.8]	25 (83.3) [64.6–93.7]
1	5 (16.7) [6.3–35.5]	6 (20) [8.4–39.1]	4 (13.3) [4.4–31.6]
≥2	1 (3.3) [0.2–19.1]	6 (20) [8.4–39.1]	1 (3.3) [0.2–19.1]
Median (IQR)	0 (0–0)	0 (0–1)	0 (0–0)
Time to vocal cords, s, median (IQR)	11.7 (8.2–17.5)	20.2 (13.5–31.8)†‖	8.9 (7–12.8)
Time to intubate, s, median (IQR)	21.2 (14–31.4)	32.9 (23–45.1)*‖	17.4 (12.9–23.7)
Time to ventilate, s, median (IQR)	29.6 (23.4–46.4)	42 (32.7–56.4)*‖	27.2 (22–35.3)
View, cm, median (IQR)	4 (3–6)	5.6 (4−8)§	3 (1.1–5)
Rigidity, cm, median (IQR)	2 (1–3.9)	7.1 (5–8.5)‡‖	0.6 (0–2)
Intubation effort, cm, median (IQR)	4.5 (4–7.9)	7.8 (6.1–8.9)*‖	3.9 (3–7)
Overall impression, cm, median (IQR)	2.6 (1.2–4)	8 (4.9–9)‡‖	1.5 (1–2.1)
Difficulty of use, cm, median (IQR)	5 (3–7)	8.8 (5.1–8)*‖	3.5 (2.9–5.9)
Cormack−Lehane score, median (IQR)	2 (2–2)	2 (2−3)§	2 (1–2)
Preferred laryngoscope blade, n (%) [95% CI]			
RUMB	15 (50) [31.7–68.3]		
SUMB	12 (40) [23.2–59.3]		
SUMB and RUMB	2 (6.7) [1.2–23.5]		
SUPB and RUMB	1 (3.3) [0.2–19.1]		

CI = confidence interval; IQR = interquartile range; RUMB = reusable metal blade; SUMB = single-use metal blade; SUPB = single-use plastic blade.
Data are reported as median (IQR) or as n (%) [95% CI, including continuity correction].
* $p < 0.05$, plastic vs. metal blade.
† $p < 0.01$, plastic vs. metal blade.
‡ $p < 0.001$, plastic vs. metal blade.
§ $p < 0.01$, plastic vs. Macintosh laryngoscope blade.
‖ $p < 0.001$, plastic vs. Macintosh laryngoscope blade.

results in both greater peak force and duration of laryngoscopy (11). However, in prehospital emergency care, single-use plastic laryngoscope blades are often provided for TI, as there is no need for hygienic reprocessing. In our manikin study, we aimed to evaluate the performance of different laryngoscope blades when used by anesthetists in a difficult airway, as well as an inhalation injury airway scenario.

In the difficult airway scenario, no significant differences in the recorded intubation times were observed between the two disposable laryngoscope blades. The results may be related to the simulated difficult, but not inhalation injury modified airway. Without light-absorbing activated carbon, the anesthetists can identify landmarks of the anatomy and may be able to perform successful intubation with less peak force and a slightly more flexible laryngoscope blade, such as the SUPB. In contrast, without being able to identify landmarks of the anatomy in the inhalation injury scenario, the likelihood of a faster TI may be higher with a less flexible laryngoscope blade. Scholz et al. demonstrated that anesthetists can see the larynx at very low light levels in a manikin, but that for a difficult intubation scenario, a higher light level is necessary (12). In our study, the participants rated the overall impression of SUMB higher than SUPB in the difficult airway scenario. The RUMB demonstrated further advantages over the SUPB, including significantly shorter time to vocal cords and time to ventilate. This can be due to the properties of rigidity of the RUMB. In the difficult airway scenario, the RUMB was considered by the anesthetists to be even more stable when compared with the two disposable laryngoscope blades. Thus, the maximum stability could explain the faster intubation times even in the difficult, but not inhalation injury modified, airway. Buléon et al. demonstrated, in a randomized single-center study with 1863 adults requiring general anesthesia, that glottic exposure was significantly better in the metallic reusable group compared with the plastic single-use group (13). No significant differences in the recorded intubation times were observed between the RUMB and the SUMB. This is consistent with the findings of Evans et al. (11).

In the inhalation injury scenario, the SUPB was associated with prolonged intubation times when compared with the SUMB and the RUMB. In addition, our study showed that the SUPB had more dental clicks than the metal blades (Table 2). Although, Itoman et al. demonstrated, based on a dental fracture model study, that plastic laryngoscope blades have a lower potential for dental fracture when compared with metal laryngoscope blades in routine intubations, these results may be related to the difficult anatomical orientation in the inhalation injury scenario (14). With the SUPB, a greater peak force is required to visualize the glottis (11). Without landmarks of the anatomy, the participants might have used the more flexible SUPB with more leverage force to obtain a direct view of the glottis. Thus, a greater number of dental clicks with the SUPB could result in a higher number of dental fractures. The prolonged intubation times in the inhalation injury scenario could be explained by the different properties of rigidity of metal and plastic laryngoscope blades. Goodwin et al. demonstrated that disposable metal blades are less flexible in the primary axis than single-use plastic blades (15). The ratings of the participants confirm these findings. Both metal laryngoscope blades required less effort during TI and were considered by the anesthetists to be more stable and easier to use when compared with the SUPB. In patients with symptomatic inhalation injury and acute upper-airway obstruction, the emergency TI with a less flexible metal laryngoscope blade may be easier because of the better alignment of the oral, pharyngeal, and tracheal axes. This could partially explain why most of the participants preferred the metal laryngoscope blades in the inhalation injury manikin scenario. Although, the RUMB demonstrated further advantages over the SUPB, there was no significant difference between the disposable and the reusable metal laryngoscope blades. Similar findings have been found in previous studies. Jabre et al. demonstrated that for out-of-hospital patients requiring emergency TI, the first-pass intubation success with SUMB was noninferior to first-pass success with RUMB (16).

Limitations

This study has some limitations. First, this study is a manikin and not a clinical study. However, the simulation of intubation scenarios in anatomically correct manikins has been described to be a reliable surrogate for the clinical context (17). Second, the potential for bias exists, as the study could not be blinded to either the participants or the assessors. Third, the anesthetists were aware that their actions were being timed, which could lead to an altered performance, as a result of the Hawthorne effect (18). Fourth, we compared only one disposable metal and one plastic laryngoscope blade with one standard RUMB. There are various other types of disposable metal and plastic blades, as well as reusable blades available, and their properties for direct laryngoscopy in the difficult airway caused by inhalation injury might be different and should be investigated. Fifth, because of the potential upper airway obstruction caused by oropharyngeal edema in patients with inhalation injury, all intubations were performed with a 6.0 mm cuffed ETT. The results might have been different using another size or brand of ETT. Sixth, certain measurements used in this study, such as grading the difficulty of use, have a subjective nature. However, there was good agreement between the collected subjective data and the objective measurements, such as TI times. Seventh, this study was carried out by anesthetists, experienced in the use of disposable and reusable blades. Thus, results may differ in the hands of less-experienced users. Finally, though the SUPB was associated with statistically significant prolonged intubation times, the clinical impact of this time difference remains uncertain. Further comparative studies in a clinical setting are necessary to confirm our findings.

CONCLUSIONS

In the inhalation injury scenario both, the reusable and the single use metal laryngoscope blades provide a quicker, easier, and safer TI compared with the SUPB when used by anesthetists. In the difficult airway scenario, the RUMB demonstrated the shortest intubation times and seems to be the most effective device. We therefore hypothesize that metal laryngoscope blades might be beneficial, especially in the airway management of burn patients.

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