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ORIGINAL ARTICLE

Resident simulation training improves operative time of the retropubic midurethral sling procedure for stress incontinence

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Abstract

Introduction and hypothesis Our aim was to assess whether immediate preoperative resident simulation training decreases operative time and improves resident proficiency when performing a retropubic midurethral sling (MUS) procedure.

Methods This prospective cohort study took place over 8 months at the Icahn School of Medicine, New York, USA. During the first 4 months, all retropubic MUS procedures were performed by residents who underwent immediate preoperative simulation training. The cases completed during the following 4 months were performed by residents who had not received preoperative simulation training. During the 8-month period, residents completed self-assessment questionnaires upon completion of the surgery and attendings evaluated the residents using the Objective Structured Assessment of Technical Skills (OSATS) global rating scale. Operative time between the two periods were compared using two-sample Student's *t* test. Comparative analysis between groups was performed based on the OSATS scores using the Wilcoxon rank-sum nonparametric test.

Results There were 22 cases in the simulation group (SG) and 20 in the no simulation group (NSG). SG mean operative time was 12.6 min and NSG mean operative time was 14.6 min ($p = 0.12$). The SG mean OSATS score was 30.4 versus NSG of 27.8 ($p < 0.001$).

Conclusions This study demonstrates that preoperative simulation significantly improves operative performance of the retropubic MUS procedure among residents and also improves their confidence in the operating room. There was a decrease in mean operative time of 2 min in the SG, but the difference was not statistically significant. This data is consistent in demonstrating improved surgical performance and resident confidence with simulation training.

Keywords Operative time · Residents · Retropubic sling procedure · Simulation training · Stress urinary incontinence

Introduction

Resident simulation training has become increasingly popular as a method of resident education. Types of simulators include but are not limited to simple tool-based models, virtual reality programs, animal tissue, and human cadavers [1–4]. Simulation teaches trainees the fundamental skills necessary to execute a surgery before even entering the operating room. To demonstrate that simulation may reflect true operative skill, McCluney et al. performed a prospective study comparing resident, fellow, and attending skills in a laparoscopic simulation setting with their actual performance in the operating room. They found that simulator scores were independently predictive of intraoperative performance [3].

Incorporation of simulation into surgical training curricula does not come without cost, but there is ample evidence that it may be worthwhile [4]. In the field of obstetrics and gynecology, several studies suppor the effectiveness of resident simulation training. Residents randomized to surgical simulator training on episiotomy repair, laparoscopic bilateral tubal ligation, or hysteroscopy had improved surgical performance in the clinical setting compared with those without simulation training [5–7]. There is, however, limited literature on simulation-based training in urogynecology-specific surgery.

One of the more commonly performed procedures in the field of urogynecology is the retropubic midurethral sling (MUS) [8, 9]. This is an effective surgical treatment option for women with stress urinary incontinence (SUI). The objective of our study was to assess whether immediate preoperative

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Table 1 Patient Demographics

	Simulation $N = 22$	No Simulation $N = 20$	P value
Mean age	55.4 ± 10.3	59.5 ± 13.1	0.26
Mean parity	1.95 ± 1.17	1.90 ± 1.62	0.91
Mean BMI	27.1 ± 4.7	26.8 ± 4.68	0.30

BMI body mass index

resident simulation training decreases operative time and improves proficiency when performing a retropubic MUS procedure.

Materials and methods

This was a prospective cohort study performed at a single academic medical center in New York and approved by the Institutional Review Board. All 29 obstetrics and gynecology residents participated. The study took place from October 2015 to May 2016. Surgical cases were divided into two cohorts: simulation (SG) and a no simulation (NSG) groups. The simulation session occurred within 30 min of the actual start time of the surgery. A gynecology fellow went through the steps of the procedure, after which the resident could practice performing the steps (passing the trocars) through a plastic pelvic model. For the first 4 months of the study, the pelvic model was available and all residents rotating on gynecology during that time period underwent simulation training prior to performing the procedure. During the subsequent 4 months, different residents rotating on gynecology performed the procedure without pre-operative simulation training.

All retropubic MUS procedures between October and January were performed by residents who had received immediate preoperative simulation training; all procedures performed thereafter were completed by residents who did not. Attendings were blinded to who had and had not undergone simulation training, being unaware of the time-frame assignments. Cases were included if most (>50%) MUS procedures (Gynecare TVT) were performed by a resident. In other words, the resident must perform at least one side of the dissection of the suburethral space and placement of one trocar.

Data was collected using an intraoperative data collection sheet completed by a member of the research team, a resident self-assessment survey, and an attending evaluation sheet. The attendings evaluated residents using the Objective Structured Assessment of Technical Skills (OSATS), which is a global rating scale that consists of seven evaluation items scored on a 5-point scale. Categories ar: respect for tissue, time and motion, instrument handling, knowledge of instruments, flow of operation, use of assistants, and knowledge of specific procedure. The highest possible score is 35. It has been proven to be both feasible and effective as a tool to assess resident skill [10, 14].

The primary outcome was operative time. Secondary outcomes were OSATS scores and resident self-assessments of performance. Mean operative times were compared using two-sample Student's t test. Comparative analysis was performed based on OSATS scores given by the supervising attendings using Wilcoxon rank-sum nonparametric test. P v<0.05 was significant.

Table 3 Year of residency

	Simulation	No Simulation	P value
Junior residents	3 (37.5%)	2 (20%)	0.61
Senior residents	5 (62.5%)	8 (80%)	

Results

Of the 42 cases, 22 occurred between October 2015 and January 2016 (SG) and 20 between February 2016 and May 2016 (NSG). Patient demographic information is shown in Table 1. Table 2 identifies transvaginal tape (TVT) slings performed concurrently with another procedure. There were eight residents in the SG, 62.5% of whom were senior residents (3rd or 4th year). There were ten residents in the NSG, 80% of whom were senior (Table 3). One resident fell into both groups, and so three cases she participated in were excluded. Individual residents' prior experience performing a TVT is shown in Table 4.

Mean operative time for the 42 cases was 13.6 min. Mean operative time for the SG was 12.6 (± 3.5). Mean operative time for the NSG was 14.6 (± 4.2) ($p = 0.11$) (Fig. 1). There were two cases of bladder perforation in each group, three cases of failed void trials immediately postoperatively in the recovery room within the NSG, and no cases of failed void trials in the SG. Average total OSATS score for the SG was 30.4 and for the NSG 27.8 ($p < 0.001$) (Fig. 2). OSATS scores by category were

Table 2 TVT +/- concurrent procedure

	Simulation	No Simulation	P value
TVT alone	10 (45%)	8 (40%)	0.57
Concurrent	12 (55%)	12 (60%)	

TVT transvaginal tape

Table 4 Experience performing a TVT

	Simulation	No Simulation	P value
Prior TVTs (junior)	0.6 ± 0.89	0± 0	0.41
Prior TVTs (senior)	2.82 ± 2.51	1.76± 1.32	0.12

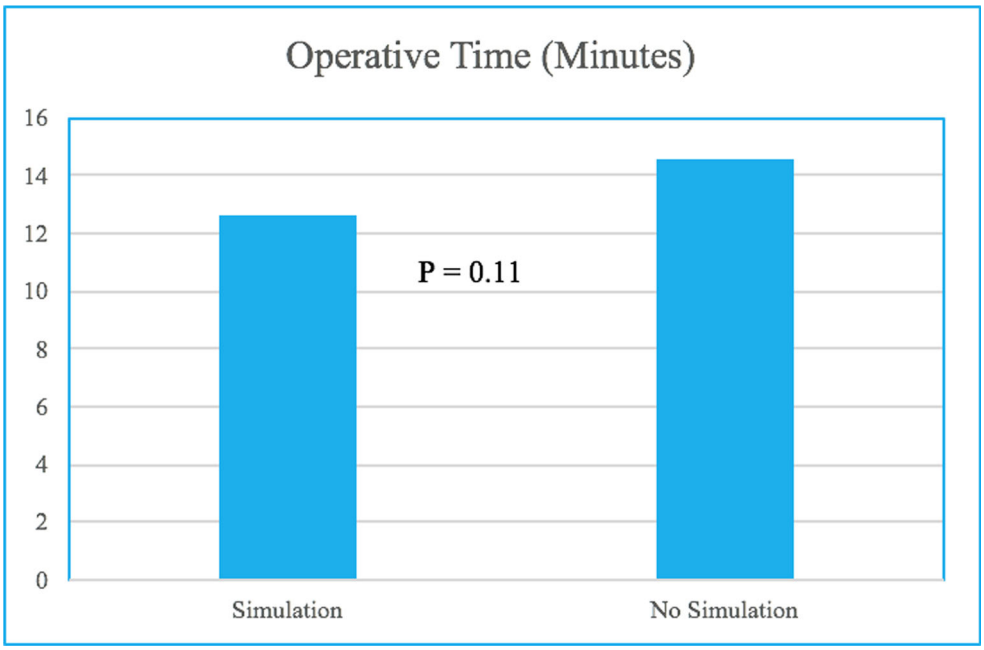

Fig. 1 Operative Times (Minutes)

compared between groups. The following three parameters showed a significant improvement in the SG: instrument handling (4.5 vs 3.7, $p < 0.001$), knowledge of instruments (4.5 vs 3.6, $p < 0.001$), and knowledge of specific procedure (3.9 vs. 3.35, $p = 0.0015$) (Fig. 3). All residents in the SG completed a self-assessment survey at the end of each case, and all reported feeling more confident during the procedure after having completed the preoperative simulation training (Fig. 4).

Discussion

This study demonstrates that subjective operative performance of residents during the MUS procedure improved with the use of preoperative simulation training. Though not statistically significant, there was also a decrease in mean operative time of 2 min between groups. There was a significant improvement in OSATS scores in the SG. This study is

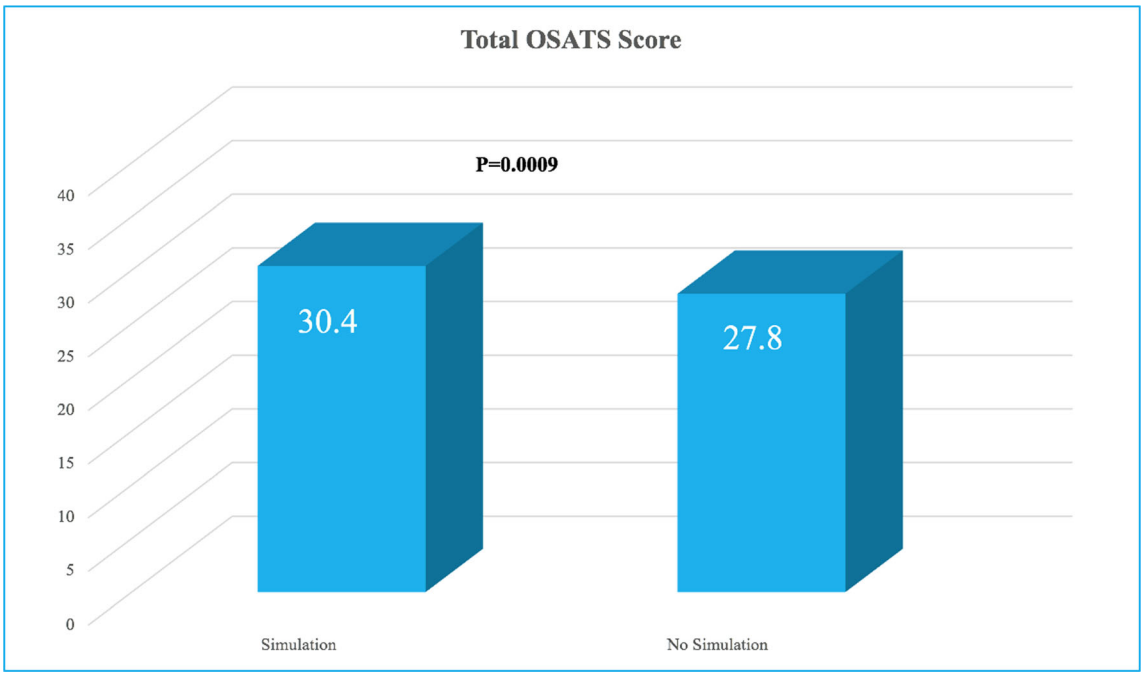

Fig. 2 Total OSATS Score

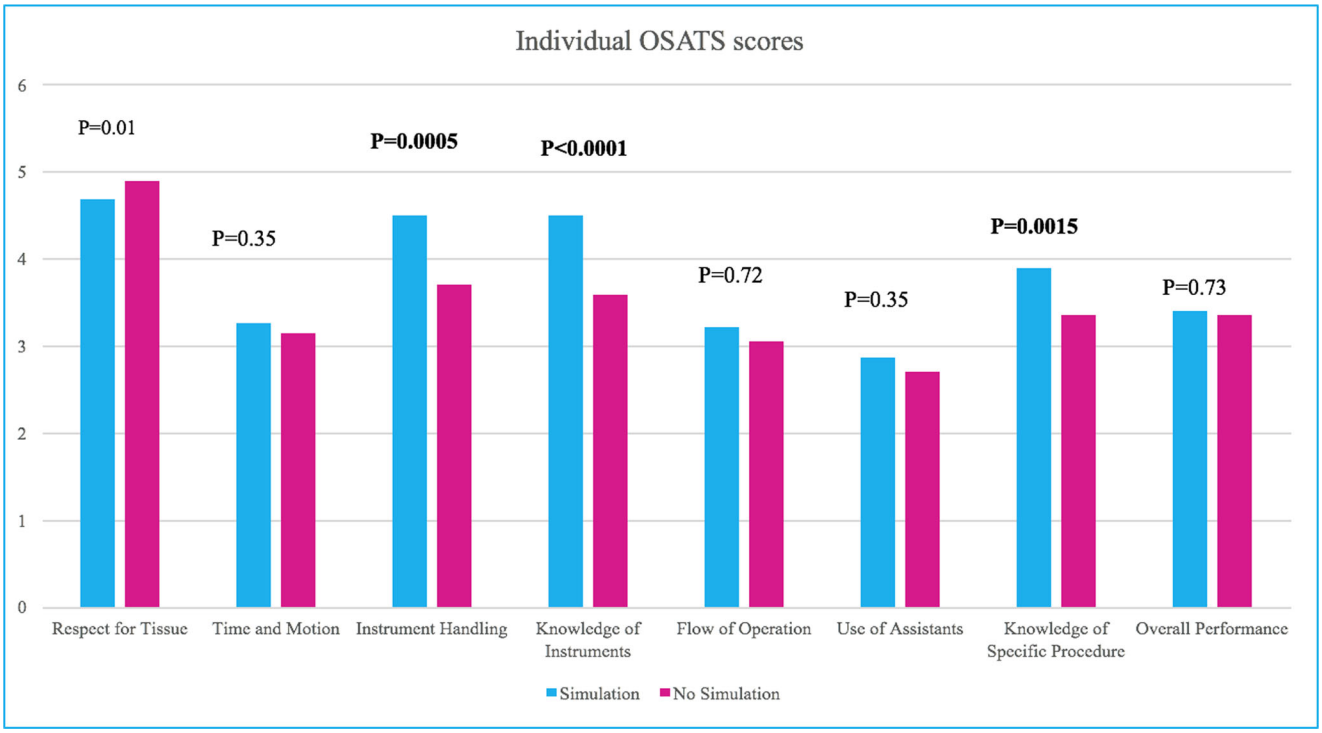

Fig. 3 Individual OSATS scores

consistent with previous literature, as it demonstrates that preoperative simulation training significantly improves operative performance of the retropubic MUS procedure by residents and also improves their confidence in the operating room.

A strength of this study is its prospective design. Additionally, it adds to the limited simulation training research within the field of urogynecology. Limitations include a small study population and lack of randomization. The pelvic model was only available to our residents for a limited time. The initial study design was to randomize each procedure to resident simulation or no simulation. The current standard of care in resident education of MUS placement at our institution involves an annual lecture on the appropriated assessment and management of patients with SUI. Residents then learn the procedure in the operating room. There are no requirements for watching videos or observing in the operating room before actually performing the procedure. Involvement in the procedure is left to the discretion of the attending surgeon. In the initial protocol, the only change from this standard was the addition of simulation training for residents involved in half of the procedures. Our IRB, however, would not allow this protocol unless patients consented to the study. Because of the short time frame in which the pelvic model was available, we believed that having to consent the patients would greatly decrease our numbers and make any assessment of simulation training impossible. We therefore opted for the current study design.

Junior and senior residents were not randomized, and there were more juniors in the SG. Perhaps simulation could have had an even greater impact on results if were an equal number of juniors in each group. In addition, we did not look at

Fig. 4 Resident Self-Assessment Survey

Resident Self-Assessment Survey

1. What level of training are you in?
   a. []PGY1 []PGY2 []PGY3 []PGY4
2. Have you performed a TVT sling before?
   a. []yes []no
3. If yes, how many? ___
4. Do you feel you are more confident in performing a TVT after the simulation training?
   a. []yes []no []maybe []don't know
5. Do you feel that immediate pre-operative simulation training should be applied to more gynecologic surgery?
   a. []yes []no []maybe []don't know

proficiency of residents in the MUS procedure prior to this study. Studies show that despite the simplicity of the procedure, the learning curve for retropubic CMUS procedures can be quite long. One study showed that to reach a target level of <5% perforation rate, one needs to perform at least 20 procedures [15]. It is possible that a second-year junior might have performed more MUS procedures than a third-year resident. Therefore, we might have identified junior residents who were in fact more proficient at sling placement than senior residents, which could have impacted our results.

Preoperative simulation training was done by a urogynecology or MIS fellow prior to the surgery and was not discussed with the attending surgeon at the time of the surgery to minimize any effects on grading by the attending. The attendings, however, were aware of the project, and their evaluations may have been biased by this knowledge. We found no significant difference in intraoperative complications, but the numbers were too small to expect to see a difference.

Limited operative experience poses a challenge to residents acquiring the appropriate skills to safely perform various surgical procedures [11]. Simulation training offers residents an opportunity to develop their abilities and hone their skills in a practice setting and develop confidence, with no risk to patient safety [12]. If residents begin their learning process in the simulator laboratory, they may start their first patient case at a higher level of proficiency [13]. This would enhance the traditional apprenticeship approach, which is limited by a fixed volume of cases. Simulation training might also provide ethical, medical–legal, and financial advantages, ultimately resulting in increased patient safety. For all these reasons, simulation training is a vital supplement to hands-on surgical training in residency. The positive reaction from both residents and attendings led to further implementation of simulation training into residency didactics at our institution. In future, a multicenter study should be performed in which residents are followed over time to assess whether the benefits of simulation training are long lasting.

Compliance with ethical standards

Conflicts of interest None.

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