Urology Residents' Experience With Simulation: Initial Evaluation of MRI/US Fusion Biopsy Workshop

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OBJECTIVE To evaluate our initial experience with a multi-institutional workshop model of MRI/US fusion biopsy simulation for resident education.

METHODS Residents from 6 Chicago area urology programs participated in a MRI/US fusion biopsy workshop, which incorporated a 30 minute didactic session followed by hands-on simulation. The workshop was facilitated by fellowship-trained university faculty members and company representatives of MRI/US fusion technologies who provided teaching assistance and verbal feedback. Participants completed pre- and post-test nonvalidated 4-item questionnaires graded on a Likert scale. Information on resident prior experience with TRUS and MRI/US fusion biopsies was also collected. Pre-and postquestionnaires were compared with paired *t* tests for each survey domain ($P < .05$ were considered significant).

RESULTS Thirty-three residents (PGY 1-6, median PGY 3) participated in the workshop. 13 (40.6%) residents reported performing between 51 and 100 TRUS biopsies previously. Twenty-one (65.6%) reported being familiar with PIRADS v2 interpretation of prostate MR imaging, however 17 (53.1%) had never previously performed a MRI/US fusion biopsy. Analysis of pre- and post-test questionnaires showed significant increases in all 4 survey domains ($P < .05$). Residents demonstrated increased familiarity with indications for fusion biopsy (mean difference = +0.59), preparation for fusion biopsy (mean difference = +1.16), methods of MRI to TRUS image registration (mean difference = +1.38), and the advantages/disadvantages of perineal vs TRUS fusion biopsy (mean difference = +1.25).

CONCLUSION This workshop model which combines didactics followed by hands-on simulation training is an effective method for increasing the knowledge and familiarity with MRI/US fusion biopsy of trainees. UROLOGY 134: 51–55, 2019. © 2019 Elsevier Inc.

Multiple technological advances have caused significant changes to the field of Urology within the last few decades. The changing landscape often requires both practicing Urologists and trainees to keep pace with new innovations, which has subsequently impacted residency training. Surgical simulation is now increasingly incorporated into residency programs within many different surgical subspecialties. The call for increased simulation stems from various factors including new limits to duty hours, medical-legal liability concerns, and financial restraints which require increasing operative efficiency. Simulators can also be useful for initial assessment of competence as well as eventual recertification.[1]

As a response to these needs, the Accreditation Council for Graduate Medical Education now requires General Surgery residency programs to provide resources for surgical simulation and skills laboratories.[2] Urology programs also look favorably on incorporating simulation within training and most programs have included at least a basic laparoscopic simulator.[3,4] Several studies have shown favorable results on a variety of different simulators with most data on laparoscopic and virtual reality trainers.[5-8] Aside from the simulation exercise itself, it is vital that trainees receive prompt feedback evaluating their performance for reinforcement of concepts.[9]

We have previously published literature on a multi-institutional, multimodality model of surgical simulation which trainees have found beneficial for GreenLight photovaporization of the prostate, ureteroscopic stone basketing and extracting, laparoscopic peg transfer, 3-dimensional laparoscopy rope pass, and transobturator sling placement.[10]

MRI/US fusion biopsy is a relatively new technology that requires MRI prostate image interpretation and processing, and guidance for biopsy that differs from the standard of care TRUS biopsy. Therefore, we sought to

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determine whether adding didactics to the hands-on education would be helpful. In this study, we present our initial experience with a multi-institutional workshop model of MRI/US fusion biopsy for resident education.

METHODS

The Chicago Urological Society in downtown Chicago hosts a centrally located surgical simulation workshop annually, as we have previously described.[10] In 2019, after institutional Review board approval was obtained, an MRI/US fusion biopsy workshop was added to the curriculum. Questionnaires were provided to the Urology residents to assess previous experience with standard TRUS and MRI/US fusion biopsies followed by a 4-item nonvalidated pretest. The workshop then incorporated a 30-minute didactic session followed by hands-on simulation. The didactic portion was delivered by fellowship-trained university faculty members (SV and MA). Didactic lecture included overview of MRI parameters and PIRADs v2 scoring system, efficacy and indications for MRI/US fusion biopsy, methods of imaging registration, preparation and procedural overview of MRI/US fusion biopsy, and an overview of transperineal access to the prostate. A detailed outline of the didactic lecture can be seen in the Supplementary Appendix.

Following didactics, residents participated in a hands-on simulation session which utilized prostate phantoms with multiple distinct lesions for targeted biopsy. Fusion biopsies were performed with the UroNav system (Invivo International, Best, Netherlands) or with the BK Fusion (Analogic, Peabody, MA). This portion of the session was supervised by the faculty as well as representatives from the manufacturers of each system who provided teaching assistance and verbal feedback. Participants then completed an identical 4-item nonvalidated post-test. Pre- and postquestionnaires were compared with paired t tests for each survey domain ($P < .05$ were considered significant). Student's t test was used to compare mean postsession scores amongst groups of different PGY level and MRI/US fusion experience.

QUESTIONNAIRE

Participants voluntarily reported their postgraduate year and their previous experience with standard TRUS and MRI/US fusion biopsies. The pre- and post—nonvalidated questionnaires were identical and contained 4 items that were graded on a Likert scale (Fig. 1). Items evaluated participants' knowledge on the indication for fusion biopsy, the limitations of MRI to TRUS image registration, the advantages and disadvantages of perineal and TRUS biopsy, and basic workflow/preparation of fusion biopsy.

RESULTS

Thirty-three residents (PGY 1-6, median PGY 3) from 6 accredited Urology residency programs participated in the workshop. Thirteen (40.6%) residents reported performing between 51 and 100 TRUS biopsies previously. Nine residents (28.1%) reported

What is your postgraduate year (PGY)	1	2	3	4	5	6
How many TRUS prostate biopsies have you performed?	None	1-50	51-100	>100		
How familiar are you with PI-RADS v2 interpretation of MR prostate?	Not Familiar	Familiar	Very Familiar			
How many MRI/US fusion prostate biopsies have you performed	None	1-20	20-50	>50		

PRE/POST-SESSION ASSESSMENT	1 Strongly Disagree	2 Somewhat Disagree	3 Unsure	4 Somewhat Agree	5 Strongly Agree
I can explain the indications for MRI/US fusion prostate biopsy					
I understand the workflow to prepare for MRI/US fusion prostate					
I know the methods and limitations of MRI to TRUS image registration					
I understand the advantages and disadvantages of perineal versus TRUS approach to fusion biopsy					

Figure 1. Data collection tool to record baseline resident characteristics as well as the pre- and/or postsession nonvalidated questionnaire.

previously performing 1-50 TRUS biopsies and the remaining 9 residents (28.1%) performed greater than 100 biopsies. Twenty-one (65.6%) reported being familiar with PIRADS v2 interpretation of prostate MR imaging, however 17 (53.1%) had never previously performed an MRI/US fusion biopsy. Baseline TRUS and MRI/US fusion biopsy experience by postgraduate year can be seen in Table 1.

Analysis of pre- and post-test questionnaires showed significant increases in all 4 survey domains (P <.0001). Residents demonstrated increased familiarity with indications for MRI/US fusion biopsy (mean difference = +0.59), preparation for MRI/US fusion biopsy (mean difference = +1.16), methods of MRI to TRUS image registration (mean difference = +1.38), and the advantages/disadvantages of perineal vs transrectal MRI/US fusion biopsy (mean difference = +1.25) (Table 1).

When grouping residents PGY 1-3 and comparing them to PGY4-6, the mean postsession scores across all survey questions were not statistically significant (P >.05). Similarly, when grouping residents based on their prior experience with MRI/US fusion biopsy (no experience vs any experience), the mean postsession scores across all survey questions were also not statistically significant (P >.05). These results are reflected in Table 2.

DISCUSSION

Didactics with surgical simulation sessions can provide reinforcement of concepts and real-time feedback for residents. Multiple simulators have been developed which improve both technical and nontechnical skills with evidence suggesting trainees reach clinical competence more quickly.[11] Advantages of simulation include the ability to practice techniques frequently prior to undertaking the entire procedure, capability to individualize learning of tasks, and the accessibility of training at convenient times.[1] Despite the advantages of simulation and the increased availability of simulators, residents have reported that use has remained stable overall.[12]

Multiple constraints can limit ability of urological programs from incorporating simulation into educational curricula. Significant barriers such as cost can deter programs from purchasing simulators. This can be further magnified by annual service or maintenance fees depending on the type of simulator. Some robotic simulators have reported costs of over $100,000 USD.[13] The lack of standardization of simulation curricula by the Accreditation Council for Graduate Medical Education, resident motivation, and fatigue can also contribute to the lack of robust use of simulators nationwide.

Our previous experience with a multi-institutional model was well received by trainees with over 97% of responders believing the workshops were beneficial adjunct to surgical education.[10] In that study, multiple surgical simulators of different modalities were provided to residents. This permitted effective allocation of resources, efficient use of faculty time, and maximal utilization of simulators in a centrally located area. In January 2018, 21 residents participated in the Chicago Urological Society Resident Simulation Workshop and Competition in which they performed MRI/US fusion biopsies on a novel

Table 1. Baseline biopsy experience and Pre/Post workshop analysis

PGY	1	2	3	4	5	6
No. of TRUS Biopsies						
None	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
1-50	1 (50%)	2 (28.5%)	1 (14.3%)	1 (16.7%)	2 (66.7%)	0 (0%)
51-100	1 (50%)	5 (71.5%)	4 (57.2%)	2 (33.3%)	0 (0%)	1 (33.3%)
>100	0 (0%)	0 (0%)	2 (28.5%)	3 (50%)	1 (33.3%)	2 (66.7%)
No. of Fusion Biopsies						
None	1 (50%)	5 (71.5%)	5 (62.5%)	2 (33.3%)	2 (66.7%)	0 (0%)
1-20	1 (50%)	2 (28.5%)	2 (25%)	4 (66.7%)	1 (33.3%)	3 (100%)
20-50	0 (0%)	0 (0%)	1 (12.5%)	0 (0%)	0 (0%)	0 (0%)
>50	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Question	Pretest mean	Post-test mean	Average difference	P value
I can explain the indications for MRI/US fusion prostate biopsy	4.212	4.813	+0.593	<.0001
I understand the workflow to prepare for MRI/US fusion prostate	3.303	4.469	+1.156	<.0001
I know the methods and limitations of MRI to TRUS image registration	3.001	4.438	+1.375	<.0001
I understand the advantages and disadvantages of perineal versus TRUS approach to fusion biopsy	3.091	4.406	+1.250	<.0001

Table 2. Analysis of post-graduate year and prior fusion biopsy experience

Question	PGY 1-3 Mean Postsession Scores ($n = 17$)	PGY 4-6 Mean Postsession Scores ($n = 12$)	*P* Value	No Fusion Experience Mean Postsession Scores ($n = 17$)	Fusion Experience Mean Postsession Scores ($n = 15$)	*P* Value
I can explain the indications for MRI/US fusion prostate biopsy	4.750	4.917	0.243	4.813	4.800	0.932
I understand the workflow to prepare for MRI/US fusion prostate	4.500	4.500	1.000	4.375	4.600	0.276
I know the methods and limitations of MRI to TRUS image registration	4.313	4.583	0.169	4.438	4.467	0.876
I understand the advantages and disadvantages of perineal versus TRUS approach to fusion biopsy	4.188	4.5	0.236	4.500	4.267	0.377

prostate phantom. A postsession survey revealed high ratings (1-10 [best]): realism 9.0, usefulness 9.4, ease of use 9.1, ease of orientation 8.9, and overall experience 9.3.[14] There was no didactic session associated with this simulation station. Additional literature on MRI/US fusion simulators is limited.

There is 1 study by Chalasani et al on the development of a virtual reality transrectal ultrasound guided biopsy simulator. The design of this device incorporated 3D TRUS prostate images into a pelvis model allowing for multiple biopsies using a standard end-fire TRUS probe. The probe position is tracked within the pelvis model and simulator software is used to dynamically slice the 3D TRUS prostate image into cross-sectional TRUS images that replicates biopsy procedure. In this study, 67% of novices found the simulator realistic compared to 93% of expert assessors. Hundred percent of both experts and novices believed the interface would be useful for training.[15] Larger studies are still needed to demonstrate predictive validity with objective performance assessments for this type of simulator.

MRI/US fusion biopsies of the prostate are increasingly performed for men with clinical suspicion of prostate cancer with many Urologists in academic centers and in the community reporting growth of incorporation into their practices.[16] Despite this, MRI/US fusion biopsy is not a widely performed procedure by residents as demonstrated by our data with over 50% of residents never previously performing a MRI/US fusion biopsy. Several hardware/software platforms are now FDA approved for MRI/US fusion biopsy, which is an additional barrier to learning. We found that this model improved scores on our nonvalidated questionnaire across all survey questions.

When comparing residents from postgraduate years 1-3 and 4-6, there was no statistically significant change in mean postsession scores across all survey questions. Similarly, there was no statistically significant change in postsession scores when comparing residents who have no experience in MRI/US fusion to residents who have experience. This shows that this workshop model was likely helpful to all residents who participated. However, the study is descriptive and not powered to detect these changes. Additionally, this cohort reported low familiarity with both TRUS and MRI/US fusion biopsy. These effects may not be observed in more experienced groups.

Although with a limited, 1-year experience, several benefits are evident through this workshop design. This workshop allowed access to simulators for a large number of residents of different training levels across multiple institutions. Additionally, fellowship-trained faculty were able to teach residents logistics of setup, procedural steps, and streamlining techniques while providing individualized feedback. Company representatives were able to provide further insights into the mechanics of each device and troubleshooting advice. The simulations were also performed on phantoms with multiple lesions to give residents accurate simulation.

There are several limitations to this study. This is a single experience with this modality and further information over a period of several years would be needed to improve internal validity. Additionally, the survey given to the residents is nonvalidated and only captures the perceived improvements by the residents rather than objectively measuring knowledge. A potential for bias also may exist among this cohort of residents from which some may have overlapped from our previous study in 2017.[10] There is also no formal assessment of biopsy technique before or after the workshop. Objective assessment of knowledge and procedural technique will need to be incorporated as part of the workshop in future iterations.

CONCLUSION

This workshop model which combines didactics followed by hands-on simulation training is an effective method for increasing the knowledge and familiarity with MRI/US fusion biopsy of trainees. Further objective measurement of procedural technique over time is still needed.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.urology.2019.09.004.

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