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Comparative effectiveness of supervised versus unsupervised video training on hysteroscopic camera navigation performance among OB-GYN residents at Tertiary Government Hospital: A randomized controlled trial

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Abstract:

BACKGROUND: Simulated video training has emerged as an effective method to enhance the surgical skills. However, in the local context, there is an absence of data contrasting the outcomes of unsupervised video training with the conventional supervised approach in surgical skill development.

OBJECTIVE: The objective of this study was to evaluate and contrast the performance score and total operating time between unsupervised video training simulations and supervised video training simulations, specifically in the domain of 30° hysteroscopic camera navigation.

MATERIALS AND METHODS: A single-blinded randomized controlled trial involved 24 obstetrics and gynecology residents in a tertiary government institution. Participants were randomized into Group A (unsupervised video training) and Group B (proctor-supervised simulation training). Utilizing a uterine model, both groups undertook nine designated tasks. The training process included a pretest simulation, 5 training repetitions, and a concluding posttest simulation. The principal investigator documented operating times and hand movements posteach session. Subsequently, a blinded Philippine Society for Gynecologic Endoscopy board-certified gynecologic endoscopist assessed these videos, using the Global Hysteroscopy Rating Scale for scoring.

RESULTS: The total operating time and performance score during posttest among Group A and Group B showed no significant difference (Group A 0.77 ± 0.19 min Group B 0.71 ± 0.15 min) ($P = 0.377$) (Group A 13.50 ± 1.73 Group B 13.83 ± 1.53) ($P = 0.622$) which suggest that participants performed comparably regardless of instructional method. On the Global Rating Scale (GRS) score, higher percentage of participants from Group B showed improved performance on respect for tissue, time and motion, and handling of hysteroscope as compared to Group A.

CONCLUSION: The video-based training simulation is effective as expert proctoring in hysteroscopic camera navigation. However, there was slightly greater improvement in the GRS scores in the proctor supervised group which suggest that feedback from proctors has a positive impact on the performance.

Keywords:

Box trainer, camera navigation, hysteroscopy, simulated video training

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Introduction

Hysteroscopy is a minimally invasive procedure that allows the diagnosis and surgical management of endocervical and intrauterine pathology. It is the gold standard procedure for evaluating and managing intrauterine pathology.[1]

In the development of training programs of residents in minimally invasive gynecologic surgery (MIGS), teaching hysteroscopic skills have received little attention. The focus was mainly on the development of physical models and box simulators. Several models that were developed ranged from cow uteri and bladders to virtual reality.

One of the innovations in surgical education is the application of video technologies and computer systems as simulation training in surgical skills. The utilization of educational videos offers advantages not just cost-effectiveness but remote learning on demand and decreasing number of health-care educators. The effectiveness of videos in learning surgical skills became visible during the COVID-19 pandemic.[2]

There are not yet any systematic reviews specifically at the utility of video-based education in teaching hysteroscopic surgical skills. This identifies an opportunity for our study addressing the research question, is supervised video-based simulation training as effective as unsupervised video-based simulation training in hysteroscopic camera navigation?

Objectives

The aim is to determine if unsupervised video training simulation is effective as supervised video training simulation in the development of surgical skills in hysteroscopic camera navigation. Our specific objectives are to compare the performance score using the global hysteroscopic rating score in hysteroscopic 30° camera navigation between obstetrician-gynecologist (OB-GYN) residents who will perform unsupervised video training simulation versus supervised video training simulation, and to compare the total operating time in minutes to accomplish specific tasks in hysteroscopic camera navigation that will be performed by OB-GYN residents who will have unsupervised video training simulation versus those with supervised video training simulation.

Materials and Methods

This study was conducted as a single-blinded randomized controlled trial. The evaluation was undertaken by an expert Philippine Society for Gynecologic Endoscopy (PSGE) specialty board-certified gynecologic endoscopist, who has performed over 100 hysteroscopic procedures. This evaluator, not involved in the study, was blinded to the supervision status of the participants during the simulated camera navigation.

The study took place at a tertiary medical facility that is government owned and a specialty medical center. A 24 OB-GYN residents who have basic knowledge but have not assisted in diagnostic hysteroscopy during rotation in the section of MIGS or before residency were included in the study. The only exclusion criteria are residents who have already performed diagnostic hysteroscopy during residency. All OBGYN residents in different levels were eligible to participate voluntarily gave informed consent.

The study only commenced upon the approval of the institutional review board of the institution. Since no patients were involved in this study, there were no significant ethical concerns to be resolved other than the confidentiality of the data gathered during the conduction of this study.

Sample size calculation

$$m \geq \left(\frac{1+\lambda}{\lambda}\right) \times \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2}{d^2} + \frac{Z_{1-\frac{\alpha}{2}}}{2(1+\lambda)}$$

$$n = 2m$$

where,

λ=1

$Z_{1-\alpha/2}$ =1.96 for 95% confidence level

$Z_{1-\beta}$ =0.842 for 80% power

d^2= Cohen's D (effect size) = large effect size of 1.2.

$$m \geq \left(\frac{1+1}{1}\right) \times \frac{(1.96+0.842)^2}{(1.2)^2} + \frac{1.96}{2(1+1)}$$

$$\geq 2 \times \frac{(2.802)^2}{1.44} + \frac{1.96}{4}$$

$$\geq 2 \times \frac{7.8512}{1.44} + 0.49$$

$$\geq 2 \times 5.4522 + 0.49$$

$$= 11.3944$$

$$\cong 12$$

$$n = 2m$$

$$n = 2(12)$$

$$n = 24$$

The 9 specific check list on camera navigation

- Step 1: Panoramic-panoramic view a view where in the fundus, bilateral ostia, anterior, posterior, and lateral uterine walls are seen [Figure 1]
- Step 2: Identification of the fundus [Figure 2]
- Step 3: Identification of the right ostium. Rotate the light post-90° clockwise toward the right surgeon [Figure 3]
- Step 4: Identification of the left ostium. Rotate the light post-180° counterclockwise toward the left of the surgeon [Figure 4]
- Step 5: Identification of the anterior uterine wall. Rotate the light post-90° counterclockwise [Figure 5]
- Step 6: Identification of the posterior uterine wall. Rotate the light post-180° clockwise [Figure 6]
- Step 7: Identification of the right lateral wall. Rotate the light post-90° clockwise [Figure 7]
- Step 8: Identification of the left lateral wall. Rotate the light post-180° counterclockwise [Figure 8]
- Step 9: Assessment of the cervical canal-gently retract the hysteroscope out of the uterine cavity and survey [Figure 9].

Participants were introduced to the study and the improvised pelvic trainer and then asked to watch a 10-min introductory video on diagnostic hysteroscopy from the SCOPE website. The video covered hysteroscopic procedures, instrument parts, and safety measures. Randomization was done using draw lots method. Residents were randomized into two groups, Group A (video training alone) and Group B (proctor supervised video training). The group letter is placed on separate pieces of paper, mixing them, and draw lots of participants without looking. Both groups performed a pretest simulation, followed by viewing an expert-narrated instructional video. Group A participants then undertook unsupervised simulation exercises, whereas Group B participants were supervised by a senior MIGS fellow. Feedback was provided to Group B participants after their fifth repetition. Once completed, all participants' procedures were video recorded for evaluation. A blinded PSGE-certified

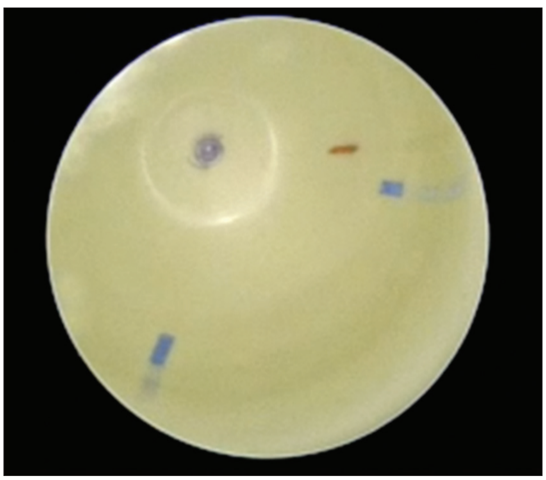

Figure 1: Panoramic view. Fundus (blue circle), ostium (red pin), lateral and posterior wall (blue pin)

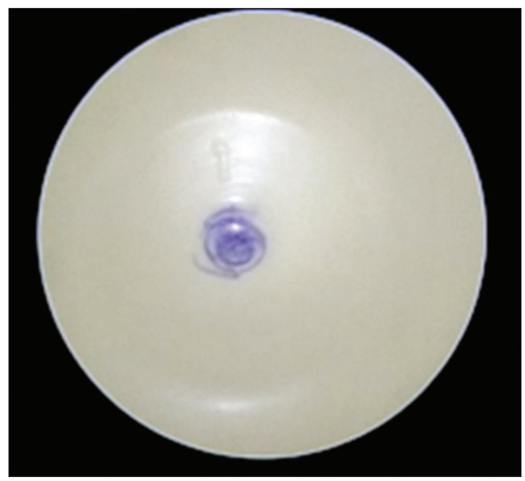

Figure 2: Identification of the fundus. Fundus (blue circle)

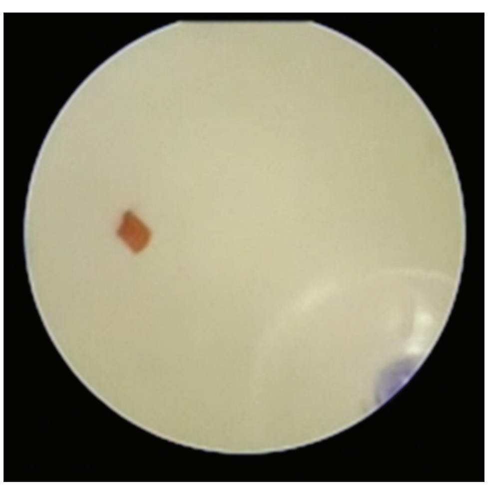

Figure 3: Identification of the right ostium. Right ostium (red pin)

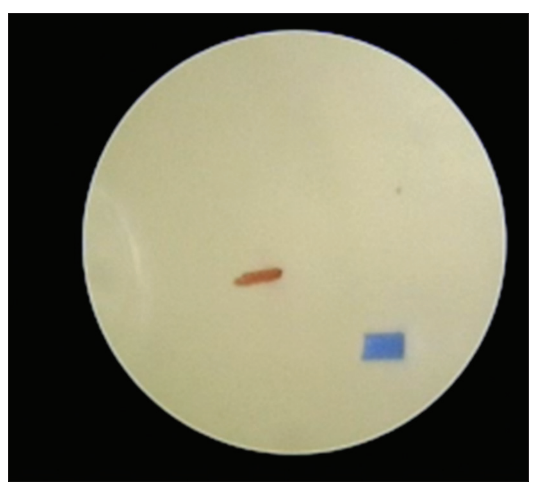

Figure 4: Identification of the left ostium. Left ostium (red pin)

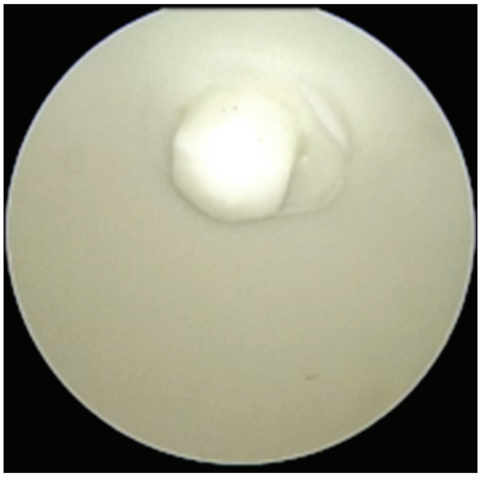

Figure 5: Identification of the anterior uterine wall. Anterior uterine wall (white circle)

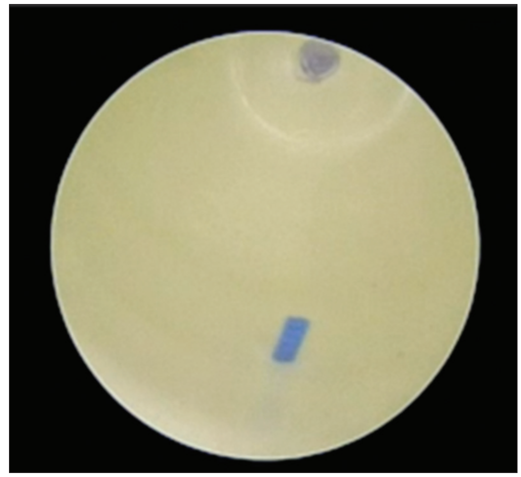

Figure 6: Identification of the posterior uterine wall. Posterior uterine wall (blue pin)

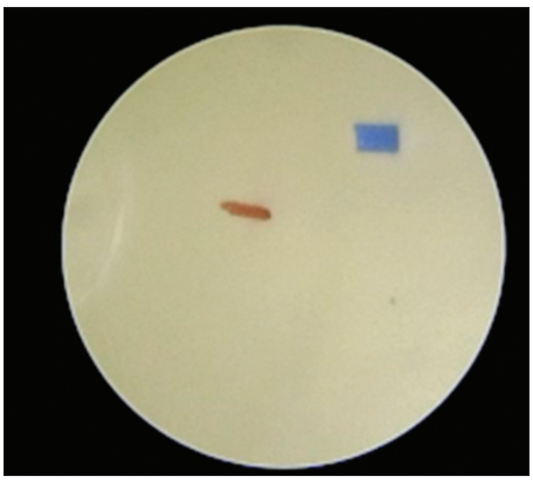

Figure 7: Identification of the right lateral wall. Right lateral uterine wall (blue pin)

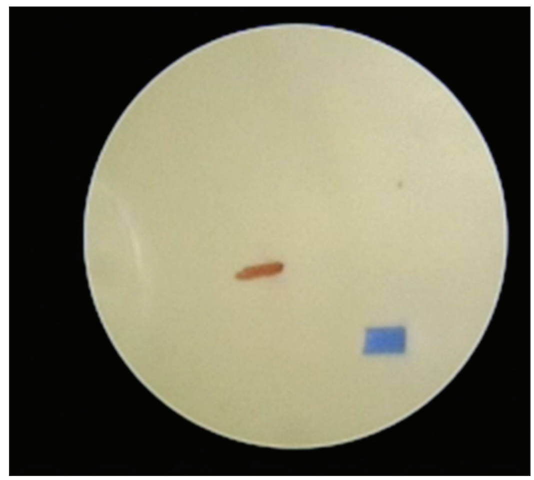

Figure 8: Identification of the left lateral wall. Left lateral uterine wall (blue pin)

gynecologic endoscopist assessed these recordings using the validated Global Hysteroscopy Rating Scale.

Data collection

Data, including total procedure time and performance scores using the Global Rating Scale (GRS) [Table 1], were gathered by the principal investigator. Procedure time began when the hysteroscope was inserted and ended upon its removal. Data were stored in an Excel file for biostatistical analysis.

Performance score

Global Rating Scale

The general and clinical characteristics of the participants were summarized. Frequency and proportion were used for the categorical variables (nominal/ordinal), mean and standard deviation for normally distributed interval/ratio variables, and median and range for nonnormally distributed interval/ratio variables. Independent *t*-test was used to compare the mean values of normally distributed continuous variables between the two groups. Mann–Whitney *U*-test was used to compare the median values for nonnormally distributed continuous variables. For categorical variables, Fisher's exact test was used to determine the difference in frequencies between groups. Paired sample *t*-test was used to compare the mean values of normally distributed continuous variables between the types of assessments (pretest and posttest) of the groups. The Wilcoxon signed-rank test was used to compare the median values for nonnormally distributed continuous variables. Missing variables were neither replaced nor estimated. The null hypothesis was rejected at a significance level of 0.05α. *R* - 4.1.3 was used for the data analysis.

Results

Table 2 presents the demographic profile of 24 residents, showcasing their characteristics based on different instructional methods. The mean age of the residents was 29.12 ± 1.78 years in the total group, with a similar trend in the subgroups: 29.25 ± 1.86 years for those exposed to video instruction alone (Group A) and 29.00 ± 1.76 years for those receiving both video instruction and proctor

Table 1: Performance score

	1	2	3
GRS 1	Scope frequently pushed into the wall of the uterus	Scope occasionally pushed into the wall of the uterus	No trauma to the uterus with scope
GRS 2	Many unnecessary moves	Made some unnecessary moves, but time more efficient	No unnecessary moves and time is maximized
GRS 3	Scope poorly aligned during procedure	Moderate use of scope angle during procedure	Scope always set in good angle throughout the procedure
GRS 4	Frequently stopped or needed advice or assistance from examiner	Demonstrated ability to think forward with relatively steady progression of procedure	Obviously planned procedure from beginning to end with fluid motion
GRS 5	Deficient knowledge. Needed specific instruction at most procedural steps	Knew all important aspects of procedure	Demonstrated familiarity with all aspect of procedure

GRS: Global Rating Scale

Table 2: Demographic profile of residents (*n*=24)

	Total (*n*=24)	Group A - video instruction alone (*n*=12)	Group B - video instruction and proctor supervised (*n*=12)	*P*
	Mean±SD; frequency (%)			
Age (years)	29.12±1.78	29.25±1.86	29.00±1.76	0.739*
Sex				
Female	21 (87.50)	10 (83.33)	11 (91.67)	>0.999†
Male	3 (12.50)	2 (16.67)	1 (8.33)	
Year level				
1st year	6 (25.00)	3 (25.00)	3 (25.00)	>0.999†
2nd year	6 (25.00)	3 (25.00)	3 (25.00)	
3rd year	6 (25.00)	3 (25.00)	3 (25.00)	
4th year	6 (25.00)	3 (25.00)	3 (25.00)	

Statistical analysis used: *Independent *t*-test, †Fisher's exact test. SD: Standard deviation

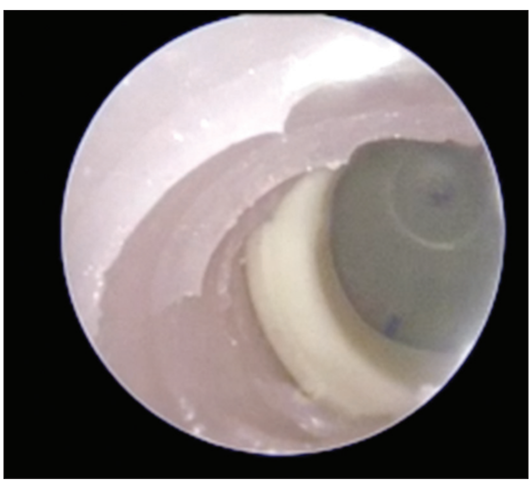

Figure 9: Assessment of the cervical canal retracting the hysteroscope out of the uterine cavity score in pretest. Internal os (white ring)

supervision (P = 0.739) (Group B). In terms of gender distribution, a higher percentage of females (87.50%) participated compared to males (12.50%), and these proportions remained consistent across both instructional subgroups. Regarding the distribution across year levels, each year group (1st, 2nd, 3rd, and 4th) accounted for 25% of the total cohort, demonstrating an equal representation across both instructional categories (P > 0.999). The presented values of age, gender, and year levels indicate similar patterns across instructional methods, with no statistically significant differences observed.

Table 3 shows the evaluation scores for diagnostic hysteroscopy performance during the pretest and posttest assessment, grouped by instructional methods. In pretest assessment, the average total operating time was approximately 1.37 ± 0.48 min for the entire group, with similar values observed for those exposed to Group A (video instruction alone) (1.40 ± 0.44 min) and Group B (video instruction along with proctor supervision) (1.35 ± 0.53 min) (P = 0.810). The total score, indicating overall performance, showed slight variation among the groups: 7.92 ± 1.72 for the total cohort, 7.83 ± 1.99 for Group A, and 8.00 ± 1.48 for Group B (P = 0.818). The GRS scores in various domains, including respect for tissue, time and motion, handling of hysteroscopy, flow of procedure, and knowledge of procedure, displayed consistent median values across the instructional groups, with no statistically significant differences. The data suggest that participants performed similarly across instructional methods, with comparable total operating time and total scores. The GRS scores indicate a consistent level of competence and skill in the various aspects of diagnostic hysteroscopy, reflecting the effectiveness of both instructional approaches.

Table 3: Diagnostic hysteroscopy performance evaluation scores

	Total (*n*=24), mean±SD	Group A - video instruction alone (*n*=12), mean±SD	Group B - video instruction and proctor supervised (*n*=12), mean±SD	*P*
Pretest				
Total operating time (s)	82.29±28.67	83.75±26.56	80.83±31.75	0.810*
Total score	7.92±1.72	7.83±1.99	8.00±1.48	0.818*
GRS, median (IQR)				
Respect for tissue	2 (1–3)	2 (1–3)	2 (1–3)	0.551§
Time and motion	1 (1–2)	1 (1–2)	1 (1–2)	>0.999§
Handling of hysteroscopy	1 (1–2)	1 (1–3)	1 (1–2)	0.887§
Flow of procedure and forward planning	2 (1–3)	2 (1–3)	2 (1–2)	0.799§
Knowledge of procedure	1 (1–3)	1 (1–3)	2 (1–2)	0.410§
Posttest				
Total operating time (s)	44.21±10.14	46.08±11.39	42.33±8.80	0.377*
Total score	13.67±1.61	13.50±1.73	13.83±1.53	0.622*
GRS, median (IQR)				
Respect for tissue	3 (2–3)	3 (2–3)	3 (2–3)	0.514§
Time and motion	3 (2–3)	2 (2–3)	3 (2–3)	0.319§
Handling of hysteroscopy	3 (2–3)	3 (2–3)	3 (2–3)	0.755§
Flow of procedure and forward planning	3 (2–3)	3 (2–3)	3 (2–3)	0.755§
Knowledge of procedure	3 (2–3)	3 (2–3)	3 (2–3)	0.755§

Statistical analysis used: *Independent *t*-test, §Mann–Whitney. SD: Standard deviation, IQR: Interquartile range, GRS: Global Rating Scale

In the posttest assessment, the average total operating time was approximately 0.74 ± 0.17 min for the entire group, with similar values observed for those exposed to Group A (0.77 ± 0.19) and Group B (0.71 ± 0.15) ($P = 0.377$). The total score, indicating overall performance, exhibited slight variance across the groups: 13.67 ± 1.61 for the entire data for posttest, 13.50 ± 1.73 for video instruction alone, and 13.83 ± 1.53 for video instruction with proctor supervision ($P = 0.622$). The GRS scores in domains such as respect for tissue, time and motion, handling of hysteroscopy, flow of procedure, and knowledge of procedure consistently showed median values within the range of 3 across instructional groups, with no significant differences. This suggests that participants performed comparably regardless of instructional method, evidenced by similar total operating time and total scores. The GRS scores underline a steady level of competence and proficiency in different diagnostic hysteroscopy aspects, highlighting the efficacy of both instructional approaches. A graphic presentation of comparison of instructional methods in total operating time and total score in pretest is shown in Figure 10 and posttest in Figure 11.

Table 4 presents the diagnostic hysteroscopy performance evaluation scores for Groups A and B, comparing between pretest and posttest outcomes. In Group A, the average total operating time was approximately 1.08 ± 0.46 min for the entire group, with a notable reduction in posttest performance (0.77 ± 0.19 min), indicating a statistically significant difference ($P = 0.001$). The total score, reflecting overall performance, exhibited different patterns between pretest (10.67 ± 3.42) and posttest (13.50 ± 1.73), with a significant improvement ($P < 0.001$). The GRS scores across various aspects, such as respect for tissue ($P = 0.002$), time and motion ($P = 0.004$), handling of hysteroscopy ($P = 0.004$), flow of procedure and forward planning ($P = 0.001$), and knowledge of procedure ($P = 0.003\phi$) indicated statistically significant enhancements in posttest assessment which demonstrated improvement from pretest to posttest. The results implies that Group A participants exhibited improvements in total operating time, total scores, and GRS scores following the instructional intervention, indicating the effectiveness of the training in enhancing their diagnostic hysteroscopy skills.

In Group B, the average total operating time was approximately 1.03 ± 0.50 min for the entire group, demonstrating a decrease in posttest performance (0.71 ± 0.15 min), signifying a statistically significant difference ($P = 0.002$). The total score, reflecting comprehensive performance, displayed observable variations between pretest (10.92 ± 3.32) and posttest (13.83 ± 1.53), with a significant improvement ($P < 0.001$). The GRS scores, including respect for tissue ($P = 0.002$), time and motion ($P = 0.002$), handling of hysteroscopy ($P = 0.003$), flow of procedure and forward planning ($P = 0.003$), and knowledge of procedure ($P = 0.002$) demonstrated statistically significant enhancements in posttest assessments. These findings indicate that Group B participants experienced significant improvements in total operating time, total scores, and GRS scores following the educational intervention, implying the efficacy of the training in augmenting their diagnostic hysteroscopy competencies. A graphic presentation of comparison between pretest and posttest in total operating time and total score for Group A is shown in Figure 12 and Group B in Figure 13.

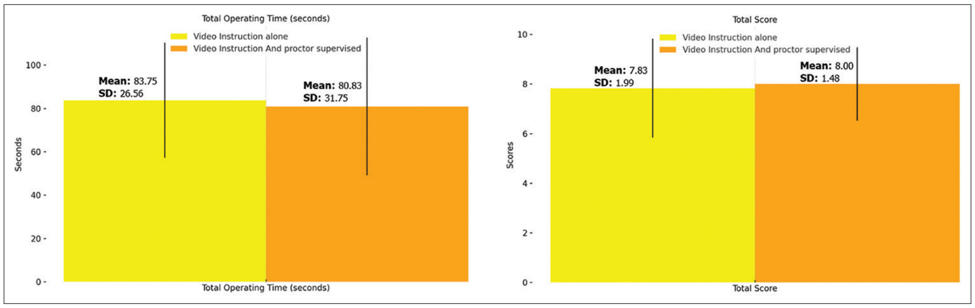

Figure 10: Comparison of instructional methods in total operating time and total. SD: Standard deviation

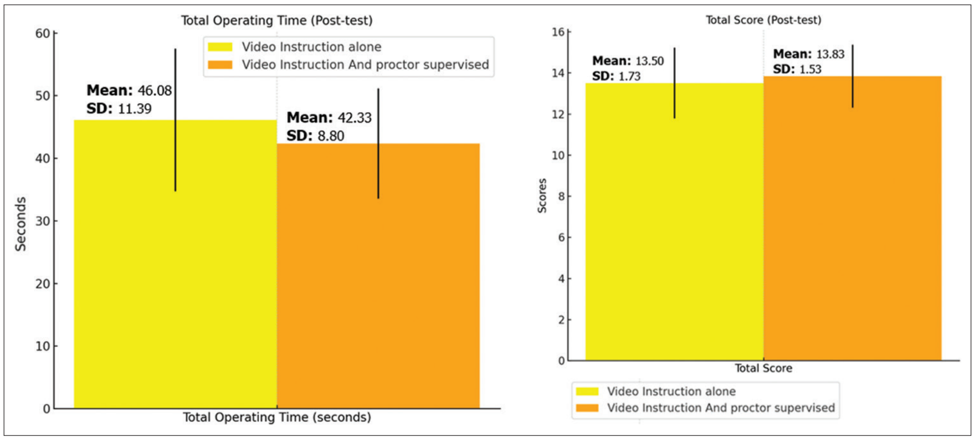

Figure 11: Comparison of instructional methods in total operating time and total score in posttest. SD: Standard deviation

Table 4: Diagnostic hysteroscopy performance evaluation scores

	Total (*n*=24), mean±SD	Pretest (*n*=12), mean±SD	Posttest (*n*=12), mean±SD	*P*
Group A				
Total operating time (s)	64.92±27.74	83.75±26.56	46.08±11.39	0.001¶
Total score	10.67±3.42	7.83±1.99	13.50±1.73	<0.001¶
GRS				
Respect for tissue	2 (1–3)	3 (1–3)	3 (2–3)	0.002φ
Time and motion	2 (1–3)	1 (1–2)	2 (2–3)	0.004φ
Handling of hysteroscopy	2 (1–3)	1 (1–3)	3 (2–3)	0.004φ
Flow of procedure and forward planning	2.5 (1–3)	2 (1–3)	3 (2–3)	0.001φ
Knowledge of procedure	2 (1–3)	1 (1–3)	3 (2–3)	0.003φ
Group B				
Total operating time (s)	61.58±30.10	80.83±31.75	42.33±8.80	0.002¶
Total score	10.92±3.32	8.00±1.48	13.83±1.53	<0.001¶
GRS				
Respect for tissue	2 (1–3)	2 (1–3)	3 (2–3)	0.002φ
Time and motion	2 (1–3)	1 (1–2)	3 (2–3)	0.002φ
Handling of hysteroscopy	2 (1–3)	1 (1–2)	3 (2–3)	0.003φ
Flow of procedure and forward planning	2 (1–3)	2 (1–2)	3 (2–3)	0.003φ
Knowledge of procedure	2 (1–3)	2 (1–2)	3 (2–3)	0.002φ

Statistical analysis used: ¶Paired sample *t*-test, φWilcoxon signed-rank test. GRS: Global Rating Scale, SD: Standard deviation

In the performance evaluation scores from the pretest assessment categorized by the GRS, the "respect for tissue" category, participants in Group A showed that 33.33% frequently pushed the scope into the uterus wall, and 16.67% occasionally did so, whereas 58.33% reported no trauma to the uterus with the scope. Similarly, participants in Group B had 75% with no trauma, 8.33% with occasional pushing, and 8.33% with frequent pushing. For "time and motion," 75% of Group A participants exhibited many unnecessary moves, whereas 25% made some unnecessary moves but with more efficient timing. In Group B, 75% also displayed many unnecessary moves, whereas 25% made some unnecessary moves but with efficient

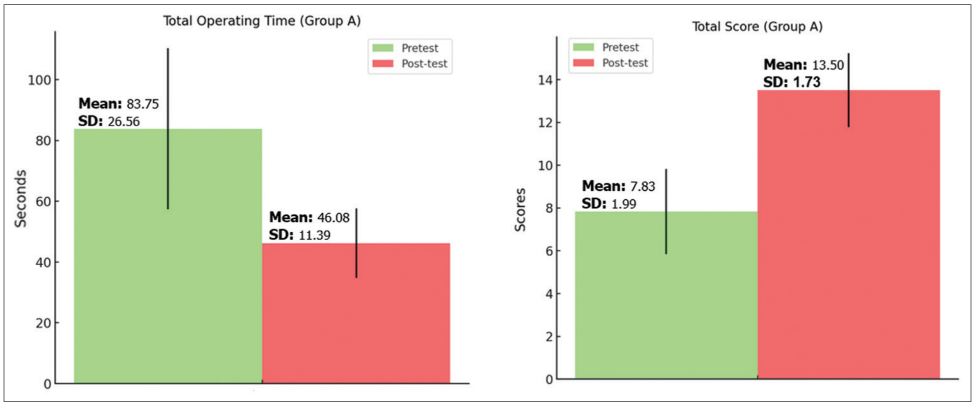

Figure 12: Comparison in pretest and posttest in total score and total operating time for Group A. SD: Standard deviation

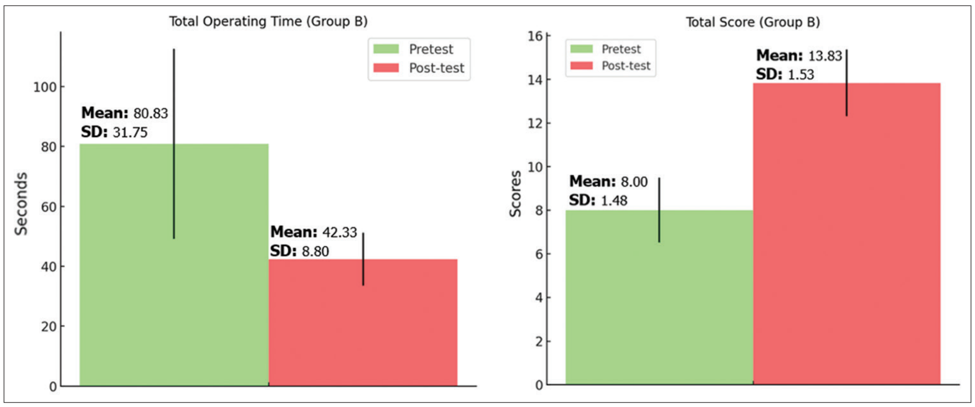

Figure 13: Comparison in pretest and posttest in total score and total operating time for Group B. SD: Standard deviation

timing. In "handling of hysteroscope," 58.33% of Group A frequently needed assistance, whereas 41.67% demonstrated the ability to think forward. In Group B, 58.33% frequently needed assistance, and 41.67% demonstrated forward thinking. Regarding "flow of procedure and forward planning," 16.67% of Group A frequently stopped and 16.67% demonstrated forward thinking, whereas 83.33% of Group B demonstrated planned procedure. Finally, in the "knowledge of procedure" category, 66.67% of Group A participants exhibited deficient knowledge, whereas 41.67% of Group B participants had complete knowledge, and 25% demonstrated familiarity. These findings indicate that participants in Group B, who received video instruction and proctor supervision showed improved performance in certain aspects of the procedure compared to those in Group A who received video instruction alone.

While in the performance evaluation scores from the posttest assessment categorized by the GRS, in the "respect for tissue" category, 33.33% of participants in Group A who received video instruction alone pushed the scope into the uterus wall, whereas 16.67% occasionally did so, and 66.67% reported no trauma to the uterus with the scope. In Group B, 83.33% demonstrated no trauma, 10% occasionally pushed the scope, and 6.67% frequently did so. Regarding "time and motion," 58.33% of Group A displayed many unnecessary moves, 33.33% made some unnecessary moves with efficient timing, and 41.67% maximized time without unnecessary moves. In Group B, 66.67% showed no unnecessary moves, 41.67% made some unnecessary moves with efficient timing, and 25% maximized time. In "handling of hysteroscope," 25% of Group A frequently needed assistance, 16.67% demonstrated forward thinking, and 75% set the scope at a good angle. In Group B, 83.33% set the scope at a good angle, 16.67% demonstrated forward thinking, and 10% frequently needed assistance. In "flow of procedure and forward planning," 8.33% of Group A frequently stopped, 16.67% demonstrated forward thinking, and 91.67% demonstrated planned procedure. In Group B, 16.67% frequently stopped, 83.33% demonstrated forward thinking, and 91.67% demonstrated planned procedure. Finally, for "knowledge of procedure," 25% of Group A exhibited had knowledge of important aspects, and 66.67% demonstrated familiarity. In Group B, 33.33% had complete knowledge and 75% demonstrated familiarity. Based on the data presented in Table 6.4, Group B (video instruction and proctor supervised) exhibited greater improvement in performance compared to Group A (video instruction alone) based on the frequency of favorable outcomes in the various categories of the GRS. In categories such as "respect for tissue," "time and motion," "handling of hysteroscope," and "knowledge of procedure," Group B had higher percentages of participants showing improved performance. This suggests that the addition of proctor supervision to the video instruction had a positive impact on participants' performance, leading to more favorable results in multiple aspects of hysteroscopy evaluation.

Discussion

This study showed that the addition of proctor supervision did not offer an additional difference in the performance of hysteroscopic camera navigation compared with video instruction alone among OBGYN residents. However, postinstruction assessments revealed that groups with video instruction and expert feedback had a slight edge over video instruction alone in terms of positive outcomes in various categories of GRS. For instance, in the posttest assessment for "knowledge of procedure," Group B had a higher percentage (76%) demonstrating familiarity with all aspects of the procedure compared to Group A's 66.67%. Such findings emphasize the importance of hands-on supervision in reinforcing and augmenting the instructional content delivered through videos.

One explanation for this finding is that even though residents have innate surgical skills, hysteroscopic camera navigation is not an easy task. In a study by Korndorffer *et al*., psychomotor skills are needed to overcome the barriers which include the fulcrum effect, two-dimensional image, a fixed access point and limited range of motion. Important skills that are unique to camera navigation includes proper horizontal axis while maintaining the operative field in the center.[3] Provided with the data that camera navigation is a complex skill and the learners are novice, the feedback from the proctor had a substantial advantage for the learners understanding of the task. The proctor was able to identify the error and initiated the necessary steps to correct the learner's performance.[4] This study has shown that video-based instruction is an effective supplemental tool in the acquisition of skills in camera navigation but the addition of external feedback from an expert offers an opportunity to understand what needs to be improved and learn how to execute it correctly.

Our findings is comparable with literatures like the study of Nousiainen *et al*., that the combination of video instruction and expert instruction did not improve the development of surgical skills of suturing and knot-tying in medical students compared with training with video material alone.[5] According to their study, the level of the trainee and the sufficient amount of information for optimal learning is enough for the development of skills and further expert supervision did not improve their skills.

We have demonstrated that video instruction alone can be effective in teaching basic and essential skills in hysteroscopic procedures which is camera navigation to OBGYN residents. Residents who have completed the 5 repetitions in both groups have become proficient in executing the 9 tasks and demonstrated significant improvement in speed and technique. We believe that the success of this study is due to two reasons, one is the content of the video. All the necessary steps and tips were indicated in the video and were shown in the simplest way possible for the resident's level of understanding. Second is the residents were allowed to practice 5 repetitions with no time limit and were able to view the video while performing the tasks. The participants were then able to monitor their performance and know when they had succeeded. We believe that the repetitions of the task in training are valuable.

A key takeaway from our study is that video-based instruction can effectively impart essential hysteroscopic skills, such as camera navigation. The success of our approach can be attributed to the clarity and comprehensiveness of the video content, coupled with the opportunity for repeated practice. The chance to re-watch the instructional video while practicing was also beneficial, allowing participants to gauge their performance in real-time.

Another limiting factor would be the relatively small number of trainees involved, making differences in performance harder to be detected if the trial is underpowered. The performance scores of residents, being subjective, might vary across different observers (although not the case here). In addition, the long-term efficacy of our training approach remains uncharted, as we evaluated skills immediately posttraining. While the skills were honed in a simulated environment, their translation to real-world patient scenarios is yet to be ascertained. Future research may explore into course design nuances, skill retention over time, and the applicability of these skills in clinical contexts.

Video-based instruction is an efficient learning tool. However, when supplemented with expert proctor supervision, it provides a more enriched and comprehensive learning experience.

Our recommendation is to enhance the surgical training in acquisition of hysteroscopic skills during residency. The demand for structured surgical training is of high demand and video-based simulation can be a tool to improve residents' comfort to perform hysteroscopy.

Conclusion

The video-based training simulation is effective as expert proctoring in hysteroscopic camera navigation. However, there was slightly greater improvement in the GRS scores in the proctor supervised group which suggest that feedback from proctors has a positive impact on the performance.

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Authorship contributions

Margarita Cantor - Involved in the conceptualization, methodology, formal analysis, software, resources, data curation, writing original draft, review and editing, visualization.

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Conflicts of interest

There are no conflicts of interest.

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