Deliberate Practice Improves Obstetrics and Gynecology Residents' Hysteroscopy Skills

Beth W. Rackow, MD
M. Jonathon Solnik, MD
Frank F. Tu, MD, MPH
Sangeeta Senapati, MD, MS
Kristen E. Pozolo, BS
Hongyan Du, MS

Abstract

Introduction Development of surgical skills is an integral component of residency education in obstetrics and gynecology.

Objective We report data from a supervised, deliberate, dry lab practice in hysteroscopy for junior obstetrics-gynecology residents, undertaken to evaluate whether simulation training improved hysteroscopy performance to a skill level similar to that of senior residents.

Methods A prospective, comparative, multicenter trial compared Objective Structured Assessment Of Technical Skills (OSATS) performance of 2 groups: 19 postgraduate year (PGY)-1 and PGY-2 and 18 PGY-3 and PGY-4 Ob-Gyn residents. PGY-1 and PGY-2 participants underwent 4 sessions of brief, deliberate, focused training in hysteroscope assembly and operative hysteroscopic polypectomy using uterine models. Subsequently, all participants completed a simulated hysteroscopic polypectomy OSATS, and procedure times and structured assessment scores were compared among groups.

Results PGY-1 and PGY-2 residents who had completed OSATS training performed at or above the level of untrained PGY-3 and PGY-4 residents. Junior residents had better assembly times and scores, resection scores, and global skills scores ($P < .05$). Resection times did not differ between groups but differed among institutions.

Discussion Brief, hands-on training sessions, which were task-specific and repetitive facilitated short-term gains in learning operative hysteroscopy and increased the dry lab skill level of junior residents compared to that of senior residents. This curriculum was effectively implemented at 3 institutions and generated comparable results, suggesting generalizability.

Beth W. Rackow, MD, is Associate Professor of Clinical of Obstetrics and Gynecology at the Department of Obstetrics and Gynecology, Columbia University Medical Center; **M. Jonathon Solnik, MD,** is Assistant Professor, Director of the Division of Urogynecology, Co-Director of the Center for Minimally Invasive Gynecologic Surgery, and Assistant Residency Program Director at the Department of Obstetrics and Gynecology, Cedars-Sinai Medical Center; **Frank F. Tu, MD, MPH,** is Clinical Assistant Professor at the Department of Obstetrics and Gynecology, NorthShore University Health System, Pritzker School of Medicine, University of Chicago; **Sangeeta Senapati, MD, MS,** is Clinical Assistant Professor at the Department of Obstetrics and Gynecology, NorthShore University Health System, Pritzker School of Medicine, University of Chicago; **Kristen E. Pozolo, BS,** is Research Assistant at the Department of Obstetrics and Gynecology, NorthShore University Health System; and **Hongyan Du, MS,** is statistician at the Center for Clinical Informatics and Research, NorthShore University Health System.

Funding: The authors report no external funding source for this study.

This work was previously presented at the 2009 Council on Resident Education in Obstetrics and Gynecology/Association of Professors of Gynecology and Obstetrics Annual Meeting, San Diego, CA, March 12. The authors thank APGO Surgical Scholars Program and Ethicon, Inc., for providing the uterine models and our Ob-Gyn colleagues at the 3 institutions for contributing time as Objective Structured Assessment Of Technical Skills judges.

Corresponding author: M. Jonathon Solnik, MD, Assistant Clinical Professor, Assistant Residency Program Director, Department of Obstetrics and Gynecology, Cedars-Sinai Medical Center, The David Geffen School of Medicine at UCLA, 8635 W. Third Street, Suite 160W, Los Angeles, CA 90048, solnikm@cshs.org

Received: March 30, 2011; revision received: January 17, 2012; accepted: January 18, 2012.

DOI: http://dx.doi.org/10.4300/JGME-D-11-00077.1

Editor's Note: The online version of this article contains the Hysteroscopic Objective Structured Assessment of Technical Skills (OSATS) assembly and resection checklist and the global assessment of technical skill used in this study.

Introduction

In obstetrics and gynecology practice, hysteroscopy is the standard procedure for diagnostic evaluation of the uterine cavity and abnormal uterine bleeding and for operative treatment of uterine abnormalities such as submucosal leiomyomas and endometrial polyps.[1,2] Simulation is becoming a standard component of resident training. It allows for practice, real-time feedback, and learning in a safe environment,[3] and a growing body of data support the effectiveness of formal, objective teaching of surgical skills and the effectiveness of surgical simulation in resident training.[4] Additionally, for some clinical tasks, simulation training can be effective when inexpensive but realistic models are used.[5] Physical simulators permit the use of the same instruments and camera equipment used in the operating room, enhancing the simulation experience as well as the familiarity with the equipment.

FIGURE 1 **Uterine Model: Exterior View of the Uterine Model and Transcervical View of the Uterine Cavity with Endometrial Polyps**

What was known

Acquisition of procedural competency traditionally has involved experience with patients, time-consuming task training, or simulation interventions.

What is new

A prospective, comparative, multicenter trial using an Objective Structured Assessment Of Technical Skills (OSATS) found that the hysteroscopy skills of junior (PGY-1 and PGY-2) residents who had completed 4 brief hands-on training sessions were superior even to those of more senior (PGY-3 and PGY-4) residents.

Limitations

Use of a dry lab variation among sites and lack of subsequent assessment of performance with real patients.

Bottom Line

Brief, hands-on training sessions increased hysteroscopy dry lab skills of junior residents compared to those of senior residents.

The goal of this study was to evaluate whether dedicated hysteroscopy simulation training improved the short-term surgical skills of junior residents in obstetrics and gynecology (Ob-Gyn) and improved their dry lab performance to the skill level of senior residents. If this level of improvement were achieved, it would suggest that focused simulation training early in residency might improve hysteroscopy skills.

Methods

Participants and Setting

We conducted a prospective, comparative, multicenter trial involving 37 volunteer Ob-Gyn residents. Participants included residents from Yale-New Haven Hospital (New Haven, CT, N = 25), Cedars-Sinai Medical Center (Los Angeles, CA, N = 19), and Evanston Hospital, (Evanston, IL, N = 40). Each study site attempted to obtain an equal number of junior postgraduate year (PGY)-1 and PGY-2 residents and senior PGY-3 and PGY-4 residents. Institutional Review Board approval was obtained at each institution.

Intervention

At each institution, the primary site investigators (BR, JS, FT) presented a standardized lecture on hysteroscopy to available residents (PGY-1 through PGY-4) during a regular didactic session. The lecture reviewed the fundamentals of hysteroscopy, including indications, equipment, surgical technique, and prevention and management of complications. Prior to the lecture, attendees completed a multiple-choice pretest of baseline knowledge of hysteroscopic indications, technique, and complications.

During a 4-week period, PGY-1 and PGY-2 residents completed 4 individually supervised 10-minute training sessions focusing on hysteroscopic assembly and surgical techniques. The preceptor was a physician (a principle investigator) or a research assistant (KP) trained to perform these tasks. Sessions were separated by 2 to 7 days. Participants completed a brief self-assessment to determine their perceived comfort with hysteroscopy (which was also given prior to the Objective Structured Assessment of Technical Skills [OSATS] for the untrained senior residents). The first 2 sessions were dedicated to hysteroscope assembly, and the last 2 sessions were dedicated to practice with operative hysteroscopic polypectomy. A standardized protocol was developed by the authors and followed at all 3 sites. A simple uterine model with an irregular endometrial surface (Chamberlain Group, Great Barrington, MA) (FIGURE 1) and bipolar hysteroscope (Versapoint; Gynecare; Ethicon, Somerville, NJ) were used for all training sessions. In order to test our hypothesis, the PGY-3 and PGY-4 residents did not undergo these deliberate practice sessions.

Assessment of Outcomes

Two weeks post training, all PGY-1 and PGY-2 participants completed an OSATS test. Residents were evaluated by gynecologic surgeons experienced in operative hysteroscopy (1 judge each at Yale-New Haven Hospital and Cedars-Sinai Medical Center and teams of 3 or 4 judges per participant at Evanston Hospital). Judges were blinded to the research question and study methods. OSATS was performed under standardized conditions in a dry lab setting, and participants were instructed to treat this exercise as if they were performing a surgical procedure. The assessment encompassed assembly and correct setting adjustment of the bipolar operative hysteroscope and performance of a hysteroscopic polypectomy using the uterine model. Residents were allowed up to 4 minutes for assembly and 10 minutes for the polypectomy. These cutoffs were based on the pilot work carried out during the posttraining performance of a research assistant (KP) who was previously unskilled, following her successful

TABLE **Junior and Senior Residents' Self-Assessment of Hysteroscopy Experience**

Experience Measure	PGY-1 and PGY-2 (n = 19)	PGY-3 and PGY-4 (n = 18)
Comfort with Assembly of Resectoscope (1–10)[a]	4.5 ± 2.8	5 ± 1.6
Comfort with Hysteroscopic Resection (1–10)[a]	5.5 ± 2.4	7.9 ± 1.8
Comfort with Managing Hysteroscopic Complications (1–10)[a]	4.1 ± 2.6	6.0 ± 2.2
Number of Diagnostic Hysteroscopy Procedures	21.2 ± 17.9	32.8 ± 25
Number of Hysteroscopic Polypectomy Procedures	9.5 ± 11.2	19.8 ± 13.0
Number of Hysteroscopic Myomectomy Procedures	3.7 ± 4.7	11.7 ± 10.4
Number of Hysteroscopy with Endometrial Ablation Procedures	6.8 ± 10.0	15.9 ± 14.1
Total Volume of Hysteroscopy Cases	41.7 ± 37.7	82.5 ± 51.9

Abbreviation: PGY, postgraduate year.

[a] Ten-point Likert scale, 1-not comfortable at all, 10-competent.

hysteroscopic training using this same protocol. OSATS scoring used a validated checklist (provided as supplemental online material) of hysteroscopic assembly steps (13 items), polyp resection steps (5 items), and a study-specific modified global assessment of technical skill (provided as supplemental online material).[4,6]

Analysis

A priori calculations determined that 12 participants in each arm were needed to show a statistically significant training effect of at least 7 points on the global assessment score, assuming standard deviation of 6, an alpha value equal to .05, and a power of 80%. Data from each OSATS test were collected, de-identified, and incorporated into a database. Bivariate statistics for key predictor and outcome variables were calculated. Box plots were created to reveal the data distribution by training and stratified by site; data normality assumption was assessed using Shapiro-Wilk's test and visual inspection. Where appropriate, independent *t* tests and the Wilcoxon rank-sum test were used to assess between-group differences (trained juniors vs. untrained seniors). One-way analysis of variance and the Kruskal-Wallis test were used to compare performance scores across sites. In a post hoc analysis, skew-distributed outcomes of interest were dichotomized at their medians, and their association to training status was assessed using the Cochran-Mantel-Haenszel test for general association, controlling for site. The assumption that there was no treatment-by-site interaction was tested by establishing the homogeneity of the treatment odds ratios across sites by using Zelen's exact test. Significance was defined at $P < .05$. Analysis was conducted with STATA version 11.0 software (College Station, TX) and SAS version 9.2 software (Cary, NC).

Results

A total of 19 participants were PGY-1 and PGY-2, and 18 were PGY-3 and PGY-4, with 9 residents each from Yale-New Haven Hospital and Cedars-Sinai Medical Center, and 19 from Evanston Hospital. Most participants were women (70%, 26 of 37), and 92% (34 of 37) of participants were right-handed. Because of scheduling conflicts, there were many residents who completed the pretest written assessment who could not participate in the study and many who did not complete the pretest but were able to participate in the study. Those results were excluded from analysis, and the pretraining brief survey was used instead. The hysteroscopic experience reported by junior and senior residents confirmed expectations. Between training levels, the self-assessment revealed that consistent with current training paradigms, senior residents performed at least 10 more diagnostic and 10 more operative (polypectomy, myomectomy) hysteroscopy procedures than junior residents (TABLE). Both junior and senior residents rated their levels of comfort with hysteroscope assembly as average. Self-rated competency in hysteroscopic resection and management of complications was higher for senior residents.

Investigators at each site spent 20 minutes judging each OSATS evaluation and 40 minutes (4 × 10-minute training sessions) training each resident. The total time investment was 19 hours for the Evanston Hospital site and 9 hours each for Yale and Cedars-Sinai Medical Centers.

We noted several key differences among study sites as well. Residents at Evanston Hospital reported higher levels of comfort with hysteroscopic resection (7.6 ± 2.4 vs. 5.7 ± 2.3 at Yale-New Haven Hospital and 5.7 ± 2.1 at Cedars-Sinai Medical Center; $P < .05$), but self-rated assessment of assembly or complication management did

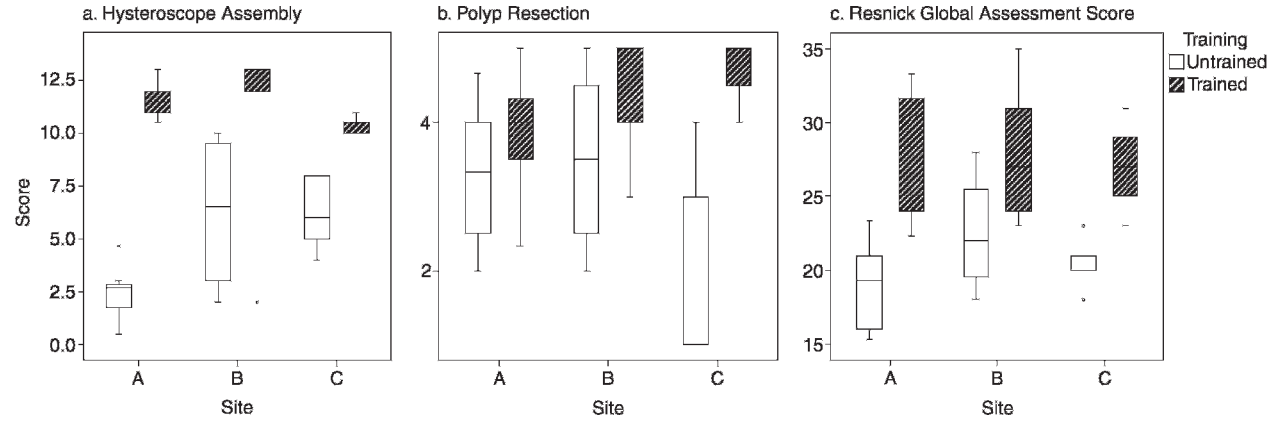

FIGURE 2 **OSATS Hysteroscopy Performance by Training Status and Study Site**

Abbreviation: OSATS, Objective Structured Assessment of Technical Skills.

not differ across study sites. Prior operative experience differed across sites, principally in the number of diagnostic hysteroscopies performed, with residents at Evanston Hospital having managed 2 to 3 times more cases than those at the other sites (39.8 ± 22.9 vs. 14.4 ± 6.8 and 11.7 ± 12.4, $P < .05$). Across the 3 sites, OSATS hysteroscope assembly times, assembly scores, polyp resection scores, global assessment scores, and pretest scores did not differ (FIGURES 2 and 3), although resection times at Cedars-Sinai Medical Center were significantly longer than those at the other 2 institutions.

During the OSATS, trained junior residents outperformed untrained senior residents in hysteroscope assembly scores and assembly times, resection scores, and global assessment ($P < .05$) (FIGURES 2 and 3). For the hysteroscope assembly task, trained junior residents achieved a mean checklist score of more than 6 (of 13) points higher ($P < .001$) and completed the assembly on average more than 1 minute faster (maximum of 4 minutes allowed; $P < .001$). Hysteroscopic resection scores also favored the junior trained cohort by 1 point (maximum of 5, $P = .006$). Although hysteroscopic resection times did not differ significantly, trained junior residents were 1 minute faster than the senior group, and only 1 of 19 (5%) failed the task versus 6 of 18 (33%) of untrained senior residents. Global assessment of technical skill

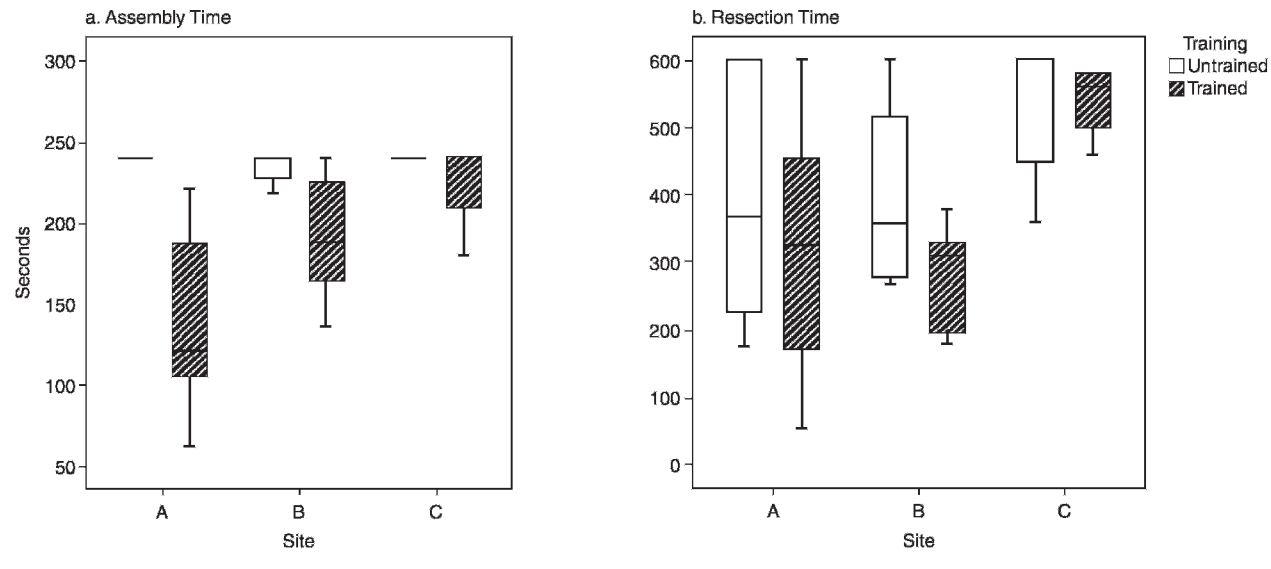

FIGURE 3 **OSATS Hysteroscopy Assessment: Comparison of Performance Times by Training Status and Study Site**

Abbreviation: OSATS, Objective Structured Assessment of Technical Skills.

scores differed by an average of 7 points between trained junior residents and untrained senior residents ($P < .001$).

On a posttraining survey, 18 junior residents gave the program high marks, with an overall score of 8 of 10 for the training. Individual scores ranged from 8.5 to 10 for posttraining comfort with hysteroscope assembly and resection of a polyp, relevance of simulation to surgical training, and ability to integrate knowledge with surgical practice.

Discussion

Our findings demonstrate that focused and distributed hands-on training improves junior residents' dry lab hysteroscopic task performance to levels similar to their more experienced senior counterparts. Recent work-hour restrictions that affect surgical volume, generalized changes in surgical indications, and nonsurgical requirements for residents in Ob-Gyn residency have created a pressing need to provide more efficient training. A comparison of case logs of 4-year residents before and after work-hour limitations revealed a decrease in hysteroscopic procedures performed from almost 60 cases to 43 cases.[7] Furthermore, specific institutional conditions such as dedicated teaching faculty and space allotted for training and funding varied. These conditions may make development of an educational curriculum difficult to standardize.

Recognizing residents' time constraints, this intervention used brief, repeated practice sessions. This approach is supported by a growing body of evidence that spaced education (repeated brief presentations of educational material over spaced intervals, as opposed to single boluses of teaching) may improve long-term retention for medical students and residents.[8,9] Boehler et al[10] used this methodology to show that individual and episodic training was able to advance the surgical skills of fourth-year medical students compared to that of junior surgical residents in the areas of chest tube placement, bowel anastomosis, skin excision, and laparoscopic cholecystectomy using inanimate and animal models.[10] Our results echo those findings.

One strength of our study was the use of a validated, reproducible assessment tool that brought a combination of objectivity (predesigned checklist) and comprehensive evaluation that allowed for some degree of subjective grading (global rating scale). Combining data from 3 sites with different levels of baseline hysteroscopic experience not only provided external validity to the study but also improved the power to show differences.

Our study intervention has several limitations. Although we attempted to minimize variations in practice by using standardized, written training and assessment tools and regular communication among sites to ensure clarity about procedures, we were unable to completely standardize the intervention across sites. The relatively greater availability of judges at Evanston Hospital may be a proxy for the quality and amount of baseline training. This would be more likely to reduce the effectiveness of our intervention. Our study hypothesis was based on the assumption that more senior-level residents would bring a greater degree of surgical experience than their younger counterparts; however, it is a potentially unjustified assumption that performance or ability within each class should be similar. Another difference among sites was that Evanston Hospital used a nonphysician trainer (KP) with no operative experience almost exclusively as an instructor (>99% of all sessions). This produced no difference in results, and trainees expressed satisfaction with this educator. Use of a well-trained surrogate may alleviate some of the training burden for faculty.

The dry lab OSATS-type assessment also has limitations, and we did not collect data assessing trainees' subsequent performance on actual patients (due to constraints on trainees' availability). Some studies suggest OSATS performance correlates positively with actual procedural performance.[11] Junior residents had an advantage over their senior counterparts, having practiced the OSATS and having been exposed to the testing environment. Another limitation of the dry lab is the inability to simulate complications such as uterine perforation or fluid overload, which may be tested better by using computer-based simulators.

Conclusions

Our results support previously published findings that brief and direct simulated procedures measurably improved performance compared to controls[3–5] and found high resident satisfaction with a formal, readily implementable hysteroscopy training program. A larger study using the concept of distributed practice is needed to confirm our finding of generalizability, as we did not have sufficient numbers to test potential training by site interactions. Future studies should confirm that a better understanding of endoscopic equipment and related operative instrumentation translates into objective improvements in resident learners' confidence, interest, and actual performance in operative gynecology.

Consistent with earlier findings,[5] many senior residents without formal exposure to a hysteroscopic training program will graduate with a lack of comfort with the basic assembly and setup for operative hysteroscopy, despite performing a large number of procedures. Incorporating

brief, repetitive training in the operating room, such as requiring a resident to assemble equipment and troubleshoot technical problems as a prerequisite to performing the surgery, should be an effective solution. Perioperative staff, given a standardized, brief curriculum guideline, may be able to work with surgeons in order to incorporate this into the preparatory work for selected cases, particularly since the equipment is already available.

References

1. Jansen FW, Vredevoogd CB, van Ulzen K, et al. Complications of hysteroscopy: a prospective, multicenter study. *Obstet Gynecol*. 2000;96:266–70.
2. Tu FF, Beaumont JL. Profile of outpatient hysteroscopy in the United States from 1994 to 1996. *J Reprod Med*. 2008;53:935–940.
3. Burchard ER, Lockrow EG, Zahn CM, Dunlow SG, Satin AJ. Simulation training improves resident performance in operative hysteroscopic resection techniques. *Am J Obstet Gynecol*. 2007;197:542.e1–e4.
4. VanBlaricom AL, Goff BA, Chinn M, Icasiano MM, Nielsen P, Mandel L. A new curriculum for hysteroscopy training as demonstrated by an objective structured assessment of technical skills (OSATS). *Am J Obstet Gynecol*. 2005;193:1856–1865.
5. Goff BA, VanBlaricom A, Mandel L, Chinn M, Nielsen P. Comparison of objective, structured assessment of technical skills with a virtual reality hysteroscopy trainer and standard latex hysteroscopy model. *J Reprod Med*. 2007;52:407–412.
6. Reznick R, Regehr G, MacRae H, Martin J, McCulloch W. Testing technical skill via an innovative "bench station" examination. *Am J Surg*. 1997;173:226–230.
7. Blanchard MH, Amini SB, Frank TM. Impact of work hour restrictions on resident case experience in an obstetrics and gynecology residency program. *Am J Obstet Gynecol*. 2004;191:1746–1751.
8. Kerfoot BP, DeWolf WC, Masser BA, Church PA, Federman DD. Spaced education improves the retention of clinical knowledge by medical students: a randomised controlled trial. *Med Educ*. 2007;41:23–31.
9. Moulton CA, Dubrowski A, Macrae H, Graham B, Grober E, Reznick R. Teaching surgical skills: what kind of practice makes perfect?: a randomized, controlled trial. *Ann Surg*. 2006;244:400–409.
10. Boehler ML, Schwind CJ, Rogers DA, et al. A theory-based curriculum for enhancing surgical skillfulness. *J Am Coll Surg*. 2007;205:492–497.
11. Kundhal PS, Grantcharov TP. Psychomotor performance measured in a virtual environment correlates with technical skills in the operating room. *Surg Endosc*. 2009;23:645–649.