

Emerging Evidence in Infection Control: Effecting Change Regarding Use of Disposable Laryngoscope Blades

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The purpose of this evidence-based project was to determine the perceptions of anesthesia providers regarding the use of disposable laryngoscope blades. Frequency of use, ease of use, and complications encountered when using the disposable blade were evaluated before and after an in-service program designed to increase the use of disposable blades.

Participants completed an anonymous questionnaire about their knowledge and practice regarding disposable laryngoscope blades. Then they received an investigator-developed article to read about the best and most recent practices regarding disposable laryngoscope blades. The same anonymous questionnaire was completed 3 months later. Inventory of the disposable laryngoscope blades was collected before the project and 1 and 3 months later.

After the intervention, 25% of anesthesia providers described performance as their reason for not using the disposable laryngoscope blade, which was down from 60% at the project's start. Inventory showed a 23% increase in use of disposable laryngoscope blades after the intervention, which a single-proportion Z test showed was statistically significant ($Z = 2.046$, $P = .041$). This evidence-based project shows that a change in practice was evident after dissemination of the best and most recent clinical evidence regarding laryngoscope blades, which should translate to improved patient outcomes.

Keywords: Disposable laryngoscope blade, infection control, reusable laryngoscope blade, single-use laryngoscope blade.

Nosocomial infections affect 1.7 million people and contribute to 99,000 deaths annually in the United States.¹ The cost to treat these infections are not only burdensome to hospitals but also felt by the average person. The greater the payout of insurance companies, the higher the standard premium will be. In view of these facts, health-care providers should be doing everything to ensure that infections are not spread unknowingly by contaminated equipment.

Blood is an excellent environment for all forms of pathogenic organisms to flourish. It is easy, therefore, to theorize that nosocomial infections could potentially result from visible and occult blood present on reusable anesthetic airway equipment. Since these infections often have major economic and health-related consequences, prevention is a top priority for hospitals and insurance companies. Anesthesia providers must be certain that reusable airway equipment such as laryngoscope blades are clean before each use, or they must use disposable equipment.

Intubation of the trachea using reusable equipment creates a risk for cross-contamination because no perfect decontamination procedure exists.² It has been estab-

lished in multiple studies that the current cleaning and sterilization techniques for reusable anesthetic airway equipment are ineffective at removing all remnants of blood.³⁻⁹ Observation alone is not a reliable method for assessing the level of contamination on airway equipment. Disposable laryngoscope blades are available to prevent potential cross contamination. These single-use disposable laryngoscope blades have come with mixed reviews from anesthesia providers.¹⁰⁻¹⁷

To help decrease the spread of nosocomial infections, the American Association of Nurse Anesthetists (AANA) recommends the use of a disposable laryngoscope blade when possible.¹⁸ Single-use airway equipment is designed to be used once and then discarded.¹⁴ There may, however, be concern about the quality of some of these devices because they are manufactured at lower cost to justify their disposal. A literature review was conducted to determine why not all anesthesia providers are using disposable laryngoscope blades.

Standard search procedures were used to locate published studies regarding the use of disposable laryngoscope blades. Electronic databases searched were Cumulative Index to Nursing & Allied Health Literature (CINAHL), Medline, PubMed, and The Cochrane Library,

using the key terms *disposable laryngoscope blade*, *single-use laryngoscope blade*, *reusable laryngoscope blades*, and *laryngoscopy*. The search was limited to the English language. Although this strategy captured a large number of studies, few of them dealt with anesthesia provider's preference and use of the disposable laryngoscope blade.

Successful tracheal intubation depends on a variety of factors such as adequate visualization of the larynx, adequate illumination of the larynx, and operator skill. Therefore, anesthetists may be concerned about difficulties in obtaining a view of the glottis with single-use laryngoscope blades because they are manufactured at lower cost. Amour et al¹⁹ conducted a study of 1,072 adult patients undergoing general anesthesia under emergency conditions and requiring rapid sequence induction. The patients were randomly assigned to receive either single-use metal or reusable metal laryngoscope blades on a weekly basis. Both groups were similar in their main characteristics and risk factors for difficult intubation. The purpose of the study was to determine the rate of failed intubations using disposable laryngoscope blades vs reusable laryngoscope blades. The researchers found that the rate of failed intubation was significantly decreased with the single-use metal blades at the first attempt compared with reusable blades (2.8% vs 5.4%, $P < .05$).

However, single-use blades are manufactured with different designs and materials. The plastic single-use laryngoscope blade is reported to be less efficient than a metal reusable blade during a rapid sequence induction of anesthesia.⁹ This idea has been corroborated by Jabre et al¹² and Galinski et al.³ Failure to visualize the larynx is in part due to the increase in flexibility that is seen with disposable plastic laryngoscope blades.¹⁰ In routine use the single-use laryngoscope blade is reported to be an efficient device, but it has been recommended to have conventional reusable laryngoscope blades reserved for difficult intubations.¹²

A comparison was conducted of 3 laryngoscope options, including a standard stainless steel Macintosh No. 3 blade, the same blade with a disposable cover applied, and a disposable Macintosh No. 3 blade, in reference to the ease of intubation using a high-fidelity human patient simulator.¹⁰ The modified model C high-fidelity human patient simulator can provide a range of intubation conditions from easy to impossible. Anesthetists with similar amounts of experience performed laryngoscopy with each of the 3 laryngoscopes in both easy and difficult simulator intubation settings. For the easy setting, 34% ($P = .001$) of anesthetists graded laryngoscopy more difficult with the covered laryngoscope and 22% ($P = .008$) with the disposable laryngoscope considered laryngoscopy more difficult than with the standard reusable metal laryngoscope. Sixty-nine percent ($P < .001$) of anesthetists found laryngoscopy more difficult with the disposable laryngoscope blade in the difficult simula-

tor setting. However, the results of this study may not determine the clinician's decision to use the disposable laryngoscope blade. Despite reservations about failed intubation and the unknown risk of an iatrogenic disease, most clinicians would want single-use devices used on themselves and their family if they were patients.¹⁴

Successful intubation requires appropriate skill but also depends heavily on access to good equipment. A study by Sudhir et al¹⁵ determined that user satisfaction is improved with metal disposable blades ($P < .001$) and that there is greater force needed to intubate with the disposable laryngoscope blade. There was a statistically significant ($P < .01$) increase in illumination when a disposable blade was used.¹⁶

We undertook the current study to determine the perceptions of anesthesia providers regarding the use of disposable laryngoscope blades and whether dissemination of the best and most recent clinical evidence regarding laryngoscope blades could change clinical practice.

Materials and Methods

• **Study Design.** This study used a 1-group before-and-after design with an 11-item anonymous questionnaire obtained from anesthesia providers before implementation of the practice change. Fixed-alternative and open-ended questions were used in the survey. This questionnaire was developed by the principal investigator (MDM). The anesthesia providers were asked by the principal investigator 3 months later to complete the same 11-item anonymous questionnaire. The study ran for 3 months.

• **Sample.** A convenience sample consisted of all anesthesia providers at a large urban hospital in South Florida that agreed to voluntarily participate and sign the informed consent. Every anesthesia provider agreed to participate (100%); thus, the participants included 7 anesthesiologists and 5 Certified Registered Nurse Anesthetists. The anesthesia providers' experience ranged in their specialty. Participants included both men and women of different ethnicities and age. All providers were over 18 years of age.

• **Data Collection Procedure.** Once institutional review board approval and written consent were obtained, participants were asked to complete an anonymous 1-page questionnaire about their knowledge and practice regarding disposable laryngoscope blades. Immediately following the completion of the questionnaire, participants were given an evidence-based article to read that was written by the primary investigator from the literature review accompanying this article. This project took place over 3 consecutive months. Final data collection, in which the participants completed the same anonymous questionnaire in a similar manner, was done 3 months following the preintervention questionnaire.

Inventory of the disposable laryngoscope blades was collected at the start of the project (before the interven-

Question	Responses (%)	
	Preintervention	Postintervention
Which best describes the amount of time you use the single-use laryngoscope blade?		
Always	33.33	33.33
75%	33.33	33.33
50%	16.67	16.67
25%	16.67	8.33
Never	0.00	8.33
If you have used the single-use laryngoscope blade, did you find it easy to use?		
Yes	83.33	91.67
No	16.67	8.33
If you routinely use the single-use laryngoscope blade, how many times would you say that you had to change to a traditional multiuse laryngoscope blade?		
Never	8.33	8.33
< 25% of the time	83.33	83.33
< 50% of the time	0.00	0.00
< 75% of the time	0.00	0.00
Not applicable	8.33	8.33
What best describes your reason for not using a single-use laryngoscope blade? ^a		
Not available to you	0.00	8.33
Expense	0.00	0.00
Performance	60.00	25.00
Other	40.00	66.67

Table. Preintervention and Postintervention Survey Results

^a Two of 12 providers did not respond to this preintervention question.

tion), at 1 month, and then again at 3 months. Inventory was collected by the primary investigator by totaling the amount of daily disposable blades used by all providers each day. Totaling the amount of daily disposable blades was calculated by the charge sheet for each case. All general anesthetics requiring intubation of adults were counted. Of those cases, use of disposable laryngoscope blades was counted each day for 1 week. This was done 1 week before the collection of the questionnaire, the first week of the second month, and again the first week of the third month.

• **Instrumentation.** The data collection instrument was an 11-item investigator-developed questionnaire regarding the anesthesia provider's knowledge of and experience with the use of disposable laryngoscope blades. Besides some standard demographic data such as age, gender, and experience, the questionnaire asked the following:

1. Which best describes the amount of time you use the single-use laryngoscope blade?
2. If you have used the single-use laryngoscope blade, did you find it easy to use?
3. If you routinely use the single-use laryngoscope blade, how many times would you say that you had to change to a traditional multi-use laryngoscope blade?

4. What best describes your reason for not using a single-use laryngoscope blade?

5. Please list any complications you have encountered in using a single-use laryngoscope blade.

All questions had multiple-choice answers except the last one, which asked to provide a short answer (Table).

The intervention involved the subjects reading an article given to them by the primary investigator. The intervention tool was an evidence-based article that was written by the primary investigator about the best and most recent clinical evidence to have an impact on patient safety during laryngoscopy. This evidence-based intervention was designed to give the anesthesia providers the best information about infection control practices of laryngoscope blades. The intended outcome of this intervention was to increase the use of disposable laryngoscope blades at this facility, thereby decreasing the potential for nosocomial infections. This article was later published in the *AANA Journal*.²⁰

• **Data Analysis.** All raw data entered into the computer were checked for errors and then analyzed using SPSS statistical software (version 17.0, SPSS, Chicago, Illinois), with statistical significance determined at $P < .05$. Descriptive statistics also were used. The Wilcoxon

signed rank test was performed to examine between-group differences in the perception and use of disposable laryngoscope blades from before to after the test. This evidence-based practice project was looking to see if there was a change in anesthesia practice as a whole. In the event that participants dropped out of the study, it would not have a major impact on the project because only overall change was measured.

Results

Of the 12 anesthesia providers who participated in the evidence-based practice project, 4 (33%) were women and 8 (67%) were men. One (8.33%) of the anesthesia providers had been in practice between 1 and 5 years. Two (17%) of the anesthesia providers have been in practice between 5 and 10 years, and 9 (75%) have been practicing for longer than 10 years. Seven (58%) of the providers described their client base as adults, 3 (25%) described their client base as children, and 2 (17%) of the providers described their client base as obstetrical. All of the anesthesia providers were aware of single-use laryngoscope blades before the intervention, and all of them have used them at some point before the intervention. All of the anesthesia providers stated that the plastic laryngoscope blade is the type of single-use laryngoscope they have used.

• **Preintervention Results.** Before the participants were given the intervention tool, 4 (33%) of the providers said they always use the single-use laryngoscope blade (see Table). Another 4 (33%) of the anesthesia providers said they use the single-use laryngoscope blade 75% of the time. Two (17%) of the anesthesia providers said they use the single-use laryngoscope blade 50% of the time, and 2 (17%) said they use the single-use laryngoscope blade 25% of the time. None of the anesthesia providers said that they never use the single-use laryngoscope blade.

Of those who had used the single-use laryngoscope blade, 10 (83%) found it easy to use. Of those who routinely used the single-use laryngoscope blade, 1 (8.33%) said that he or she never had to change to a traditional multiuse laryngoscope blade during laryngoscopy. Eighty-three percent, or 10 anesthesia providers, said that they had to change to a traditional multiuse laryngoscope blade during laryngoscopy less than 25% of the time.

Six of 10 anesthesia providers (60%) described performance (inability to visualize the larynx) as their reason for not using a single-use laryngoscope blade in some cases. Four (40%) of 10 anesthesia providers described something other than availability, expense, and performance as their reason for not using a single-use laryngoscope blade. Two of the anesthesia providers left this question blank. When asked to list any complications encountered in using a single-use laryngoscope blade, 6 (50%) answered none. Some individuals, however, listed flexibility, broke while attaching, limited view, bulky, environmental waste, or battery life as a complication.

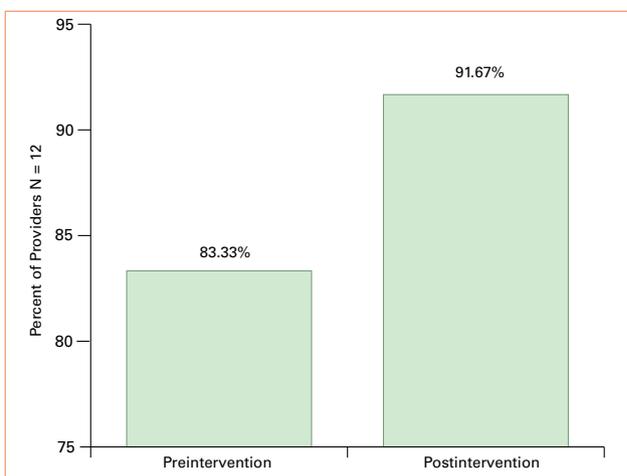


Figure 1. Ease of Use of Disposable Laryngoscope Blades

• **Postintervention Results.** Three months after the intervention tool was disseminated, 33% of the providers (n = 4) said they always use the single-use laryngoscope blade. Thirty-three percent of the anesthesia providers (n = 4) said they use the single-use laryngoscope blade 75% of the time. Seventeen percent of the anesthesia providers (n = 2) said they use the single-use laryngoscope blade 50% of the time. Eight percent of the anesthesia providers (n = 1) reported using the single-use laryngoscope blade 25% of the time, and 8% (n = 1) reported never using the single-use laryngoscope blade. These results are listed in the Table.

Of those who have used the single-use laryngoscope blade, 11 (92%) found it easy to use. Of those who routinely use the single-use laryngoscope blade, 1 (8%) said that he or she had never had to change to a traditional multiuse laryngoscope blade during laryngoscopy. Ten (83%) said that they had to change to a traditional multiuse laryngoscope blade during laryngoscopy less than 25% of the time. One (8%) said the question was not applicable. Figure 1 shows the difference in percentage of anesthesia providers who found the disposable laryngoscope blade easy to use before and after the intervention. A Wilcoxon signed rank test showed that a 3-month period to experiment with disposable laryngoscope blades after the intervention did not elicit a statistically significant change in provider perception of the ease of use ($Z = -1.00, P = .317$).

One (8%) anesthesia provider described availability as the reason for not using a single-use laryngoscope blade. Three (25%) anesthesia providers described performance as their reason for not using a single-use laryngoscope blade. Eight (67%) of anesthesia providers described something other than availability, expense, and performance as their reason for not using a single-use laryngoscope blade. Figure 2 shows the difference in percentage of anesthesia providers who found performance of the

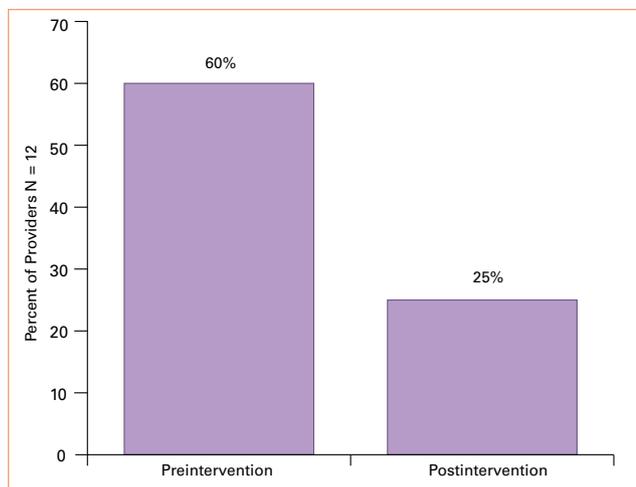


Figure 2. Performance as Reason for Not Using Disposable Laryngoscope Blades

disposable laryngoscope blade the reason for not using it before and after the intervention.

• **Inventory of Disposable Laryngoscope Blades.** A total of 30 general anesthetics requiring intubation were recorded in the week before the dissemination of the intervention article. Of those, 12 (40%) intubations were performed using a disposable laryngoscope blade. There was a substantial increase (25%) in the number of disposable laryngoscope blades used in the second month. A total of 48 general anesthetics requiring intubation were recorded over 1 week in month 2, after dissemination of the intervention article. Of those, 31 (65%) intubations were performed using a disposable laryngoscope blade. Twenty-four general anesthetics requiring intubation were recorded over 1 week in the third month after dissemination of the intervention article. Fifteen (63%) of those intubations were performed using a disposable laryngoscope blade. The percentages are graphed in Figure 3 to illustrate the amount of change from one month to another. A single-proportion Z test showed that the increase in use of disposable laryngoscope blades after the intervention was statistically significant ($Z = 2.046, P = .041$).

Discussion

• **Level of Improvement.** The 23% increase in disposable laryngoscope blade use at the completion of the project reflects the practice change of the anesthesia providers. A greater number of anesthesia providers stated they believed that disposable laryngoscope blades were easy to use at the completion of the project. Before the intervention, 83% of providers found it easy to use, whereas 92% of anesthesia providers found it easy to use after the intervention. Because of the small sample size ($N = 12$), it is difficult to conclude how significant these results are. However, if one looks only at those who did not find the disposable laryngoscope blade easy to use before the intervention ($n = 2$), there was a 50% increase in how easy

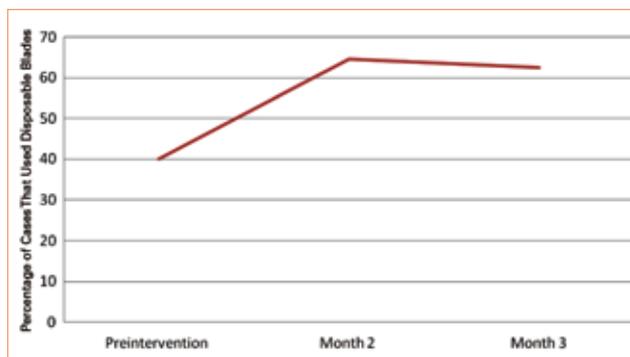


Figure 3. Use of Disposable Laryngoscope Blades in Cases Requiring Intubation

to use the providers found the disposable laryngoscope blades to be after the intervention ($n = 1$).

There was a large change in providers' reasons for not using a single-use laryngoscope blade. Before the intervention, providers mainly chose performance (60%) and other (40%) as their reason. However, 8% of providers cited availability, 25% cited performance, and 67% cited other as their reason for not using disposable laryngoscope blades after the intervention. This change might be attributed to how comfortable anesthesia providers became with the disposable laryngoscope blades during the 3 months after the intervention. With increased use, there was a perceived decrease in performance issues with the disposable laryngoscope blade.

Availability issues in the questionnaire relate to not having appropriately sized disposable laryngoscope blades at the facility where the evidence-based practice project took place. A Macintosh No. 4 blade or Miller blade might be the best choice for intubation in certain adults, whereas smaller blades would be appropriate for pediatric use. Macintosh No. 3 blades are the only disposable laryngoscope blade available at this facility. One participant stated on the postintervention questionnaire that he or she never uses the disposable laryngoscope blade. One possibility of this outcome could be attributed to the disposable laryngoscope blades that are available on site. If this anesthesia provider routinely worked in pediatrics and appropriately sized disposable laryngoscope blades were not available, that person would never have the opportunity to use one.

• **Implications for Clinical Practice.** Based on the results of this evidence-based practice project, the researchers recommend routinely using disposable laryngoscope blades. Metal reusable laryngoscope blades should remain available for a difficult intubation. Just as other airway equipment (laryngeal mask airway's oropharyngeal airway) is now single use, the move to disposable products is in our future, as the evidence clearly states that it is a better choice for protecting patients.

• **Strengths, Weaknesses, and Limitations of the Study.** The strengths of this project are the increased use

of the disposable laryngoscope blade and the impact that has on patient safety. The weaknesses of this project are the small sample of anesthesia providers who were given the intervention (N = 12), the duration of the project, and the possibility that the participants did not read the intervention article. There is also the possibility that the Hawthorne effect has contributed to the findings, whereby participants alter their behavior in response to the fact that they know they are being studied.

One of the major limitations of the study deals with the answers on the questionnaire. When asked which best describes the amount of time a provider uses the disposable laryngoscope blade, the answer key allowed only for always or the next level of measurement, which was 75% of the time. The difference between the 2 answers was too large and therefore did not allow for any level of improvement. Providers communicated that they always use a disposable blade except when there is a difficult intubation. They therefore cannot choose "always" so the next closest is "75% of the time"; in reality, their use might have been 99% of the time.

• **Implications for Future Research.** This relatively short, evidence-based project showed a change in practice and can serve as a pilot study for a larger geographical study. The project should be continued and expanded to include multiple facilities to see if there is consistency in the findings. It is also recommended that this project be expanded beyond anesthesia and incorporate the use of disposable laryngoscope blades with emergency room personnel as well as emergency medical services. Future research will need to investigate the effectiveness of different types of disposable laryngoscope blades (metal vs plastic) as well as different sizes and in different patient populations. This project focused on plastic Macintosh No. 3 disposable blades in the adult nonobstetrical patient because that is what was available in the facility in which the project took place.

Conclusion

It is well documented that the current procedures for the cleaning, disinfecting, sterilizing, and handling of reusable laryngoscope blades may be ineffective, or that there may be poor compliance with established protocols.³⁻⁹ The disposable laryngoscope blade is available as a method to eliminate the potential breakdown in the sterilizing process. Although the concept of disposable laryngoscope blades makes sense, anesthesia providers have been reluctant to fully embrace its use in the past.¹⁰⁻¹⁷ This evidence-based project has shown that despite apprehension, a change in practice is evident after dissemination of the best and most recent clinical evidence regarding laryngoscope blades.

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