Diffusion of Robotic Technology Into Urologic Practice has Led to Improved Resident Physician Robotic Skills

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OBJECTIVE: To investigate whether propagation of robotic technology into urologic practice and training programs has improved baseline urology resident trainee robotic skills.

DESIGN: Questionnaires were completed by each urology resident trainee participating in a training course and asked about access to robotic simulation, robot experience, and console time. Baseline resident trainee scores on the Mimic Robotic Simulator (Mimic Technologies, Inc., Seattle, WA) from 27 participants of 2012 course were compared with the 2015 scores of 34 trainees on 4 standard Mimic exercises using Wilcoxon rank-sum tests. $p = 0.05$ or less were considered statistically significant.

PARTICIPANTS AND SETTING: Totally, 34 resident trainees from 17 programs in the Southeast Section of the American Urological Association participated in an annual 2-day robotic training course.

RESULTS: Overall score, economy of motion score, and time to complete exercise were all significantly better in the 2015 trainee group compared with the 2012 trainee group ($p < 0.001$) for the Peg Board 1, Camera Targeting 2, and Energy Dissection exercises. Overall scores for needle targeting improved between 2012 and 2015 ($p = 0.04$). Trainee access to a simulator was not associated with overall score on any of the 4 exercises in the 2015 group. In the 2015 group, actual robotic console time was associated with better overall scores in Camera Targeting 2 ($p = 0.02$) and Peg Board 1 ($p = 0.04$).

CONCLUSIONS: Baseline resident trainee performance on basic robotic simulator exercises has improved over the past 3 years irrespective of robotic simulator access or console time. (J Surg Ed ▮:▮▮▮-▮▮▮. © 2016 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: robotic surgery, simulation, resident training, robotic training, robotic prostatectomy

COMPETENCIES: Patient Care, Medical Knowledge

INTRODUCTION

Greater than 84% of urologists in the United States indicated that robotic procedures were performed in their practice, and 62% believed that resident trainees should be able to perform most robotic procedures upon completion of residency.[1] There is a steep learning curve associated with this technology, which poses challenges to both residents and seasoned urologists with varying backgrounds. This learning curve combined with more restrictions on residency duty hours by the Accreditation Council for Graduate Medical Education has made resident education in robotic technology more difficult. The Mimic Robotic Skills trainer (MdVT) (Mimic Technologies, Inc., Seattle, WA) has demonstrated good face, content, and construct validity in numerous studies.[2-7] Therefore, the simulator may serve as an excellent robotic skills assessment tool.[3] Over the past 5-year period, virtual reality robotic simulators went from being available in 14% of American urology residency training programs to nearly 60% of these programs.[8]

The Southeast Section of the American Urological Association (SESAUA) hosts an annual 2-day robotic training course for its residents. Further, 2 to 3 residents from each training program are invited to meet at the Nicholson Center in Celebration, Florida, for the weekend course. The course includes didactics, simulation with the MdVT, and live porcine model surgery using the da Vinci Surgical

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System (Intuitive Surgical, Sunnyvale, CA). Trainee skill performance was assessed using the MdVT. Performance from the 2015 cohort was compared with the performance of a cohort of residents from the same course in 2012. The purpose of this study was to evaluate whether baseline trainee performance has improved over the 3-year period given the increased access to simulation and better integration of formal robotic curriculum into resident training programs.

MATERIALS AND METHODS

Study Setting

In total, 38 resident trainees from 17 SESAUA programs were evaluated during the 2015 course. This cohort was compared with a previous cohort of 27 residents from 14 SESAUA programs that completed the same training course in 2012. Details regarding the 2012 course have been previously published.[8] Invitations to attend the course were sent to all department chairs and program directors in the SESAUA, allowing up to 3 attendees per program.

Expenses for the course were covered by the SESAUA. Expert faculty from several SESAUA programs were invited as mentors to the trainees.

Day 1 of the 2015 course included 10 hours of expert faculty lectures as well as video demonstration covering robotic surgery basics, safety, patient positioning, port placement, and appropriate surgical steps of robotic-assisted partial nephrectomy, robotic-assisted nephroureterectomy, robotic-assisted retroperitoneal lymph node dissection, and robotic-assisted radical prostatectomy. On day 2, all resident trainees rotated through a live anesthetized pig labaratory and skills and tasks simulation exercises on the MdVT. All trainees completed a 1-page questionnaire following the MdVT portion of the course; this questionnaire has been previously published.[8]

Study Design

For the MdVT portion of the course, a brief tutorial was given to all participants before beginning simulation. Initially, the trainees worked through various simulation modules of their choice. Once familiar with the workings of the simulator, trainees were provided with a list of exercises to complete in the allotted simulation time. Of all exercises performed, 4 standard exercises were studied including "Camera Targeting 2," "Energy Dissection 1," "Needle Targeting," and "Peg Board 1."[1] The studied exercises were to be completed by the trainee at their leisure in no particular order and at no particular time period within their allotted block time. In each of these exercises, overall score, economy of motion score, and time to complete exercise score was collected.

Questionnaires completed by the trainees provided resident data, including year of urology residency, use of robotic console for an actual case, estimated number or actual robotic console cases, most difficult task, previous use of simulator, and type of simulator at their home program. Of the 38 trainees who completed the course in 2015, 34 surveys were completed, and MdVT data were collected on 34 trainees.

Simulator Exercises

Multiple exercises were available for the trainees to complete. Of all available exercises, data were collected on "Camera Targeting 2," "Energy Dissection 1," "Needle Targeting," and "Peg Board 1." "Camera Targeting 2" allows the trainee to practice moving the camera in an efficient manner while maintaining the operative target centered within the field of view. "Energy Dissection 1" tests the trainees' ability to apply thermal energy to tissues with an appropriate amount of precision without causing thermal spread or undue tension. "Needle Targeting" tests the trainees' ability to appropriately pass suture needles accurately and at the proper angle. "Peg Board 1" requires the trainee to place the appropriate colored rings with the corresponding peg. This requires camera movement and instrument clutching to complete in an efficient manner.

Statistical Analysis

Data were summarized with the sample median and interquartile range. Comparisons in performance metrics between 2012 and 2015 trainees were performed using Wilcoxon rank-sum tests separately for each of the 4 exercises ("Camera Targeting 2," "Energy Dissection 1," "Needle Targeting," and "Peg Board 1"). Among the 2015 trainees, associations of urology residency year (junior: postgraduate year [PGY]-2/3 versus senior: PGY-4/5), access to a robotic simulator (yes versus no), and robotic console for an actual case (yes versus no) with the overall score were explored using Wilcoxon rank-sum tests, separately for each exercise. $p \leq 0.05$ was considered statistically significant without adjustment for multiple testing. SAS version 9.3 (SAS Institute Inc., Cary, NC) was used for data analysis.

RESULTS

A total of 38 residents from 17 SESAUA programs completed the course in 2015, and 32 residents from 14 SESAUA programs completed the course in 2012. In the 2015 group, 34/38 trainees completed the MdVT tasks and questionnaires. The 2015 group consisted of 2 PGY-2, 13 PGY-3, 12 PGY-4, and 7 PGY-5 residents. In the 2012 group, 27/32 trainees completed the MdVT tasks and questionnaires. The 2012 group consisted of 2 PGY-2, 8 PGY-3, 18 PGY-4, 3 PGY-5 residents, and 1 fellow. Totally, 25 residents in the 2015 group had access to a robotic simulator at their home program, and 23 had