Eurasian Journal of
Anesthesiology & Intensive Care
Original Article
doi
10.51271/EAJAIC-0041

The effect of dominant hand on laryngoscope use in medical students*

Ruslan Abdullayev[1], Ömer Ekinci[2], İsmail Karayel[2], Fatih Mehmet Kalkan[2], Eren Öztürk[2], Esra Gemici[3], Dilan Taş[4], Seyhan Hıdıroğlu[3]

[1]Department of Anesthesiology and Reanimation, Faculty of Medicine, Marmara University, İstanbul, Turkiye
[2]Medical Student, Faculty of Medicine, Marmara University, İstanbul, Turkiye
[3]Department of Public Health, Faculty of Medicine, Marmara University, İstanbul, Turkiye
[4]Department of Anesthesiology and Reanimation, Erciş Şehit Rıdvan Çevik State Hospital, Van, Turkiye

Cite this article: Abdullayev R, Ekinci Ö, Karayel İ, et al. The effect of dominant hand on laryngoscope use in medical students. *Eur J Anesthesiol Intens Care.* 2025;2(4):116-121.

Corresponding Author: Dilan Taş, dilantas11@hotmail.com

Received: 03/06/2025 ◆ **Accepted:** 14/08/2025 ◆ **Published:** 13/11/2025

ABSTRACT

Aims: This study investigates the effect of hand dominance on endotracheal intubation performance among medical students with no prior intubation experience, focusing on procedural time, success rates, glottic visualization, and subjective difficulty. The hypothesis was that right-hand dominant individuals would perform the intubation faster due to the ergonomic advantages of standard intubation equipment designed for right-handed use.

Methods: A cross-sectional study was conducted with 14 medical students (7 right-hand dominant, 7 left-hand dominant) from a university. Participants received standardized training before performing intubation on a mannequin using a standard left-hand Macintosh laryngoscope. Intubation time, number of attempts, percentage of glottic opening (POGO), Cormack-Lehane grade, and subjective difficulty (Likert scale) were recorded. Statistical analysis was conducted using Jamovi software, with $p<0.05$ considered significant.

Results: Right-hand dominant individuals achieved significantly shorter intubation times than left-hand dominant ones (median 26 vs. 59 s; $p=0.029$). Although the first-attempt success rate was higher in the right-handed group (85.7 vs. 57.1%), the difference was not statistically significant. No significant differences were found in POGO scores, Cormack-Lehane grades, or subjective difficulty ratings, although trends indicated that left-handed individuals experienced greater difficulty and inferior glottic visualization.

Conclusion: The study demonstrates that standard intubation equipment ergonomically favors right-hand dominant individuals potentially leading to more efficient procedural performance. These findings highlight the need for inclusive training strategies and equipment design considerations that accommodate hand dominance, thereby improving educational outcomes and patient safety in airway management.

Keywords: Hand dominance, intubation, laryngoscopy, left hand, right hand.

* This study was presented as a poster presentation at the 24th National Marmara Student Congress (MaSCO), held at Marmara University Faculty of Medicine, İstanbul, Turkiye, between May 23-25, 2024.

INTRODUCTION

Endotracheal intubation is a complex procedure that plays a critical role in establishing the airway and requires a high level of visual, cognitive and motor skill coordination.[1,2] The success of the procedure directly depends not only on theoretical knowledge but also on the practitioner's manual dexterity, visual-motor coordination and habits.[3] Especially in laryngoscope use, dominant hand preference stands out as an important individual factor that may affect intubation performance.[4] Standard laryngoscopes are designed for right-handed use, with the handle held in the left hand by right-handed users, which creates an ergonomic advantage for right-hand dominant individuals and a disadvantage for left-handed individuals in educational settings.[5]

The effect of hand dominance on applied skills has been emphasized in studies conducted in pediatric and emergency

care fields, and it has been shown that motor learning and ergonomics play a decisive role in procedural performance and patient safety.[1,6] Some studies have reported that the dominant hand provides an advantage in technical control and glottic view,[3] while others have shown that intubation can be performed with the non-dominant hand as well.[4] Despite all these findings, the number of studies directly comparing performance differences between individuals with right-and left-hand dominance and no intubation experience under standard conditions is quite limited.

The aim of this study was to evaluate whether there is a difference in intubation time, success rate, achievement of glottic view and procedural difficulty between right and left hand dominant medical students with no intubation experience. Accordingly, the study aims to contribute to the restructuring of educational materials that consider individual differences and to a better understanding of technical difficulties reflected in clinical practice. It is anticipated that the findings will lay the groundwork for the development of more inclusive and personalized intubation training strategies by revealing the difficulties faced by left-hand dominant individuals during standard laryngoscopy. The hypothesis of our study is that right-hand dominant individuals will have better intubation performance regarding the procedure time, as the standard intubation equipment is ergonomically designed for right-handed users.

METHODS

For this cross-sectional study permission was obtained from Marmara University Clinical Researches Ethics Committee (Date: 08.12.2023, Decision No: 09.2023.1691). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. A total of 14 students, seven with right dominant hand and seven with left dominant hand, who were studying at Marmara University Faculty of Medicine and had no previous intubation experience, were included in the study. The study was conducted in the student laboratory of the university. Exclusion criteria were having received training on intubation, having watched a training video, having performed intubation on a patient or mannequin, and having any pathology that would affect hand-eye coordination for the procedure. This study was supported by TÜBİTAK Scientist Support Programs Presidency within the scope of the 2209-A University Students Research Projects Support Program (No: 1919B012317940).

Prior to the procedure, participants were clearly informed that the study aimed to examine the role of hand dominance in intubation performance, ensuring they understood the study's purpose. This was followed by a ten-minute theoretical training course on endotracheal intubation provided by the researcher (R.A.) to standardize the instructions given to all participants. Airway anatomy, indications for endotracheal intubation, airway assessment and intubation techniques were explained. Demographic and anthropometric data of the students were recorded. Then, intubation was performed on an airway model (Laerdal Medical, Stavanger, Norway). Intubation was performed with a standard Macintosh number 4 laryngoscope (Heine Classic+, Heine Optotechnik, Herrsching, Germany) with the handle held in the left hand and the blade opening to the right. During the laryngoscopy procedure, the practitioners were asked to state the percentage of glottic opening (POGO) and Cormack-Lehane grade. Intubation was then performed and the balloon of the endotracheal tube (ETT) was inflated. The success of intubation was confirmed by applying positive pressure through the ETT with a balloon-valve-mask and inflation of the lungs, which were clearly visible on the model. The time from the handling of the laryngoscope by the practitioner to the inflation of the ETT balloon was recorded. Intubation success was recorded. In case of unsuccessful intubation, the practitioner repeated the procedure again. This continued until successful intubation was achieved and the number of attempts was recorded. Finally, a subjective evaluation of the intubation procedure by the practitioner was performed. For this, a likert scale from 1 to 5 was used (1-very easy, 2-easy, 3-moderate, 4-difficult, and 5-very difficult).

For POGO, we looked at how much of the glottis opening was visible. To avoid confusion, the practitioners were asked to mark this opening as 100% (full opening visible), 75%, 50%, 25% or 0% (no opening visible at all), whichever value was closest to these numbers. The Cormack-Lehane grade was assessed as the standard; 1-glottis fully visible; 2-glottis partially visible; 3-glottis not visible, only epiglottis visible; 4-neither glottis nor epiglottis visible.

Statistical Analysis

Jamovi software was used for statistical analysis (The Jamovi Project (2022). Jamovi. (Version 2.3) [Computer Software]. Retrieved from https://www.jamovi.org.). In descriptive analyses, mean±standard deviation, and median and interquartile range (IQR) were used for normal and non-normally distributed variables, respectively. Intergroup comparisons for continuous variables were made with Student t, Welch and Mann-Whitney U tests in independent groups. Fisher's exact test was used to analyze categorical variables. $p<0.05$ was considered statistically significant. The primary outcome measure of our study was intubation time. Secondary outcome measures were the number of intubation attempts, Cormack-Lehane grade, POGO and objective measure of intubation difficulty. For the sample size calculation, the data obtained from observations on right and left dominant handed students were taken as reference. No literature data could be found in this regard. Effect size was calculated to be 2, from the preliminary investigation on four patients, two right- and two left-handed. Based specifically on endotracheal intubation times, it was calculated that a total of 12 patients, six in each group, were required for an effect size of 2, a type-1 error of 0.05 and 80% power of the study. We planned to complete our study with a total of 14 participants, seven in each group. It should be noted that this effect size estimate was derived from a very small preliminary observation involving only four participants (two right-hand dominant and two left-hand dominant). Therefore, this calculation should be considered exploratory, and the precision of the estimate is limited. Larger sample sizes are needed in future studies to provide a more robust and generalizable effect size.

RESULTS

The study was completed with a total of 14 participants, 7 males and 7 females, with a median age of 21.5 years (21-22). The characteristics and intubation parameters of the participants according to dominant hand use are given in Table. Demographic and anthropometric measures were comparable between the two groups. Intubation duration times were between 17 and 51 seconds in group R and between 26 and 350 seconds in group L (Figure 1). There was a significant difference between the two groups in this regard (26 vs. 59 s, p=0.029, Mann-Whitney U). The number of intubation attempts was observed to be between 1 and 2 in group R and between 1 and 6 in group L. While 6 (85.7%) of the intubations in group R were successful on the first attempt, this number in group L was 4 (57.1%) (Figure 2). In this context, although there was a mathematical difference between the two groups, this difference was not statistically significant (p=0.559, Fisher's exact test).

Table. General information and intubation parameters of right-and left-hand dominant students

		Group R (n=7)	Group L (n=7)	p
Age (year)		21.7±0.76	21.4±0.98	0.552[S]
Gender (male/female)		4/3	3/4	>0.9[F]
Height (cm)		173.4±8.9	176.3±14.7	0.669[S]
Body weight (kg)		67.4±7.2	67.7±12.9	0.960[W]
Intubation time (sec)		26 (24.5-37.0)	59 (31.5-132.5)	0.029[M]*
Intubation attempts		1 (1-1)	1 (1-3)	0.229[M]
	1	6 (85.7)	4 (57.1)	0.559[F]
	≥2	1 (14.3)	3 (42.9)	
Cormack-Lehane grade		1 (1-2)	2 (1-2)	0.659[M]
POGO (%)		100 (50-100)	50 (50-75)	0.253[M]
Intubation difficulty (Likert 1-5)		2 (1.5-2)	3 (2-3)	0.156[M]

Continuous data are presented as mean±standard deviation or median (25th-75th percentiles). Categorical data are presented as number or number (%). Group R: right-hand dominant individuals, Group L: left-hand dominant individuals, POGO: Percentage of Glottic Opening, S: Student's t test, F: Fisher's exact test, W: Welch test, M: Mann-Whitney U test. For the Cormack-Lehane grade and POGO, refer to the text. *p<0.05.

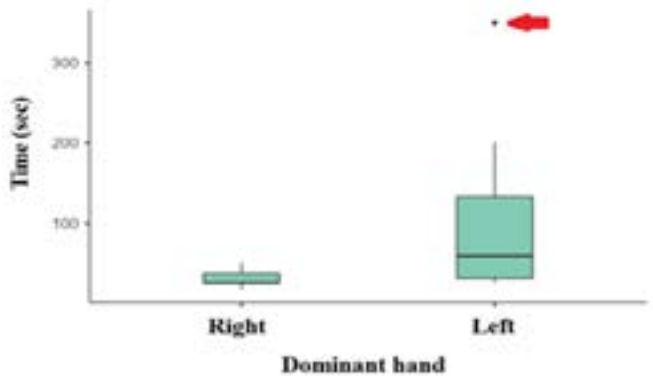

Figure 1. Intubation time. The red arrow indicates the practitioner who performed intubation in 350 seconds in the left-hand dominant group. Significant difference between the groups (p=0.029, Mann-Whitney U test).

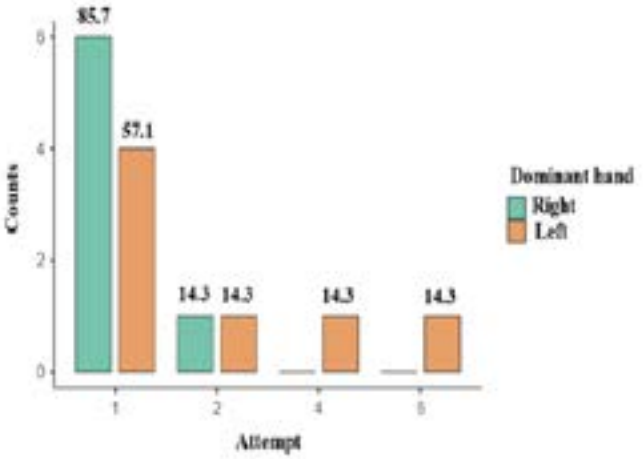

Figure 2. Number of attempts. Although left-handed individuals tended to have more attempts, there was no significant difference between the two groups (p=0.559, Fisher's exact test).

The Cormack-Lehane grades and percentages of glottic opening in relation to the airway appearance created by the practitioners on the model during the intubation procedure are presented in Figure 3. Although the glottic appearance tended to be worse in Group L, there was no significant difference between the two groups (p=0.659 and 0.253 for Cormack-Lehane grade and POGO, respectively, Mann-Whitney U test).

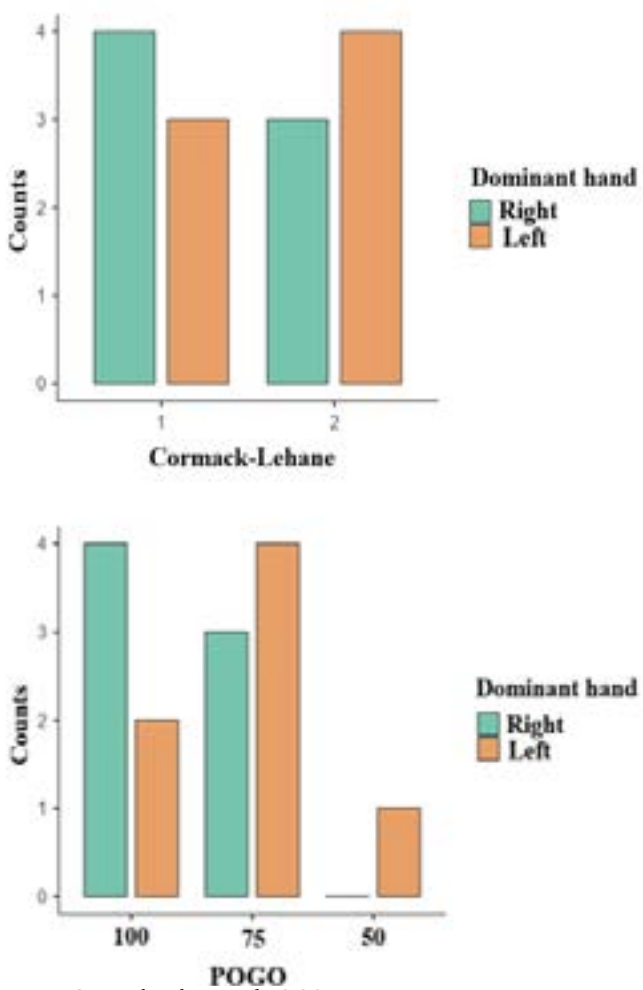

Figure 3. Cormack-Lehane and POGO views.
POGO: Percentage of Glottic Opening. Both parameters were comparable between the groups (p=0.659 and 0.253, respectively, Mann-Whitney U test).

In terms of subjective intubation difficulty, the procedure tended to be very easy or easy in Group R, while in Group L it was more likely to be moderately difficult or very difficult; however, no significant difference was observed between the two groups (p=0.156, Mann-Whitney U test; Figure 4).

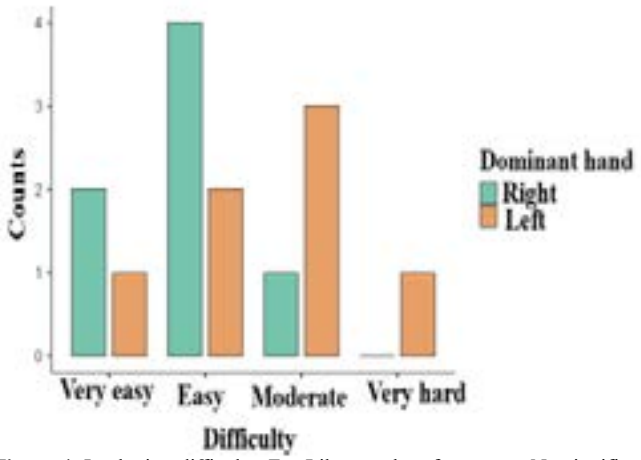

Figure 4. Intubation difficulty. For Likert scale refer to text. No significant difference between the groups (p=0.156, Mann-Whitney U test).

DISCUSSION

This study aimed to multidimensionally evaluate the effect of hand dominance on intubation performance in medical students with no intubation experience. The findings revealed that right-hand dominant individuals achieved more advantageous results in terms of intubation time in the traditional practice of using the standard laryngoscope with the left hand. This may be explained by the design of intubation equipment to favor right hand dominance.

Looking at the intubation time, which was the primary outcome of our study, it was observed that right-hand dominant individuals completed the procedure in a significantly shorter time compared to left-hand dominant ones. This finding suggests that motor adaptation between the dominant hand and the equipment directly contributes to the speed of the procedure and technical fluency. Indeed, Carlson et al.[2] in their study based on motion analysis demonstrated that dominant hand use decreased intubation time with shorter and more controlled motor movements. This finding aligns with the significant time advantage observed in right-hand dominant individuals in our study. Kerrey et al.[7] reported that the use of dominant hand was a determinant of the duration of the procedure regardless of the practitioners' level of experience. However, since our study was conducted only with participants without intubation experience, it was not possible to make a direct comparison with this result based on experience level.

The secondary outcome measures of our study included the number of intubation attempts, Cormack-Lehane grade, POGO scores and objective measures of intubation difficulty. Although there was no statistically significant difference between the groups in terms of the number of intubation attempts, it was observed that the success rate in the first attempt was higher in right-hand dominant individuals than in left-hand dominant individuals. Motor adaptation may contribute not only to the duration but also to the efficiency of the procedure. Similarly, Damore et al.[1] reported that left-hand students progressed more slowly in procedural skill learning. This finding is in line with the fact that left-hand dominant participants in our study showed a tendency for lower performance in intubation time, first attempt success and subjective difficulty.

No statistically significant differences were observed between the groups in terms of Cormack-Lehane grades and POGO scores used in the evaluation of glottic appearance. However, the fact that the right-hand dominant group had a higher median POGO score and exhibited a lower Cormack-Lehane distribution may reflect a technical advantage in terms of visual field. These findings are consistent with the differences in glottic appearance quality associated with hand dominance reported by Adhikary et al.[5] and Carlson et al.[2] reported that the left-sided laryngoscope blade may provide technical ease in certain anatomical situations, but this method requires habituation, especially for right-hand dominant individuals. This assessment supports the inference that standard equipment may not be sufficiently ergonomic for left-handed individuals in all situations. Especially in 3D motion analyses, dominant hand use has been shown to be more stable and effective in positioning the laryngoscope blade. The tendency toward better glottic visualization observed in right-hand dominant individuals in our study aligns with these findings; however, this difference did not reach statistical significance. Lee et al.[3] reported that laryngoscopy performed with the dominant hand significantly improved glottic visualization. Although our study observed better POGO scores and lower Cormack-Lehane grades in right-hand dominant individuals, this difference may not be statistically significant due to the limited sample size. The same study also evaluated the blade-to-tooth distance and found that this distance was significantly increased during laryngoscopy performed with the dominant hand, meaning that the blade was positioned further away from the teeth. This was interpreted as a factor that increases technical safety, especially in right-hand dominant individuals. However, this parameter was not measured in our study. It is thought that dominant hand-equipment compatibility offers ergonomic advantages that may not only improve procedure success but also reduce the risk of complications. Furthermore, the use of laryngoscopes compatible with the dominant hand may play an important role in preventing dental trauma that may occur during intubation. This topic should be comprehensively investigated in future studies from both anatomical and clinical safety perspectives.

To improve the educational experience for left-handed learners, intubation training programs must be specifically adapted to address the unique challenges faced by these individuals. Given the ergonomic difficulties encountered by left-handed learners when using standard intubation equipment, training programs could benefit from incorporating specific adjustments. For instance, training with equipment that is better suited for left-handed individuals, or providing more tailored feedback during training, may improve both procedural efficiency and comfort. In addition, exploring the feasibility of ambidextrous training, which aims to teach students to proficiently use both hands, is crucial. Studies have shown that performing intubation with the non-dominant hand

is technically feasible, although it requires additional practice.[4] Moreover, ElHawary et al.[8] demonstrated that ambidextrous training improves surgical dexterity and technical proficiency, suggesting that such an approach could enhance performance in both hands. Similarly, Skinner et al.[9] examined ambidexterity in laparoscopic surgical training using the Fundamentals of Laparoscopic Surgery (FLS) platform and found that greater ambidexterity was associated with improved overall performance and task proficiency. They suggested that incorporating ambidexterity-focused metrics into training could enhance skill acquisition and retention, highlighting its relevance for procedural skills education in medical curricula. While the applicability of ambidextrous training in intubation remains uncertain, it may offer a potential solution to the difficulties left-handed individuals face with traditional intubation techniques. Incorporating such training into early medical curricula could offer substantial benefits for left-handed learners. Further research is necessary to assess the effectiveness and long-term impact of this training approach within medical education.

In our study, the subjective difficulty level of the intubation procedure was assessed by participants using a Likert scale.[10] Right-hand dominant individuals generally described the procedure as "easy," while left-handed individuals' assessments were more concentrated at the "moderate" and "difficult" levels. Although there was no statistically significant difference between the groups, this trend suggests that left-handed individuals may experience greater cognitive and technical difficulties when working with standard equipment. Similar results have been reported in the literature. Callahan et al.[11] noted that left-handed medical students experienced greater difficulty when working with right-handed equipment. Kuo et al.[4] emphasized that lightwand-guided intubation performed with the non-dominant hand is technically feasible, but this method requires a certain learning process in terms of procedure duration and control. These findings suggest that the relationship between hand dominance and equipment compatibility may affect not only technical success but also mental effort and participants' subjective experiences. In our study, left-handed individuals reporting higher difficulty levels align with these assessments. Baker et al.[12] emphasized that structuring airway training with individualized modules could enhance learning success. Similarly, Aggarwal et al.[13] demonstrated that the use of scenarios tailored to individual differences is effective in simulation-based patient safety training. These findings suggest that educational strategies that take individual differences into account can both improve technical performance and make the learning process more supportive. The mismatch between hand dominance and equipment design may cause left-handed practitioners to perceive the intubation procedure as more complex and challenging during the learning process. This situation may lead to increased subjective difficulty perception, decreased learning motivation, and reduced confidence during the procedure.

In this study, participants were informed that the research aimed to examine the role of hand dominance in intubation performance, which may have unintentionally introduced stereotype threat, particularly for left-handed individuals. Miyake et al.[14] showed that endorsing negative stereotypes, such as the belief that men perform better in physics, can lead to increased anxiety and self-doubt, negatively affecting performance. Similarly, left-handed individuals might have been influenced by the belief that right-handed individuals are superior in tasks like intubation, leading to stereotype threat that could affect both their objective performance and subjective difficulty ratings. Future studies should explore the impact of stereotype threats on left-handed individuals in more detail and consider presenting the study's purpose in a more neutral way or withholding certain information to reduce potential bias and improve the reliability of the results.

Limitations

This study has some limitations. First, the sample size is quite limited. The small number of participants may have prevented the differences observed in some parameters from reaching statistical significance. In addition, all the individuals participating in the study were medical students with no experience in intubation. This means that the data obtained are only valid for beginners and different results may be obtained in more experienced groups. Another limitation is that the study was conducted only in a simulation environment, under fixed conditions, and with a specific mannequin model. While mannequins are useful for standardization, they do not fully replicate the anatomical variability and dynamic physiological responses of real patients. In a clinical setting, factors such as airway shifts, reflexive responses, and patient variability are present, which cannot be accounted for in a simulated environment. Additionally, the mannequin used in this study cannot replicate various patient conditions, such as different airway anatomies or the impact of comorbidities, which could affect intubation performance. These limitations should be considered when interpreting the results. Furthermore, the type of laryngoscope and intubation technique used were kept constant; comparisons using different equipment or alternative techniques could reveal the effect of hand dominance in more detail. In the future, studies with larger samples, participants with different levels of experience, and various equipment and application scenarios will contribute to a more comprehensive assessment of the effect of hand dominance on intubation performance. Finally, the absence of blinding between participants and the researcher may have introduced measurement bias. Knowledge of group allocation and the study hypothesis could have, even unintentionally, influenced the measurement of objective outcomes such as intubation time and success rate. Although these parameters were recorded using standardized procedures, the potential for subtle observer or performance bias cannot be entirely ruled out. We acknowledge that participants' awareness of their hand dominance may have introduced potential bias in the subjective evaluation of the procedure. This awareness may have led left-handed individuals, in particular, to perceive the procedure as more challenging. However, the aim of our study was to reflect real-world conditions, where awareness of hand dominance is common and natural during the training process. Future studies could blind participants to their hand dominance to allow for a more objective assessment of intubation performance.

CONCLUSION

As a result, this study revealed the effects of hand dominance on procedure performance in individuals with no intubation experience and showed that right-hand dominant individuals completed the intubation process in a shorter time. The findings suggest that the ergonomic advantages of standard laryngoscopes being designed for right-hand dominant use have a decisive effect on performance. The low first-attempt success rate and limited glottic view tendency observed in left-handed individuals indicate that equipment incompatibility may negatively affect the learning process. In this regard, considering handedness in intubation training and restructuring training materials to accommodate ergonomic diversity may increase both the effectiveness of the learning process and technical success.

ETHICAL DECLARATIONS

Ethics Committee Approval

For this cross-sectional study permission was obtained from Marmara University Clinical Researches Ethics Committee (Date: 08.12.2023, Decision No: 09.2023.1691).

Informed Consent

All participants signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

This study was supported by the Scientific and Technological Research Council of Turkiye (TÜBİTAK).

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Damore D, Rutledge J, Pan S, Knotek N, Ramundo M. Handedness effects on procedural training in pediatrics. *Clin Pediatr (Phila)*. 2009;48(2):156-160. doi:10.1177/0009922808323111
2. Carlson JN, Das S, De la Torre F, Callaway CW, Phrampus PE, Hodgins J. Motion capture measures variability in laryngoscopic movement during endotracheal intubation: a preliminary report. *Simul Healthc*. 2012;7(4):255-260. doi:10.1097/SIH.0b013e318258975a
3. Lee S, Huh J, Lee JS, Lee J. The implication of using dominant hand to perform laryngoscopy: an analysis of the laryngoscopic view and blade-tooth distance. *Anesthesia and Pain Med*. 2018:*13*(2);207-213. doi:10.17085/apm.2018.13.2.207
4. Kuo YW, Yen MK, Cheng KI, et al. Lightwand-guided endotracheal intubation performed by the nondominant hand is feasible. *Kaohsiung J Med Sci*. 2007;23(10):504-510. doi:10.1016/S1607-551X(08)70008-1
5. Das Adhikary S, Venkatesan T, Mohanty S, Ponniah M. Difficult laryngoscopy made easy with the use of left-hand laryngoscope blade. *Br J Anaesth*. 2007;98(1):141-144. doi:10.1093/bja/ael289
6. Robinson K, Donaghy K, Katz R. Inverse intubation in air medical transport. *Air Med J*. 2004;23(1):40-43. doi:10.1016/j.amj.2003.10.007
7. Kerrey BT, Boyd SD, Geis GL, et al. Developing a profile of procedural expertise: A simulation study of tracheal intubation using 3-dimensional motion capture. *Simul Healthc*. 2020;15(4):251-258. doi:10.1097/SIH.0000000000000423
8. ElHawary H, Aldien AS, Salimi A, Abdulkarim S, Gilardino M. Ambidextrous surgical skills training: What is left to do it right?. *J Surg Educ*. 2025;82(9):103595. doi:10.1016/j.jsurg.2025.103595
9. Skinner A, Auner G, Meadors M., Sebrechts M. Ambidexterity in laparoscopic surgical skills training. *Medicine Meets Virtual*. 2013;20:412-416. doi:10.3233/978-1-61499-209-7-412
10. Sullivan GM, Artino AR Jr. Analyzing and interpreting data from likert-type scales. *J Grad Med Educ*. 2013;5(4):541-542. doi:10.4300JGME-5-4-18
11. Callahan D, de Virgilio C, Tillou A, DeUgarte DA. Medical student hand preference, perceived dexterity, and impact of handedness on training. *J Surg Res*. 2016;204(1):114-117. doi:10.1016/j.jss.2016.04.046
12. Baker PA, Weller JM, Greenland KB, Riley RH, Merry AF. Education in airway management. *Anaesthesia*. 2011;66(2):101-111. doi:10.1111/j.1365-2044.2011.06939.x
13. Aggarwal R, Mytton OT, Derbrew M, et al. Training and simulation for patient safety. *Qual Saf Health Care*. 2010;19(2):i34-i43. doi:10.1136/qshc.2009.038562
14. Miyake A, Kost-Smith LE, Finkelstein ND, et al. Reducing the gender achievement gap in college science: a classroom study of values affirmation. *Science*. 2010;330(6008):1234-1237. doi:10.1126/science.1195996