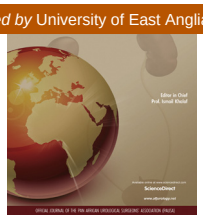
African Journal of Urology (2017) **xxx**, xxx–xxx

Official journal of the Pan African Urological Surgeon's Association
web page of the journal

www.ees.elsevier.com/afju
www.sciencedirect.com



Education
Original article

First Urology Simulation Boot Camp in the United Kingdom☆,☆☆

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Received 29 December 2016; accepted 13 March 2017
Available online xxx

KEYWORDS
Simulation;
Boot camp;
Training;
Urology;
Medical education;
Technical skills;
Non-technical skills;
Surgical education

Abstract

Objective: Simulation is now firmly established in modern surgical training and is applicable not only to acquiring surgical skills but also to non-surgical skills and professionalism. A 5-day intensive Urology Simulation Boot Camp was run to teach emergency procedural skills, clinical reasoning, and communication skills using clinical scenario simulations, endoscopic and laparoscopic trainers. This paper reports the educational value of this first urology boot camp.
Subjects and methods: Sixteen urology UK trainees completed pre-course questionnaires on their operative experience and confidence level in common urological procedures. The course included seven modules covering basic scrotal procedures, laparoscopic skills, ureteroscopy, transurethral resection of the

☆ Abstract was presented at the EAU Congress Munich abstract. Eur Urol Suppl 15(3);e357 (2016).
☆☆ Course report was published in the European Urology Today March/May 2016, Page 29.

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Peer review under responsibility of Pan African Urological Surgeons' Association.

http://dx.doi.org/10.1016/j.afju.2017.03.002

Please cite this article in press as: Biyani CS, et al. First Urology Simulation Boot Camp in the United Kingdom. Afr J Urol (2017), http://dx.doi.org/10.1016/j.afju.2017.03.002

prostate and bladder tumour, green light laser prostatectomy, familiarisation with common endoscopic equipment, bladder washout to remove clots, bladder botox injection, setting up urodynamics. Emergency urological conditions were managed using scenarios on SimMan®. The main focus of the course was hands-on training using animal models, bench-top models and virtual reality simulators. Post-course assessment and feedback on the course structure and utility of knowledge gained together with a global outcome score was collected. **Results**

Overall all the sections of feedback received score of over 4.5/5, with the hands-on training on simulators getting the best score 4.8/5. When trainees were asked "The training has equipped me with enhanced knowledge, understanding and skills," the average score was 4.9/5.0. The vast majority of participants felt they would recommend the boot camp to future junior trainees.

Conclusion: This first UK Urology Simulation Boot Camp has demonstrated feasibility and effectiveness in enhancing trainee's experience. Given these positive feedbacks there is a good reason to expect that future courses will improve the overall skills of a new urology trainee.

Introduction

"*There is no excuse today for the surgeon to learn on the patient*" [1]

Changes in health care within the National Health System have had a profound impact on the number of hands-on surgical training opportunities that are available to urology trainees. The changeover from core surgical trainee (CT) to first-year (ST3) urological specialty trainee can be a stressful time as they develop anxieties related to their clinical skills, accountabilities and expectations [2]. Trainees join the program with varying levels of knowledge and ability of procedural skills and simulation based learning is one means to assess and improve proficiency. Various higher specialty training programmes provide their newly appointed trainees with an acclimatization period to help prepare for their new environment and training. The learning content and length of these training sessions differ commonly. There is little accord on what the perfect early on educational modules ("bridging the gap") ought to incorporate. In a study, authors introduced a 9-week simulation-based course for surgical interns and trainees demonstrated a statistically significant correlation between cognitive and procedural skills assessments with subjective and objective clinical performance evaluations over the 4 years [3]. A 10-day structured program with didactic lectures, online modules, simulation, and mock clinical scenarios for the first-year Obstetrics and Gynecology residents showed improvement in confidence level (cognitive skills (2.9 vs 3.9, $P < 0.05$) and technical skills (3.9 vs. 4.6, $P < 0.05$)) [4]. Orientation is the planned introduction of new junior doctor to their jobs, required skills, and work ethics. It is an important task to minimise their anxiety and facilitate them to become a competent member of a team. Interestingly, there is little in the urology literature examining the impact or most appropriate structure of these programs.

Given that an ever-expanding complement of new surgical technologies increases the number of skills trainees are expected to acquire during training years, the interface between core surgical training and urology specialty training provides an opportunity for early skill development with the goal of achieving the proficiency levels necessary to optimise patient care, operative experience, and skill refinement. Additional educational provision has traditionally been by the way of short courses and there is a wide selection to choose from.

In UK, once a student graduates from medical school a further 2-year period of foundation training is done to acquire the general competencies to work as a junior hospital doctor. This will involve working on wards with nurses and allied health professionals and delivering day to day medical care to in and out patients. Having completed the required foundation in the practice of hospital medicine, the next stage involves 2 years of core training either in surgery or medicine. Core surgical training lasts two years and provides training in a hospital in a range of surgical specialties and trainees are expected to take the examination to achieve membership of the Royal College of Surgeons (MRCS) or equivalent. For surgical specialty training, core trainees are invited to apply for the specialty training post through a national selection process. If successful, trainee is allocated a national training programme number and joins a regional "rotation" as a Specialty Trainee (ST3—designating the fact that is the third year of a seven-year formative training programme and finish as ST7, STs are often called registrars [resident]).

We have created a curriculum for a "boot camp" to develop urological skills proficiency among core surgical trainees entering the UK urology training scheme. This curriculum emphasises attaining proficiency on basic endoscopic urological procedures, common urological emergency surgical procedures and non-technical skills.

What is a boot camp? In the context of medical education—"A boot camp is a focused course designed to enhance learning, orientation, and preparation for learners entering a new clinical role. This is achieved through the use of multiple educational methods with a focus on deliberate practice with formative feedback" [5].

Subjects and methods

We started with a general needs assessment using a questionnaire to a small group of newly appointed ST3 urology residents. The sur-

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Table 1 Course curriculum.

1a

Day	Procedures							
Procedures	Circumcision Scrotal examination Testicular fixation Hydrocele Suprapubic catheterisation (SPC)		Bowel anastomosis Stoma formation		Basic lap skills Access Lap trainer box E-BLUS exercises Lap mentor exercises		Rigid and flexible ureteroscopy TURP TUBT Green Light laser prostatectomy	
Model	Bulls' Scrota Circumcision and SPC Model from Limbs and Things		Pig's bowel		EBLUS exercises on Lap trainers. LapMentor		Bench top models for rigid ureteroscopy UroMentor TURMentor (TURP/TURBT)	
	AM 8:30 to 12:30	PM 13:00 to 15:00	AM 8:30 to 12:30	PM 13:00 to 15:00	AM 8:30 to 12:30	PM 13:00 to 15:00	AM 8:30 to 12:30	PM 13:00 to 15:00
Friday 18th September	A	B	C	D	B	C	D	A
Saturday 19th September	C	D	A	B	D	A	B	C

1b

Day	Procedures							
	Scenario		Botox, urodynamics TOT/TVT		Cystoscopy, stent insertion Bladder wash out, Instruments, LASER Energy source talk		Rigid and flexible ureteroscopy TURP TUBT Green Light laser prostatectomy	
Model	SimMan 3G and actors		Synthetic models		Synthetic models, synthetic clots, original equipment		Bench top models for rigid ureteroscopy UroMentor TURMentor (TURP/TURBT)	
	AM 8:30 to 12:30	PM 13:00 to 15:00	AM 8:30 to 12:30	PM 13:00 to 15:00	AM 8:30 to 12:30	PM 13:00 to 15:00	AM 8:30 to 12:30	PM 13:00 to 15:00
Sunday 20th September	A	B	C	D	B	C	D	A
Monday 21st September	C	D	A	B	D	A	B	C

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vey listed several potential topics for procedure simulation, but also focused on duration of the course its funding and when to implement the course. A 5-day "Urology Simulation Boot Camp" was held in September 2015, prior to starting urology training post in October 2015. For this pilot course we restricted the participants number to 16 trainees. The 16 trainees were divided into 4 equal groups and rotated through each module (Table 1a, 1b). Each module was of 4-h duration and included a very short oral commencement presentation or video followed by face to face hands on training. The participants were taught and supervised by experienced consultants. Approval was obtained from the Urology Specialty Advisory Committee (SAC) and all participants gave informed consent to participate in the study. The content and delivery of each module were based upon the information derived from survey of trainees and discussion with faculty. In addition, skills recommended for ST3 in the curriculum for urology training were included [6,7]. The course included intensive training in technical (30 h over 5 days) and non-technical skills (4 h over 5 days). The aim was to provide hands on experience in common urological procedures in addition to enhancing professional development by improving ability to solve problems, think creatively and independently, and communicate clearly with patients. The added dimension of targeted training on state of the art virtual reality simulators (TURPMentor, LapMentor and UroMentor) made this course unique [8–10]. By the end of the course each delegate had performed 5 procedures each in transurethral resection of prostate (TURP), transurethral resection of bladder tumour (TURBT) and ureteroscopy (URS) and basic laparoscopic skills.

Pre-course information — Within the course manual, video-links and website links were provided along with a breakdown of each practical station in terms of objectives, indications, contraindications, critical procedural steps and potential complications using information from the British Association of Urological Surgeons (BAUS) consent forms [11].

Module 1 — This module was designed and dedicated to provide a uniform formal approach to essential urological emergencies and basic genital procedures. The module included (a) Scrotal examination on a model (Limbs and Things, Bristol, UK), (b) Scrotal exploration including a testicular fixation and hydrocele repair (bulls' scrotum), (c) Suprapubic catheterisation (Limbs and Things) and (d) Circumcision (Limbs and Things).

Module 2 — Although all participants had done a bowel anastomosis as part of a basic surgical skills course, this module was used to reinforce bowel anastomosis techniques. In addition, urostomy formation, ureteric and bladder repair were taught on animal models.

Module 3 — In this module didactic content included physiological changes and port placement during laparoscopy. The European Training in Basic Laparoscopic Urological Skills (E-BLUS) exercises were used for technical skills training [12]. In addition to this, nine basic laparoscopic skills exercises on the LapMentor were also included to hone their skills further.

Modules 4 and 8 — As endoscopic procedures are integral part of urology clinical workload 8 h were utilised for teaching endourology. Bench-top and virtual reality models (UroMentor, TURP/BT Mentor; Simbionix, Airport City, Israel) and Green Light Laser simulator: AMS, Minnetonka, MN, US were used to teach rigid and flexible URS, TURP, TURBT and green light laser prostatectomy.

Module 5 — This half-day module included simulated scenarios related to Emergency Urology and non-technical skills. We used a SimMan® 3G (Laerdal, NY, USA), an actor, a simulated side room, an observation room to run SimMan, a debriefing and observation room for other candidates to watch. Each scenario was 25 min with 25 min for debriefing. Scenarios included renal trauma, infected obstructed kidney, pelvic fracture and haemodynamically unstable patient after renal trauma. The simulation scenarios were based around managing patients admitted to hospital with an acute urological problem.

We focused on technical knowledge related to management of the urological problems or emergencies as well as interpretation of imaging and blood results and on non-technical skills. The non-technical skills focused on judgment, teamwork, decision-making, communication skills both face to face with nursing staff, patient and relative, as well as over the phone. There was a faculty member responsible for being the SimMan's voice. All candidates had an introduction to the ward environment and to ensure they understood how the mannequins work with its limitations and what to expect from this scenario. All mannequins were dealt with as if they are real patients. Distractions and challenges were added to replicate the complexity of the clinical environment. The set-up allowed direct feedback from the team, the patient as well as objective feedback from other faculty members observing. Filming allowed other participants and faculty to observe in another room. One of the faculty members sat in with the rest of the candidates observing the scenario and facilitating discussion points.

Module 6 — The session included a mix of didactic tutorials with discussion and practical hands-on-stations on intravesical botulinum toxin, urethral bulking agents, mid-urethral tapes and practical urodynamics. We also felt that a basic introduction to urodynamics with hands-on practice of setting up the equipment is lacking in a lot of current clinical training and would allow the trainees to gain the most from their future experience of urodynamics (Fig. 1A–D).

Module 7 — This module was designed to cover endoscopic equipment knowledge, principles of laser and harmonic, cystoscopy and stent insertion, cystoscopy and clot evacuation. Participants were assessed about their knowledge on basic cystoscope, resectoscope and urethrotome equipment. Artificial clots made up from fybogel were used to perform bladder clot evacuation (Fig. 2a and b).

Stepping up from core surgical trainee to specialty training (ST) grade may be perceived as a daunting experience with added responsibility, professional attitude and leadership skills expected from early on in their ST training. We organised pre-dinner evening talks on medico-legal aspects delivered by a barrister, an interactive talk from the Vice President of the Royal College of Surgeons of England on professionalism and a talk on human factors by a leading national expert.

Course assessment

It was vital to assess all participants regularly and continuously throughout the course. Assessment tools were designed to test performance in three domains: knowledge, technical skills and non-technical skills. Knowledge assessment was assessed via 20 multiple-choice questions (MCQs) and were selected from all 8 modules. Each module Lead was asked to provide 5 MCQs. A total

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Figure 1 (A) Circumcision (Limbs & Things), (B) Stoma formation, (C) Human factor training with clinical scenario and (D) Urethral bulking agent model.

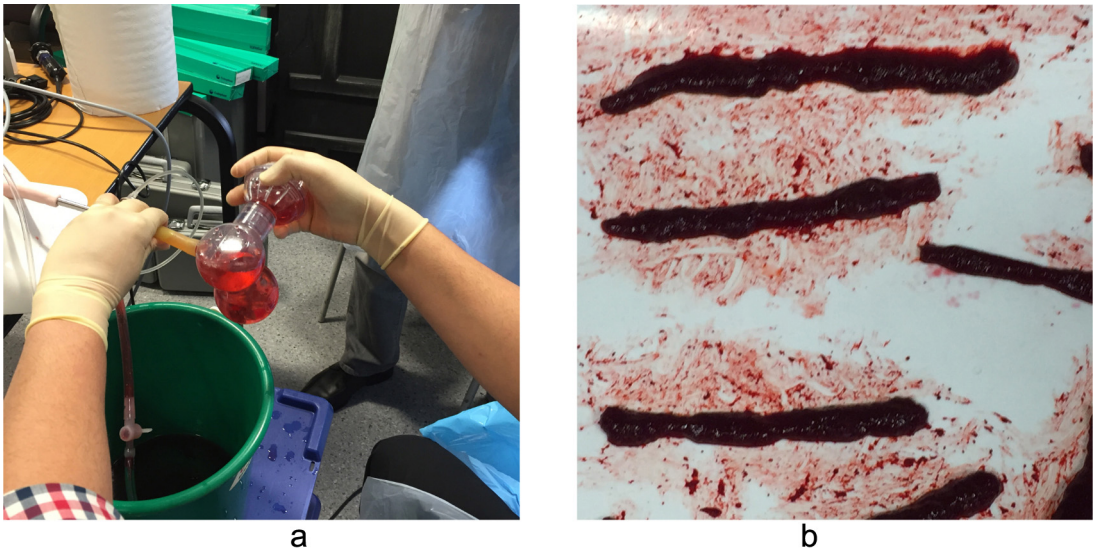

Figure 2 Bladder washout simulation with artificial clots (a and b).

of 20 MCQs were selected and same set of questions was used during pre and post course assessment. The questions were completed prior to and then repeated upon completion of the course. Technical skills—prior to the course, all delegates were asked to complete a pre-course questionnaire assessing previous experience in performing the procedures included in the course and their level of confidence to perform each skill prior to the course (self-assessment) using a modified Likert Scale (1–5). In addition, procedure specific

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Table 2 Assessment and evaluation forms completed.

At registration	Consent form (delegates & faculty) Pre-course experience Pre-course MCQ
Module 1 (Circumcision, SPC, Acute scrotum)	Continuous Assessment Score Peer observation of Teaching Assessment of scrotal model Circumcision Competency Evaluation SPC Competency Evaluation Session Feedback
Module 2 (Bowel anastomosis, urostomy, ureteric injury)	Continuous Assessment Score Peer observation of Teaching Global rating scale for bowel anastomosis Session Feedback
Module 3 (Basic lap skills)	Continuous Assessment Score Peer observation of Teaching E-BLUS score Session Feedback
Modules 4 & 8 (Ureteroscopy, TURP, TURBT, GLL)	Continuous Assessment Score Peer observation of Teaching Global Assessment of Urological Endoscopic Skills (GAUES) Session Feedback
Module 5 (Scenarios)	NASA Task Load Index Continuous Assessment Score Session Feedback
Module 6 (TVT, TOT, BOTOX, Urodynamics)	Continuous Assessment Score Peer observation of Teaching TVT assessment Session Feedback
Module 7 (Laser, Harmonic, Equipment, bladder wash out and stenting)	Continuous Assessment Score Peer observation of Teaching Cystoscopy Evaluation Form Urethrotomy Evaluation Form Resectoscope Evaluation Form Session Feedback
Assessment day	8 stations
Post-course	MCQ Delegate course feedback Faculty course feedback

assessment forms were used to assess technical skills. Non-technical skills—a generic formative assessment form was used to score participants at all stations during rotation through the session [13]. Faculty members scored participants on knowledge, technical abilities and non-technical skills, with the latter focused on teamwork skills.

All delegates were assessed on (a) ureteroscopy on UroMentor (b) TURP on TURmentor (c) circumcision (d) suprapubic catheterisation (e) cystoscopy and ureteric stent insertion (f) knowledge and assembly of instruments (g) basic laparoscopic skills and (h) Botox injection & TVT insertion. There were 2 stations for each skill, and a faculty member on each station assessed each delegate. An objective structured tool was used for assessment and performance and was graded according to the Intercollegiate Surgical Curriculum Programme Performance level (Appendix) [7]. We allocated 25 min for the skill and 5 min for the candidate feedback. At the end of the assessment a post-course MCQ test was done. Delegates were asked to repeat the survey to assess their level of confidence on procedures after the course. Each participant was given feedback on his or her strengths and areas they should attempt to improve.

We performed a 6-week post-course survey to assess whether and to what extent participants found each module useful. A feedback form to assess each session was designed for course evaluation (Table 2). A perception survey was done at the conclusion of the boot camp, and participants were asked to assess curriculum topics and overall value of the boot camp using a Likert-type scale. In addition, the faculty was asked to provide their feedback on the course. A follow-up questionnaire was performed for all course participants 6 weeks and 3 months after course.

Peer observation of Teaching (PoT)—Collaborative reflection is a practice in which ideas and experiences are exchanged with others to enhance professional practice. It is considered essential for enhancing the quality of reflection. We encouraged faculty members to consider completing a PoT during the course [14,15].

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Results

Thirteen newly appointed urology residents (from Urology National selection) and three trainees looking for a National training number (NTN) in the urology scheme participated in the pilot course. These 16 participants included 11 males and 5 females trainees. Multiple Choice Questions (MCQs): apart from one trainee, all trainees demonstrated an improvement in knowledge (Fig. 3).

Procedure confidence

Self-reported pre-course confidence scores for all the participants showed a median score of 3 (2–4) across all surveyed skills. The highest reported confidence scores were in flexible and rigid cystoscopy. Following the boot camp experience, median confidence scores increased to 4 (3–5). The improvement in confidence scores was statistically significant ($p < 0.00001$, paired t test)

Follow up surveys about clinical exposure to procedures and confidence scores was carried out at six weeks and twelve weeks respectively. The response rate at six weeks was 75% (12/16). Except one trainee, none had exposure to major open or laparoscopic procedures at 6 weeks. The feedback (Fig. 4) showed that the median confidence scores had remained at post-course levels (4, range 2–5) for all the commonly performed peno-scrotal and endourological procedures although the overall score deteriorated to pre-course levels 3. At twelve weeks, the response rate was 63% (10/16) and a similar trend was seen, with the median confidence scores for all the commonly performed open and endourological procedures remaining unchanged at post course levels 4. The change in the overall confidence scores reflects the clinical exposure, as most of the trainees in their initial years' placements have focused training on core urological procedures with limited exposure to major and complex open/endoscopic procedures.

Course satisfaction

Overall all the sections of feedback received a score of over 4.5/5, with the hands-on training on simulators getting the best score 4.8/5. When trainees were asked "The training has equipped me with enhanced knowledge, understanding and/or skills," the average score was 4.9/5.0. The vast majority of participants felt they would recommend the boot camp to future Urology trainees (Table 3).

Table 3 Course feedback.

Structure	4.6
There was a clear introduction	4.6
The aims & objectives were clearly stated	4.6
The course/material was well organised	4.5
Course	4.4
What did you think of the course/did you enjoy it?	4.6
How useful was the pre-course reading material?	3.9
Overall support from faculty	4.9
Videos	4.1
How useful was the assessment?	4.5
New knowledge, ideas, learning	4.7
I feel that my personal learning objectives were met	4.8
The training has equipped me with enhanced knowledge, understanding and/or skills	4.9
The training covered everything I had expected	4.8
Assessment, resources & MCQs enhanced learning	4.4
How useful were the practical sessions	4.7
High fidelity virtual reality simulators	4.6
The simulation scenario	4.8

Discussion

Rationale for simulation training and boot camp

Recent General Medical Council (GMC) guidance states that "Learners *must* have access to technology of enhanced and simulation based learning opportunities within their training programme blue printed against their curriculum" This statement came into effect on 1st January 2016 [6].

There is, therefore, an imperative need to be innovative with current surgical training. Various studies have demonstrated profound benefit of targeting junior trainees for the skills workshop, therefore, we have addressed this through a novel urology boot camp open to newly appointed ST3 trainees [16,17].

Other specialties have used boot camp and reported a very effective learning process [18–20]. The results of our pilot Urology Simulation Boot Camp have demonstrated the feasibility of conducting a simulation-rich hands on course to ST3 urology trainees. The initial data of the present study suggest that the boot camp was an efficient way of transferring knowledge, technical and non-technical skills to newly appointed urology residents. In addition, increasing level of confidence of trainees in procedural skills were also observed. Participants were exposed to a range of learning tools by incorporating synthetic and animal models, innovative models for urinary stoma, virtual reality simulators, high-fidelity models for scenarios with a debriefing session, and didactic lectures and small group discussions. For ureteroscopy participants were exposed to low-fidelity model first followed by a training on a high-fidelity simulator. It has been suggested that skills gained on a low-fidelity model transfer to improved performance with a high-fidelity simulator and probably such a training may transfer into the clinical practice [21,22].

Strengths of the boot camp

It appears that majority of topics and skills were at the right level. Participants enjoyed 1:1 teaching and many delegates in feedback mentioned this. Virtual reality simulators (VRS) were useful tool to assess progression [23]. Scenario session was very well received. Overall, all the modules feedback received a score of over 4.5/5, with the hands-on training on simulators getting the best score 4.8/5. When trainees were asked "The training has equipped me with enhanced knowledge, understanding and/or skills," the average score was 4.9/5.0.

The course assessment process worked well. Course evaluation revealed that feedback was very positive and all participants passed the MCQs and demonstrated gain in competency. The faculty concerned undertook assessment during each module. This covered technical and non-technical aspects such as judgment and decision-

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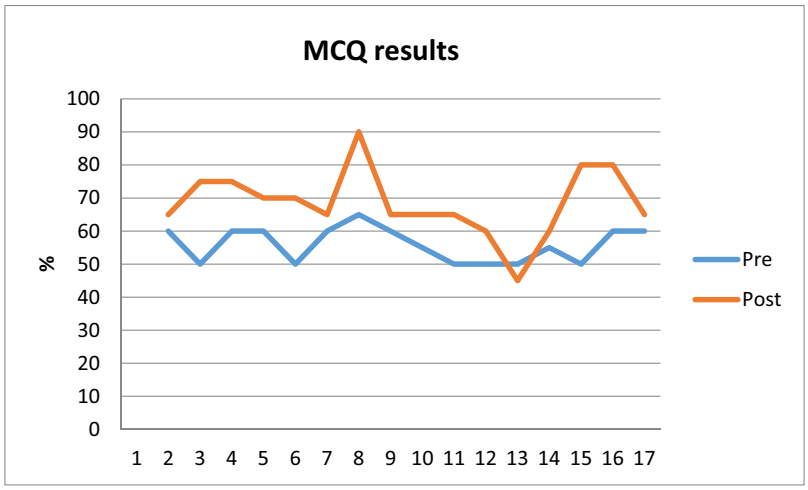

Figure 3 Multiple Choice Questions Test results.

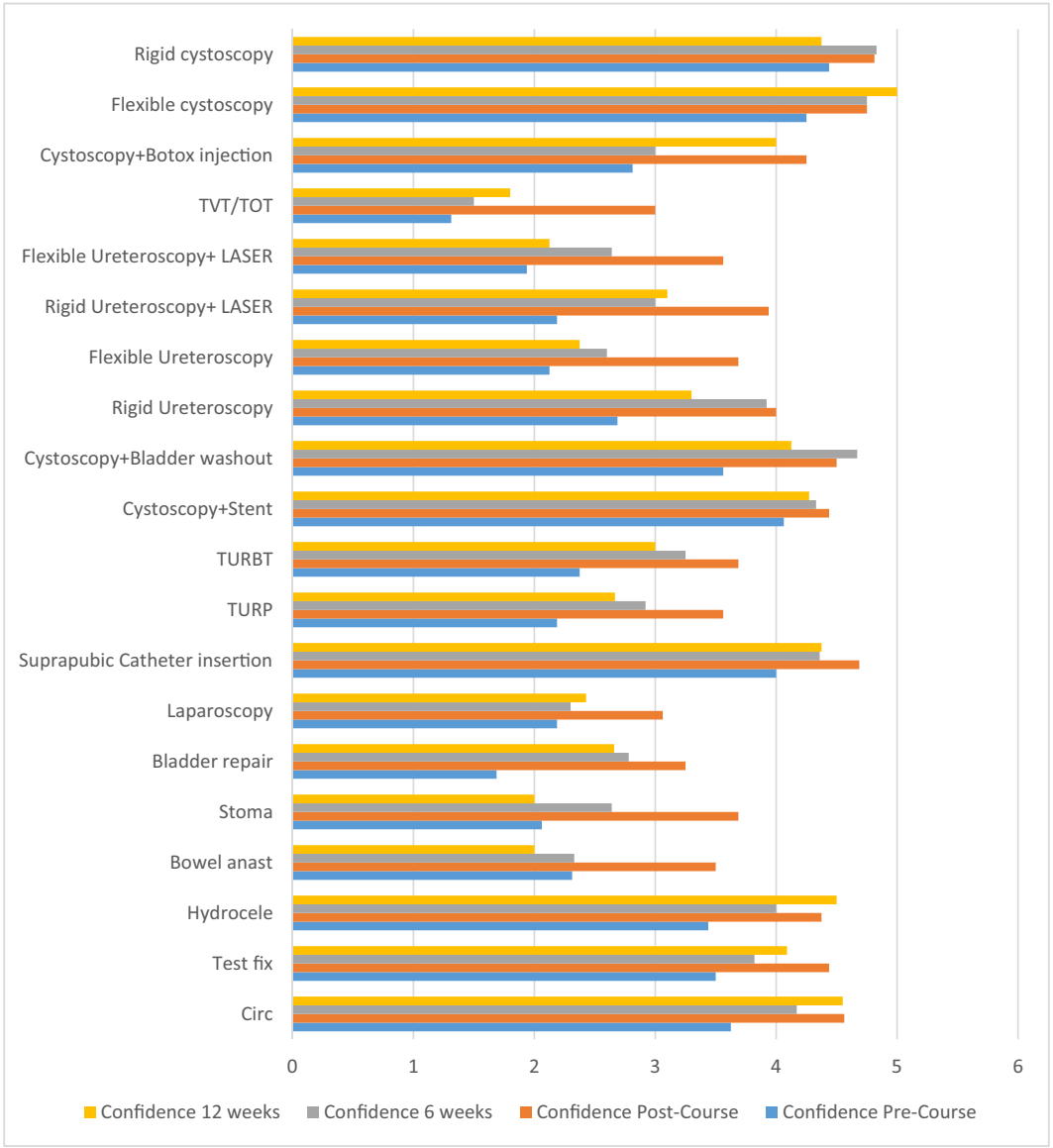

Figure 4 Procedure confidence level.

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making, communication and teamwork. The need for small group assessment was essential to identify poorly performing trainees and rectify problems quickly.

Each module was found to be relevant and was delivered with an excellent time management. Evening talks on professionalism in surgery, medico-legal matters and human factors provided an extra facet to the course.

Limitations and areas of future improvement

Our feedback showed that circumcision and SPC stations were felt to be too simple for an ST3 trainee and no competence progression was seen with these procedures. This is partly because most core training programme cover aspects of it and trainees get exposure and experience in this during their early training years. Based on trainee request for future courses, we plan to change session to include troubleshooting with catheterisation and penile emergencies. The need for new more versatile simulators (both bench models and virtual simulators) not only need to be educational but also need to be economical for a wider accessibility and use by all trainees. For a long-term viability and sustainability of this course, the cost of running it need to factor in the kit and equipment, different types of simulator models used along with the logistic, manpower and administration support needed for it. An individualized course and trainer feedback to improve it and national training committee and local deanery support is a must to ensure all new trainees have to do it as a part of their mandatory training curriculum. This will ensure that all trainees coming in the training programme are benchmarked against the same national standard and the boot camp will be the first step in their gateway for a long-term successful career ahead.

Conclusions

Results from this pilot study demonstrated that the urology boot camp positively affected trainee's confidence. We feel that close intensive supervision and regular feedback were essential to supporting these improvements. Our proposed curriculum provides a broad exposure to core skills required at the ST3 level and should be offered and made available to all trainees.

Authors contributions

Data Collection — VH, SR, MG, BS, RG, PK, FR, KR.

Manuscript preparation — CSB, VH, BS, AM.

Review and comments — SB, VH, SJ, IE, JC, PC, TT.

Conflict of interest

None declared.

Source of funding

Yorkshire and the Humber Deanery, Storz, Coloplast.

Acknowledgements

We are grateful to all faculty members for their fantastic support, ideas and encouragement throughout the preparation. We could not have done without the excellent support from Joanne Johnson, Margaret Flanagan and Mandy Sedler, Medical Education, Leeds Teaching Hospital.

In addition, we would like to acknowledge excellent support from Mr. Luke Gordon, (Urology Business Manager, Karl Storz Endoscopy (UK) Ltd.), Steve Bridgewater (Karl Storz), Mr. Kevin Brown & Roy Norum (OKB Medical, Simbionix), Mr. Jonathan Cheetham (Allergan), Mr. Robin Benson (Coloplast), Ms. Sarah Taylor (AMS), Ms. Emma Kershaw (Ethicon), Mr. Marek Druzynski (Mediplus), and Jamie Barr (Dantec Dynamics).

We are also indebted to Mr. David Wilkinson, Postgraduate Dean, Health Education Yorkshire and the Humber Deanery for his encouragement and support.

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Please cite this article in press as: Biyani CS, et al. First Urology Simulation Boot Camp in the United Kingdom. Afr J Urol (2017), http://dx.doi.org/10.1016/j.afju.2017.03.002