Impact of urology simulation boot camp in improving endoscopic instrument knowledge

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ABSTRACT

Objective Education and training of surgeons has traditionally focused on the development of individual knowledge, technical skills and decision making. Knowledge about endoscopic instruments is one of the core elements of urological training. We assessed the precourse knowledge of newly appointed urology trainees and the impact of boot camp in improving their knowledge.

Methods Newly appointed specialty trainees in urology took part in a pilot 5-day urology simulation boot camp (USBC). The aim of the USBC was to improve their confidence, procedural performance and non-technical skills, with one of the modules looking at the trainees' knowledge about common endoscopic instruments in urology. Delegates were first asked to identify and assemble the instruments, followed by one-to-one teaching about the instruments. An Objective Structured Assessment Tool was used to assess their knowledge in the identification and assembly of the cystoscope, resectoscope and optical urethrotome, before and at the end of the course.

Results Data of two successive boot camps were collected to assess knowledge of instruments of newly appointed urology trainees. Majority of the trainees had good precourse knowledge of the cystoscopy kit, with 84% able to correctly identify the parts. Seventy-six per cent of candidates were able to identify the resectoscope equipment, but only approximately a third of trainees were able to correctly identify the urethrotome kit. The assembly of cystoscope, resectoscope and urethrotome was performed correctly in 74%, 42% and 32% at baseline and 94%, 90% and 77% postcourse, respectively. Overall performance improved significantly in the postcourse assessment (<0.001).

Conclusion This urology boot camp has addressed gaps in trainees' core equipment knowledge and guided them to improve their knowledge with respect to identification and assembly of cystoscope, resectoscope and urethrotome.

INTRODUCTION

Traditionally, medical education has relied on an apprenticeship model, a model in which a learner observes an expert performing a particular skill on a patient that they then perform themselves.[1–3] In recent years, such model has been under a lot of criticism due to reduced training time, increased number of trainees and changing patterns in the delivery of healthcare (shorter hospital stays for patients, more focus on preventative care).[4] In the last decade, medical simulation has emerged as a solution to overcome the hurdles of the traditional apprenticeship model of learning. There has been a significant growth of medical simulation along with increasing evidence that simulation training improves healthcare education, practice and patient safety.[5 6] Furthermore, it allows learners to achieve competence without putting patients at risk. Over the past two centuries, the surgical profession has undergone a profound evolution in terms of efficiency and outcomes.[7 8] Education and training of surgeons has traditionally focused on the development of individual knowledge, technical skills and decision making.

Technological advances in urology ranging from endoscopic instruments to laparoscopic instruments have brought new challenges for surgical trainees and educators. Healey *et al*[9] surveyed urology resident applicants' knowledge of endoscopic instruments and reported suboptimal knowledge of the clinical application of these instruments. Another study assessed the knowledge of energy-based surgical instruments in urology trainees and reported limited understanding among the surveyed population.[10] There is a paucity of data regarding the level of knowledge in urological residents regarding endourological instruments. To address these issues Davis and Mulligan[11] introduced a course for urology residents.

The introduction of a urology simulation boot camp (USBC) may provide benefits during career transitions by increasing trainees' knowledge, skills and confidence.[12 13] The 5-day course was set up with the intention of improving their confidence, procedural performance and non-technical skills. The course consisted of eight modules of 4-hour duration (table 1), with a total of approximately 30 hours of procedural training from experts on common urological technical skills. Each module consisted of a short presentation/video, followed by hands-on training. Participant's precourse and postcourse knowledge were assessed via 40 multiple-choice questions. For technical skills assessment, all delegates filled in a questionnaire about their experience and confidence in each procedure (using a modified Likert scale (1–5) prior to the course). Furthermore, each candidate was assessed by the teaching faculty on their technical skills throughout the course and at the end using a practical assessment. Baseline scores on equipment knowledge and assembly were not disclosed to assessors. Similarly,

Table 1 Eight modules of urology simulation boot camp

Module	Title
1	Essential urological emergencies and basic genital procedures.
2	Bowel anastomosis, urostomy formation, ureteric and bladder repair.
3	Basic laparoscopic skills exercises and E-BLUS assessment on the LapMentor.
4	Endoscopic procedures (rigid and flexible URS, TURP, TURBT and green light laser prostatectomy) using bench-top and virtual reality models (UroMentor, TURP/BT Mentor; Simbionix and Green Light Laser simulator, AMS).
5	Simulated scenarios related to emergency urology and non-technical skills using SimMan 3G.
6	Hands-on stations on intravesical botulinum toxin, urethral bulking agents, mid-urethral tapes and practical urodynamics.
7	Endoscopic equipment knowledge, principles of laser and harmonic, cystoscopy and stent insertion, cystoscopy and clot evacuation.
8	Endoscopic procedures (rigid and flexible URS, TURP, TURBT and green light laser prostatectomy) using bench-top and virtual reality models (UroMentor, TURP/BT Mentor; Simbionix and Green Light Laser simulator, AMS).

TURP, transurethral resection of the prostate; E-BLUS, European training in basic laparoscopic urological skills; URS, Ureterorenoscopy; TURBT, Transurethral Resection of Bladder Tumour

non-technical skills were assessed using a generic formative assessment form (online supplementary appendix 1).

Knowledge regarding endoscopic instruments is one of the core elements of urological training. To date, no study has examined the effect of a focused instructional session on familiarisation with endourological equipment and improvement in knowledge of a urological trainee. We assessed the precourse knowledge of newly appointed urology trainees with regard to endoscopic instruments and the impact of boot camp in improving their knowledge.

METHODS

The USBC was an innovative, practical, hands-on, interactive, simulation-rich, 5-day course for newly appointed specialty trainees entering the urology scheme.[12] The USBC followed the ST3 urology curriculum from Higher Specialty Training syllabus. It was aimed to improve the confidence of newly appointed urology specialty trainees in their basic technical and non-technical skills in a structured workshop environment.

One of the USBC modules assessed the participant's level of knowledge of the urological endoscopic instrument. At the start, each participant was asked by one faculty member to identify instruments, and their knowledge level was recorded. This was followed by one-to-one full explanation about the instrument by the faculty member. Instruments taught are listed in online supplementary appendices 2–4. An assessment of the level of knowledge was performed after 48 hours of focused training. A modified Objective Structured Assessment Tool was used to assess their ability to identify and assemble the cystoscope (online supplementary appendix 2), resectoscope (online supplementary appendix 3) and optical urethrotome (online supplementary appendix 4) before and at the end of the course.[11] For example cystoscope evaluation forms assessed the candidate's ability to identify key components such as telescope, obturator, biopsy forceps and working channel, and their ability to assemble the scopes for clinical use. Resectoscope assembly for resection, incision and coagulation was assessed during the transurethral resection of the prostate (TURP) equipment (resectoscope) assessment. During the course, the cystoscope, resectoscope and urethrotome were explained to all participants in detail. A well-known 3-point Likert scale was used and the candidates were scored 1, 2 or 3, respectively, for 'correct', 'needed prompting' and 'incorrect' in equipment identification and assembly.[14 15] Feedback was an essential part of the USBC and was collected throughout the course. Following each module, feedback on the structure and knowledge gained together with a global outcome score was collected.

The median scores for each candidate were calculated for equipment identification and assembly. Data were statistically analysed using IBM SPSS Statistics V.22. The 'Wilcoxon signed-rank test' was used to assess differences in precourse and postcourse matched scores as judged by experts.

RESULTS

There were 34 candidates in 2016 (second USBC) and 16 in 2015 (first USBC). One trainee from the 2016 cohort was missing from the final postcourse assessment. All candidates were assessed for precourse knowledge of identification and assembly by a consultant at the start of the course.

Majority of the trainees had good precourse knowledge of the cystoscopy kit, with 84% (28/34) able to correctly identify the parts. Seventy-six per cent (25/34) of the candidates were able to identify the resectoscope equipment, but only approximately a third (34%, 11/34) of the trainees were able to correctly identify the urethrotome kit. The assembly of cystoscope was performed correctly in 74% (25/34) of trainees during the precourse assessment. The assembly of resectoscope and urethrotome was worse in comparison, with only 42% (14/34) and 32% (10/34) able to correctly perform the task.

The postcourse assessment occurred on day 5 of the USBC. There was a significant improvement in scores, with 100% of trainees able to identify the cystoscope ($p=0.008$) and resectoscope ($p=0.002$) sets, compared with 96% on the urethrotome ($p<0.001$). The greatest improvement in the assembly was seen on the resectoscope, with approximately 90% correct ($p<0.001$). Additionally, there was a significant improvement of 20% ($p<0.004$) and 45% ($p<0.001$), respectively, on the cystoscope and urethrotome assembly assessments (table 2).

Overall, there was a significant improvement in overall performance (table 3) in the use of cystoscope ($p<0.001$), resectoscope ($p<0.001$) and urethrotome ($p<0.001$). There was no significant difference in the performance of knowledge and assembly at precourse assessment on cystoscope, resectoscope and urethrotome between candidates who attended the USBC in 2015 or 2016 ($p>0.05$). Only significant differences were found at postcourse assessment in the scores given by experts for overall performance on resectoscope ($p=0.001$) and

Table 2 Candidates' ability to identify and assemble the equipment (online supplementary appendices 2–4)

Instrument	Trainee competency	Correct precourse (%), n=50	Correct postcourse (%), n=49	Significance
Cystoscope	Identify	84	100	0.008
	Assemble	74	94	0.004
Resectoscope	Identify	76	100	0.002
	Assemble	42	90	<0.001
Urethrotome	Identify	34	96	<0.001
	Assemble	32	77	<0.001

Hanchanale V, *et al*. *BMJ Stel* 2019;**5**:151–154. doi:10.1136/bmjstel-2018-000313

Table 3 Overall performance by candidates on a 5-point Likert scale (online supplementary appendix 1)

	Median overall score from assessors for performance (5-point Likert scale)		
Instrument	Precourse	Postcourse	Significance
Cystoscope	4	5	<0.001
Resectoscope	3	5	<0.001
Urethrotome	3	5	<0.001

urethrotome (p=0.003), in which the 2015 cohort performed better.

Overall, the feedback score was over 4.5 out of 5, with the hands-on training on simulators getting the best score of 4.8 out of 5. Instrument section feedback was exceptionally good, with 4.5 for didactic and 4.6 for practical. The vast majority of participants felt they would recommend the boot camp and particularly the instrument section to future course participants.

DISCUSSION

There is growing evidence to support the role of simulation in developing surgical skills, and an intensive boot camp simulation can be an effective way for the rapid acquisition of basic technical and non-technical skills specific to urological surgery for junior urology trainees. Several simulation boot camps in other specialties have shown significant improvements and retention of general cognitive and procedural skills.[16–19] The non-technical skills such as teamworking, effective communication, self-confidence and patient care have also shown to improve with effective boot camp.[20–22]

Surgical training has changed and resulted in a limited time spent by trainees in the hospital, and training and education issues like the continuity of care, surgical case loads and poor educator–trainee interactions. Innovative techniques such as 'teaching virtual reality simulation surgery over the internet are being used to substitute conventional teaching methods. However, it is not clear whether these will be a complete substitute to teaching knowledge about instruments. In particular, an important characteristic of surgical training is that its educator–trainee interaction cannot be so easily substituted. The interaction between the educator and the trainee, both in the one-on-one setting (in the operating room) and in the team setting, is paramount in both operative and non-operative training. This is the first simulation boot camp that addresses trainees' ability to identify and assemble basic endoscopic urological instruments. Most trainees had a good understanding of the cystoscopy kit, suggesting some urological experience as a core trainee. On the other hand, a majority of the candidates were unable to identify and assemble the resectoscope and urethrotome sets, which is largely explained by the complex nature of the instruments and poor hands-on experience of core trainees for TURP and optical urethrotomy. As it is clearly shown in the table, the USBC improved all participants' knowledge at the end of the course.

A review of the literature shows that structured educational sessions aimed at teaching urological endoscopic equipment are limited. A clear understanding of urological endoscopic equipment is important to minimise hazards. The recent explosion in technology has therefore placed new demands on trainees and educators as how to best teach their residents about the use of such equipment. Teaching basic knowledge of urological endoscopic equipment and anatomy in the operating theatre is not ideal.[23] Furthermore, training residents in the operating room has been shown to increase procedure times and resource consumption costs.[24 25]

Limitations of this article include the skills learning ability of the trainee, and the teaching and assessing ability of the trainer.[19] To address such variabilities, the USBC trainers are undergoing structured Non-technical skills for Surgeons (NOTSS) training.

CONCLUSION

This urology boot camp has addressed gaps in trainees' core equipment knowledge and guided them in improving their knowledge with respect to identification and assembly of cystoscope, resectoscope and urethrotome.

Contributors Study concept and design: VH, CSB Acquisition of data: VH, MK Analysis and interpretation of data: VH, MK, CSB Drafting of the manuscript: MK, VH, SR Critical revision of the manuscript for important intellectual content: SJ, AM, CSB Statistical analysis: MK, VH. Obtaining funding: CSB Administrative, technical or material support: PK, MY, VP, KR, IE, TTSupervision: CSB

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REFERENCES

1 Harrell AG, Heniford BT. Minimally invasive abdominal surgery: lux et veritas past, present, and future. *Am J Surg* 2005;190:239–43.
2 Nasca TJ, Day SH, Amis ES, *et al*. The new recommendations on duty hours from the ACGME Task Force. *N Engl J Med* 2010;363:e3.
3 Aggarwal R. Simnovate: simulation, innovation and education for better healthcare. *BMJ Simulation and Technology Enhanced Learning* 2017;3(Suppl 1):S1–2.
4 Chikwe J, de Souza AC, Pepper JR. No time to train the surgeons. *BMJ* 2004;328:418–9.
5 Scott DJ, Cendan JC, Pugh CM, *et al*. The changing face of surgical education: simulation as the new paradigm. *J Surg Res* 2008;147:189–93.
6 Alyousef SM, Almaani M, Zahraa J, *et al*. The efficacy of medical simulation course on improving ultrasound—guided central venous catheter insertion. *BMJ Simulation and Technology Enhanced Learning* 2015;1:41.
7 Braga MS, Tyler MD, Rhoads JM, *et al*. Effect of just-in-time simulation training on provider performance and patient outcomes for clinical procedures: a systematic review. *BMJ Simulation and Technology Enhanced Learning* 2015;1:94–102.
8 Edwards S, Crouchman C, Hudgell L, *et al*. 45 Simulation using a variety of learning, teaching and assessment strategies: developing competence for professional practice. *BMJ Simulation and Technology Enhanced Learning* 2016;2(Suppl 1):A37–8.
9. Healey K, Kasturi S, Sendeki J, *et al*. *Urology residency applicants: knowledge of endoscopic instruments. 3rd International Meeting "Challenges in Endourology & Functional Urology"*. Paris, 2013.
10 Lehman DS, Phillips CK, Hruby GW, *et al*. An assessment of urologists' training and knowledge of energy-based surgical devices. *BJU Int* 2008;102:226–30.
11 Davis C, Mulligan M. Introduction to endoscopy for urology residents. *MedEdPORTAL Publications* 2015;11.
12 Biyani CS, Hanchanale V, Rajpal S, *et al*. First urology simulation boot camp in the United Kingdom. *African Journal of Urology* 2017;23:258–67.
13 Blackmore C, Austin J, Lopushinsky SR, *et al*. Effects of postgraduate medical education "boot camps" on clinical skills, knowledge, and confidence: a meta-analysis. *J Grad Med Educ* 2014;6:643–52.
14 Burns R, Adler M, Mangold K, *et al*. A Brief Boot Camp for 4th-Year Medical Students Entering into Pediatric and Family Medicine Residencies. *Cureus* 2016;8:e488.
15 Chin CJ, Chin CA, Roth K, *et al*. Simulation-based otolaryngology - head and neck surgery boot camp: 'how I do it'. *J Laryngol Otol* 2016;130:284–90.
16 Fernandez GL, Page DW, Coe NP, *et al*. Boot cAMP: educational outcomes after 4 successive years of preparatory simulation-based training at onset of internship. *J Surg Educ* 2012;69:242–8.
17 Moazed F, Cohen ER, Furiasse N, *et al*. Retention of critical care skills after simulation-based mastery learning. *J Grad Med Educ* 2013;5:458–63.
18 Cohen ER, Barsuk JH, Moazed F, *et al*. Making July safer: simulation-based mastery learning during intern boot camp. *Acad Med* 2013;88:233–9.
19 Eppich W, Cheng A. Competency-based simulation education: should competency standards apply for simulation educators? *BMJ Simulation and Technology Enhanced Learning* 2015;1:3–4.
20 Krajewski A, Filippa D, Staff I, *et al*. Implementation of an intern boot camp curriculum to address clinical competencies under the new Accreditation Council for Graduate

Medical Education supervision requirements and duty hour restrictions. *JAMA Surg* 2013;148:727–32.
21 Ravindran S, Dimmock V, Mitchell S, *et al*. O60 Enhancing general medical higher specialty training – delivery of a dedicated inter-professional pilot simulation course focussing on non-technical competencies. *BMJ Simulation and Technology Enhanced Learning* 2017;3(Suppl 2):A39.
22 Stewart-Parker E, Martinou E, Galloway R, *et al*. 0101 Developing non-technical skills through simulation: designing a course to improve patient safety. *BMJ Simulation and Technology Enhanced Learning* 2014;1(Suppl 1):A20.1.
23 Ceponis PJ, Chan D, Boorman RS, *et al*. A randomized pilot validation of educational measures in teaching shoulder arthroscopy to surgical residents. *Can J Surg* 2007;50:387–93.
24 Puram SV, Kozin ED, Sethi R, *et al*. Impact of resident surgeons on procedure length based on common pediatric otolaryngology cases. *Laryngoscope* 2015;125:991–7.
25 Taravella MJ, Davidson R, Erlanger M, *et al*. Time and cost of teaching cataract surgery. *J Cataract Refract Surg* 2014;40:212–6.