# Comparison of Self Versus Expert-assisted Feedback for Cricothyroidotomy Training

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**Research Article**

**Keywords:** Medical education research, simulation, feedback

**Posted Date:** April 25th, 2022

**DOI:** https://doi.org/10.21203/rs.3.rs-959406/v2

## Abstract

The self-video feedback method may have the potential to provide a low-cost alternative to physician-driven simulation-based training. This study aimed to assess the utility of video feedback by comparing the improvement in procedural performance when trainees received self-video feedback (trainees review their performance alone) and expert-assisted video feedback (trainees review their performance while an emergency physician provides additional feedback). This study was performed at a university simulation center with 89 final-year medical students and used a cricothyroidotomy simulation model. Following the educational presentation and the best practice video, trainees were randomized into two groups (self video-feedback and expert assisted video-feedback). They performed the cricothyroidotomy before and after the feedback, The procedures were recorded and scored. Scoring were made using a pre-defined checklist. Mann Whitney U test and Wilcoxon test were used to analyze non-normally distributed data. For the analysis of normally distributed data, Student t-test and Paired Samples t-test were used. Results demonstrated significant improvement in cricothyroidotomy performance with both types of video feedback. The improvement was significantly greater in the expert-assisted video feedback group. We think that simulation-based training is effective with self video feedback.

## Introduction

In medical education, simulation-based training (SBT) is a rapidly expanding field due to advances in technology. Simulation-based medical training improves patient safety and eliminates human factors through developed technical competency in a risk-free environment (1). Simulation-based medical training aims to create real lifelike situations using specially designed structured activities. With this realistic simulated environment, students would enhance their skills, knowledge, and attitudes (2).

Feedback in simulation-based training is defined as “specific information that compare a trainee’s performance to the preset standard, aiming to improve the trainee’s performance” (3). It is a crucial process that follows the practice and induces the trainee to reflect on their performance (3). Despite the importance of feedback in academic literature, effective feedback remains hard to achieve within the clinical training context. Coping with barriers to meaningful feedback requires both institutional and individual efforts (4). Failures at providing effective feedback to medical students have been discussed many times in recent years (5). Overly complex, delayed, and overly brief feedbacks were some of the common complaints of the students (5, 6). The instructor’s disappointment arises when trainees ignore their feedback and continue with the uncorrected practice (5).

As an alternative way to performative evaluation, video feedback (viewing the video recording of one’s own performance) may improve the debriefing quality and maximize learning (7). Also, self-assessment has been long known as an important procedure in the development of learning skills (8). A randomized trial study revealed that expert feedback provided no significant additional advantages. A similar improvement can be achieved when students are allowed to assess their performance by video recording (9). Besides that, Vnuk reports that students viewing the video recording of their performance did not improve the agreement of trainees' self-assessment with the objective assessment by the expert (10). In light of these findings, the self-video feedback method is expected to reduce the need for an expert in SBT. This self-assessment may have the potential to provide a low-cost alternative to physician-driven SBT.

This study aimed to assess the utility of video feedback by comparing the development in procedural performance when trainees received video feedback in isolation (trainees review their performance alone) and video feedback with an expert (trainees review their performance while an emergency physician provides additional feedback).

*Emergency cricothyroidotomy* is a potentially life-saving procedure performed to provide oxygenation if neither intubation nor a mask or mouth-to-mouth ventilation is possible (11). However, these airway procedures may not always be employed successfully (12). This procedure's life-saving potential necessitates training and experience for clinicians (13). The majority of student training on this procedure is simulation-focused (14). We used "Emergency Cricothyroidotomy Simulation" as surgical training on a realistic mannequin model.

## Material And Method

The study was performed between September 2019 – November 2019 at the Acibadem Mehmet Ali Aydınlar University Simulation Center, Turkey. On a volunteer basis, the study included 89 final-year medical students studying at the Acıbadem Mehmet Ali Aydınlar University. The study protocol was approved by the Acıbadem Mehmet Ali Aydinlar University Medical Research Ethical Committee (ATADEK-2019/14).

We used an effective and low-cost simulation model, which was done, using styrofoam, a sheep trachea, and a double-layer of chicken skin. Sterile gloves, a scalpel, a scalpel handle, a hook, an endotracheal tube, and a syringe were used in carrying out the procedure. The sheep trachea was placed in the cavity made in the styrofoam, and two layers of chicken skin were then fixed over the trachea (Figure 1). Skins were replaced after every 3 or 4 cricothyroidotomy applications.

Two emergency medicine assistant professors and an emergency medicine resident recorded a best practice video of the cricothyroidotomy procedure (15). The video was shown three times to trainees following a PowerPoint presentation regarding the cricothyroidotomy procedure. During the presentation, trainees were informed about cricothyroidotomy indications, complications, and how the procedure should be performed.

Trainees were randomized into two groups after the presentation and the best practice video. One was self video-feedback group (SVFG); trainees review their performance alone for 15 minutes with a checklist of procedure steps (Appendix A). And the other was expert assisted video-feedback group (EVFG); trainees review their performance while an emergency physician provides additional feedback.

Nine of the trainees were quitted before the practical session of the study. 80 trainees subsequently performed the cricothyroidotomy procedure and all performances were recorded using a dome camera (2 Megapixel, 4.8 - 120 mm) positioned to record an optimal view of the application site. Trainees received no instruction or feedback during the procedure. An emergency physician evaluated students' live performance skills and assessed them based on the cricothyroidotomy steps checklist (Appendix A). Each step on the checklist was scored separately. Any step that was applied incorrectly or missed was scored as "1". Steps including a pause after the previous step but performed properly and at the correct time, scored as "2". In contrast, those performed at the proper way and time, and without hesitation, scored as "3". The last step was about total procedure time. We used a threshold of 40 seconds to define success as Wong et al. (16). Failure and success were scored "1,2" respectively. After the feedback (SVFG or EVFG), trainees performed the procedure, recorded it onto video, and scored again. Scores gained for each step were added, and the total score was obtained.

On the other hand, video recordings of pre- and post- feedback performances were also watched and scored by another emergency physician based on the same checklist. The mean total score was calculated from the assessment results of the two physicians. Also, trainees' age, sex, and the duration of applications were recorded.

We additionally evaluated the mean scores of the 1st and the 4th steps because they are the most critical.

Statistical analysis was performed using the MedCalc Statistical Software version 12.7.7 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2013). Descriptive statistics were presented using mean, standard deviation, median, minimum, maximum scale variables. For comparison of two non-normally distributed independent groups, Mann Whitney U test was used. For comparison of two normally distributed independent groups, Student t-test was used. For comparison of two non-normally distributed dependent groups, the Wilcoxon test was used. For comparison of two normally distributed dependent groups, Paired Samples t-test was used. Statistical significance was accepted when the two-sided p-value was lower than 0.05.

# Results

The study was performed with 80 final-year medical students. The average age of the trainees was 25. Forty-four students (55%) were men, and 36 (45%) were women.

There was a statistically significant difference between **PreFAss.** (Pre Feedback Assessment) and **PostFAss.** (Post Feedback Assessment) measurements in terms of **L Ass./ V Ass._Mean (**Live Assessment Score/Video Assessment Score) and **Time** in **SVFG** (Self Video Feedback Group) and **EVFG** (Expert Assisted Video Feedback Group) ($p<0.05$). The average of **PostFAss.** was higher in both **SVFG** and **EVFG** for **L Ass./ V Ass._Mean**. The average of **PreFAss.** was higher in both **SVFG** and **EVFG** for **Time** (Table 1).

Table 1
COMPARISONS ACCORDING TO GROUPS AND MEASUREMENTS

| | | PreFAss. | PostFAss. | p |
|---|---|---|---|---|
| | **SVFG/EVFG** | **Mean±Std.Dev.**<br>**Med. (Min.-Max.)** | **Mean±Std.Dev.**<br>**Med. (Min.-Max.)** | |
| **L Ass.-V Ass._ MEAN** | **SVFG** | 19.2±3.1<br>19 (10-25.5) | 22.5±3.6<br>23.5 (15-28.5) | **<0.001[1]** |
| | **EVFG** | 19.5±3.8<br>20.0 (12-28.5) | 24.3±2.9<br>25 (17-29) | **<0.001[2]** |
| | **p** | 0.634[3] | **0.027[4]** | |
| **TIME** | **SVFG** | 86±27<br>85 (40-150) | 68±22<br>62 (33-125) | **<0.001[1]** |
| | **EVFG** | 88±37<br>78 (40-210) | 53±14<br>52 (28-90) | **<0.001[1]** |
| | **p** | 0.762[3] | **0.001[3]** | |

*Paired Samples t test[1],Wilcoxon test[2],Student t test[3],Mann-Whitney U test[4]*

PreFAss. : Pre Feedback Assessment PostFAss : Post Feedback Assessment SVFG : Self Video Feedback Group EVFG : Expert Assissted Video Feedback Group L Ass. : Live Assessment Score V Ass. : Video Assessment Score

There was a statistically significant difference between **SVFG** and **EVFG** in terms of **L Ass./ V Ass._Mean** and **Time** for **PostFAss.** measurements (p<0.05). The average of **EVFG** was higher for **L Ass./ V Ass._Mean**, and the average of **SVFG** was found higher for **Time** (Table 1).

When we additionally evaluated the critical steps, we noticed a statistically significant difference between **PreFAss.** and **PostFAss.** measurements in terms of **Step1Step4_Mean** in **SVFG** and **EVFG** groups (p<0.05). The average of **PostFAss.** was higher in both **SVFG** and **EVFG** for **Step1Step4_Mean** (Table 2).

Table 2
COMPARISONS ACCORDING TO GROUPS (Step1Step4_Mean Differences)

| | | PreFAss. | PostFAss. | p |
|---|---|---|---|---|
| | | **Mean±Std.Dev.** Med. (Min.-Max.) | **Mean±Std.Dev.** Med. (Min.-Max.) | |
| **Step1Step4_Mean** | **SVFG** | 1.98±0.41<br>2 (1-2.75) | 2.35±0.55<br>2.5 (1-3) | **<0.001[1]** |
| | **EVFG** | 1.97±0.43<br>2 (1-2.75) | 2.59±0.41<br>2.75 (1.5-3) | **<0.001[1]** |
| | **p** | 0.920[2] | **0.047[2]** | |

*Wilcoxon test[1], Mann-Whitney U test[2]*

We also found a significant difference between **SVFG** and **EVFG** in terms of **Step1Step4_Mean** for **PostFAss.** measurements ($p<0.05$). The average of **EVFG** was higher for **Step1Step4_Mean** (Table 2).

# Discussion

The traditional model for simulation-based training includes post-simulation feedback in which students' experiences are explored and reflected upon to improve future performance (17). A better understanding of the role of feedback in competency-based education could result in a more efficient student learning process (18). But this traditional model needs an expert in the post-simulation feedback session. Shifting the degree of primary learning responsibility from the expert to the learner through self-guided learning has received more attention in reducing resource intensity (17).

This study set out with the aim of assessing the probability of low cost simulation-based practical education method. Results demonstrated significant progress in cricothyroidotomy performance with both types of video feedback. This finding agrees with Hawkins's findings, which showed progress with video self-assessment ( including video recorded 'benchmark performance' ) and expert assessor groups (8).

This also accords with the study of Nesbitt (19), Backstein (20), and Phillips (9), who demonstrated a significant improvement in practical performance for participants receiving self video feedback with an expert or alone. In these three studies, no significant additional benefit was demonstrated from EVFG, and a similar improvement can be obtained using a best practice expert video and allowing attendees to assess their performances.

Our results demonstrated significant enhancement with expert-assisted video feedback group and self-video feedback group, suggesting that the opportunity to review trainee's performance using video feedback plays an important role in improving the learning experience. However, the progress was significantly greater with the expert-assisted video feedback group. When considered from this point of view, we can see there was an expert effect. However, it does not mean "expert need" is essential. In 2003, Wong designed a study to determine the minimum practical training need for successful cricothyroidotomy with a self video feedback alone. This study showed that by the fifth attempt, 96% of the attendees could perform the cricothyroidotomy successfully (16). According to this information, it can be thought that expert assistance saves time, and more practice time is required if we use the self video assessment method.

According to our sub-group evaluation on two critical steps, we demonstrated similar results with overall findings. Again, we found significant improvement with the expert-assisted and the self video-feedback groups when two steps were taken into account. Also, the progress was significantly greater with the expert-assisted video-feedback group.

The main limitation of this study was that students performed the procedure only once. The literature indicates that at least five trials must be done to perform the procedure successfully. The other limitation is that the study design neglected control groups that received no feedback (to define the baseline of how much learning occurs by recurrent practice). The lack of a power analysis calculation to plan the sample size is another limitation of this study.

# Conclusion

This study demonstrates significant progress in cricothyroidotomy performance with both types of video feedback. This combination of findings may help us to understand what the most appropriate simulation-based training model is. It is clear that video feedback enables trainees to understand the process and progress of clinical procedures. They can visualize the actions involved in the task in a stepwise manner. The real question is about the necessity of an expert in low-cost, effective simulation-based training. With self video feedback without an expert, simulation-based training is effective. However, more practice time seems to be necessary.

# Declarations

**Ethics approval and consent to participate :** The study protocol was approved by the Acıbadem Mehmet Ali Aydinlar University Medical Research Ethical Committee (ATADEK-2019/14). The study was performed in accordance with the Declaration of Helsinki and Ethics Committee of the Chamber of Physicians approval. The written informed consent was obtained from the participants before the practice. All of the participants were more than 16 years old; therefore, parental consent was not required.

**Consent for Publication :** Not Applicable

**Availability of data and materials :** All the data, written documents, materials are available.

**Competing interests:** The authors declare that they have no competing interests.

**Funding:** No funding was obtained for this study.

**Authors' contributions:** H.A. ve S.Y. designed the study. H.A. and C.O.S. wrote the main manuscript. S.Y. and C.G. conducted the statistical analysis. F.G. and M.S. prepared tables and figures. K.K. and S.T. reviewed the manuscript. All authors read and approved the final manuscript.

**Acknowledgements:** We thank Emre Aldinc MD and Ela Ahmad MD for editorial support.

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# Figures

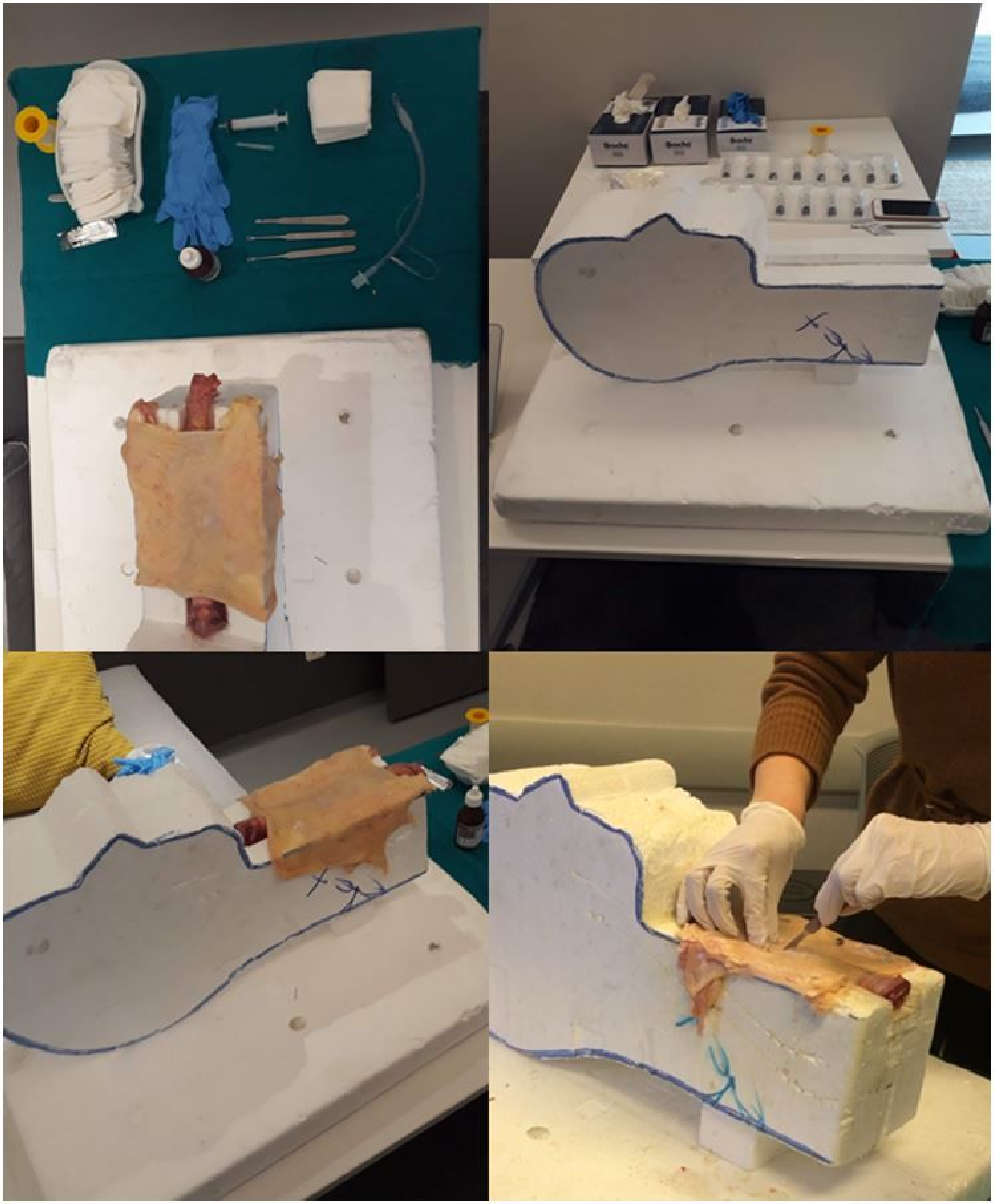

**Figure 1**

Cricothyroidotomy Practice On A Realistic Mannequin Model

# Supplementary Files

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