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Urology training: past, present and future

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What's known on the subject? and What does the study add?

Dedicated training hours for surgeons are falling as the complexity of techniques and patient expectations are increasing. Urologists therefore need to train in more sophisticated and effective ways.

This article looks at past and current urological training and suggests emerging and innovative ways to teach the next generation of urologists.

Since 2004 the estimated available training time, for all doctors, has dropped from 30 000 h to ≈8000 h. By decreasing the initial stages of the learning curve, medical simulation has the potential to compensate for the reduced time available to train urologists. The current urological training pathway consists of 2 years of foundation year training, 2 years of core surgical training, followed by 5 years of specialty training. Training time pressures and the expansion of treatment techniques have led to a trend towards increased sub-specialization in urology. To optimize patient care, training programmes must evolve, taking into account several key issues and in accordance with advances in urological care.

KEYWORDS

urology, education, simulation, training, assessment

INTRODUCTION

A urological training programme produces trained surgeons equipped with the knowledge, skills and attitudes to eventually become consultant urologists. Modern urology comprises a range of inter-related sub-specialties, which include urological oncology, endourology, female and reconstructive surgery and andrology (Table 1). In all sub-specialities rapid medical and surgical developments, e.g. laparoscopic, robot-assisted and single-port surgery are occurring. As the nature of the work is changing, the definitions of competency in urology are also changing. It is vital that urological training constantly adapts to these changes in practice to ensure that standards are maintained and patient safety is not compromised.

With the introduction of the European Working Time Directive in 2004, the training time available, for all doctors, is estimated to have dropped from 30 000 h to only 8000 h [1]. Furthermore, with earlier diagnosis, progress in minimally invasive surgery and pharmacological advances, fewer patients require major urological surgery [2]. The volume-based traditional ('see one, do one, teach one') Halstedian model of training is therefore likely to play a smaller role in future training. Surgeons are constantly looking for novel methods of effective training that are valid and reproducible. With quality assurance targets in place and rising patient expectations and litigation cases, it is becoming increasingly necessary to have acquired basic technical skills before operating on patients. This has lead to huge interest in the field of medical simulation.

Healthcare politics is inevitably going to have a role in shaping the future of urological training. The government has indicated an increasing shift in the management of certain urological conditions and surgical procedures from larger centres to smaller units, in primary care if possible. In view of this, the aim of the present article is to highlight the future direction of urological training. Initially we report a description of the current nature of urological training, and then we critically appraise some of the newer training methods. Finally we will make recommendations as to how training might be improved in future.

CURRENT UROLOGICAL TRAINING

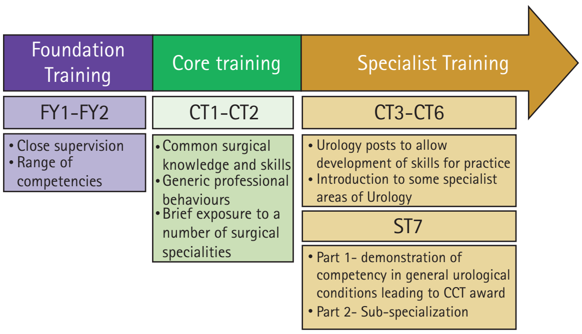
The career course followed by a prospective urologist is shown in Fig. 1. It comprises 2 years of foundation year training, and 2 years of core surgical training, followed by 5 years of specialty training [3]. After this time, if they have passed an exit examination, trainees are eligible to apply for a Certificate of Completion of Training. This certificate enables trainees to be on the General Medical Council's (GMC) specialist register, so that they may apply for consultant or specialist posts. An additional and optional final stage of sub-specialty training is a fellowship period, which allows consultant urologists to extend their skills and competences in specific areas.

The standards for surgery are set by the Royal College of Surgeons, which operates through the Joint Committee on Surgical Training and its nine Specialty Advisory Committees [4]. The key bodies that regulate trainees and training are the GMC and the Healthcare Commission. The Intercollegiate Surgical Curriculum Programme (ISCP) 2011 describes defined curricula for each stage of urological training [3]. These highlight the

TABLE 1 Sub-specialities in urology

Sub-specialty	Description	Hospital
Andrology	Study of the male reproductive system or problems of the male reproductive system and urological problems unique to men.	University College Hospital
Endourology/ Laparoscopic surgery	Minimally invasive surgery	Guy's Hospital, King's College Hospital, Nottingham City Hospital, Charing Cross Hospital, Royal Free Hospital, Broomfield Hospital, Eastbourne District General Hospital, Royal Surrey County Hospital, Royal Preston Hospital
Female urology	Study of disorders specific to the female urological tract and sexual health	Guy's Hospital, Addenbrookes Hospital, Broomfield Hospital, Christie Hospital
Urological oncology	Study of urological cancers, notably kidney, bladder, prostate and testicular cancers	Leicester General Hospital, Norfolk and Norwich University Hospital, University College Hospital, Freeman Hospital
Paediatics	Study of urological disorders in children, including abnormalities of the urinary tract, tumours (both benign and cancerous) in children, disorders of urogenital development	Guy's Hospital, Addenbrookes Hospital, Royal Marsden Hospital, Royal Surrey County Hospital, Freeman Hospital, Arrowe Park Hospital, Royal Liverpool Hospital, Salford Royal Hospital, Christie Hospital, Royal Preston Hospital
Transplantation	Study of kidney transplantation	Addenbrookes Hospital, Great Ormond Street Hospital, Royal Victoria Infirmary Hospital
Trauma and reconstruction	Diagnosis and treatment of patients with trauma to the genitourinary tract, and reconstruction and repair of injuries	Royal Free Hospital, University College Hospital

FIG. 1. The training pathway. FY, foundation year; CT, core surgical training; ST, specialty training; CCT, Certificate of Completion of Training.



competencies required, methods by which this training should be provided, and methods by which training can be assessed. The competencies are divided into three domains: knowledge, clinical skills and technical skills and procedures. There is also a 'professional skills and behaviour' syllabus which is common to all specialties.

Progression through training is now increasingly based on the achievement of outcomes which are competency-based rather than time-based. This change reflects recognition of the fact that experience does not necessary relate to clinical ability. The ISCP 2011 lays out the various methods by which training currently occurs:

- Informal training through clinical cases, audit and observing/shadowing senior doctors.
- Workplace training through theatre lists, outpatient clinics and ward rounds. Trainees initially observe and then practise, first with supervision and then independently.
- Self-directed learning through study groups, journal clubs and peer review

There is an emphasis on informal and formal regular assessment with feedback to form an integral part of the training process. Assessment methods include surgical direct observation of procedural skills in surgery, procedure-based assessment, a mini-clinical evaluation exercise and case-based discussion.

NEW DEVELOPMENTS IN TRAINING AND ASSESSMENT

Medical simulation has the potential to supplement workplace training, in order to decrease the initial stages of the learning curve in an environment that does not compromise patient safety [5]. In the field of urology, where minimally invasive surgery plays a large role, the concept of simulation has deservedly received significant interest. In newly developed techniques, such as robot-assisted surgery, there is a particular problem with training through observation because the patient-side assistant is placed away from the console surgeon and is unable to directly observe the operating steps that are coupled to surgical hand movements. This is an area where simulation training is likely to be particularly useful to ensure that trainees become quickly proficient.

Simulators can be of three types [6,7]: (i) Mechanical simulators (dry-lab training), which are boxes in which organs or objects are placed and manipulated using surgical instruments. Trainees are observed for assessment purposes; (ii) Hybrid simulators, which also involve a box containing objects and organs, but performance is assessed by a computer that can give feedback according to programmed metrics. Simple metrics in urology include time of procedure, economy of movement and collisions. More complex metrics include diathermy errors, clip placement errors and grasping errors. These metrics are defined by expert surgeons who identify critical errors for a procedure and ways to prevent or correct an error; and (iii) Virtual reality (VR) simulators, which allow trainees to interact with three-dimensional computer databases in real time. Trainees manipulate computer-generated images and receive feedback on performance. With CT/MRI, there is now even the technology to practise operations before the real procedure. This practice has the potential to enhance patient safety in future.

Simulation training has been shown to be safe, time-efficient and cost-effective [8]. It has been promoted by the London Deanery's Simulation and Technology Enhances Learning Initiative, or STeLI [9]. It has been shown to be superior to traditional clinical medical education in achieving specific skill acquisition goals and is widely accepted by surgical trainees as a new training tool [12]. Several randomized controlled trials have shown that surgical simulation can improve operating room performance [11,12]. As trainees become more skilled, simulator tasks of increasing difficulty can be set. Surgical simulation could possibly shift the learning curve for both proficiency and expertise [13]. Consequently, there is a growing consensus of opinion amongst urologists and surgeons that simulation should be a compulsory part of training [14,15]. Furthermore, it may become a part of the revalidation process for practising clinicians.

There are currently some barriers, however, to the widespread use of simulation training. 'Dry labs', which involve the use of isolated tissues or organs, lack fidelity. Animal legislation in the UK prohibits the use of 'wet labs', which involve using live or freshly killed animals. VR simulation offers an alternative but the haptics and graphic resolution of VR simulators must be improved.

The simulators described so far mainly relate to training and assessment of technical skills. Simulation can also be used to assess non-technical skills such as knowledge and decision-making abilities. Computer-based interactive systems are currently in the experimental stages. The trainee is presented with a virtual patient and asked to manage treatment. These systems provide immediate feedback and are able to identify the areas of knowledge that need improving, ultimately improving patient care [16].

With advancements in technology it may also be possible to assess the judgment of surgeons during simulation training [17]. Eye-tracking technology is well developed with regard to advertising and marketing but it is currently not in use for surgical training and assessment. Eye-tracking technology could project a dot on the computer monitor that determines where the trainee is looking [18]. By simultaneously recording the hand movements, e.g. from the da Vinci robot, and comparing hand and eye movements, it could be possible to infer what the trainee is thinking.

Urology training could also be revolutionized by telementoring techniques [19]. Telementoring allows an experienced surgeon to assist or direct a junior operating at a distance by indirectly observing procedures and offering advice or directing surgical steps. The possibility of using this technology regionally, and even internationally, to improve access to specialist surgeons has massive potential to reform the nature of surgical education and patient care [20].

CONTENTS OF TRAINING

INCORPORATING NEW DEVELOPMENTS

Training programmes must evolve according to advances in urological care. Since the first successful laparoscopic nephrectomy two decades ago, there has been a revolution in minimally invasive procedures in urology [21]. More recently robot-assisted surgery has flourished and become very popular amongst urologists. The availability of faster broadband could see the progression of telesurgery beyond being just being an experimental tool. Urologists could potentially perform operations in remote locations where it may not have been practical to do so previously, such as on the battlefield. There have also been developments in radiation oncology and pharmacological management of urological problems [22]. The use of laser technology in urology is being increasingly recognized [21]. Whilst some applications are expansions of previous techniques, the majority are recent innovations, which require a different set of skills and have a steep learning curve. The content of training, the method of training and the methods of assessment for these various developments needs to be defined in future urology curricula. The cost of newer technologies makes it crucial that training programmes use these expensive resources effectively [19].

CLINICAL, LABORATORY AND EDUCATIONAL RESEARCH

In the UK there is currently no protected research time within the urology training programme. Like most specialities, urology is increasingly evidence-based and translational research in urology has undoubtedly been responsible for many improvements in urological care.

The Walport Report (2005) was published by the UK Clinical Research Commission and the NHS Modernizing Medical Careers [23]. This document recommended schemes to integrate the development of academic skills at various stages of a clinician's career. The surgical specialties were highlighted as being especially important areas of research. In response to this, the BAUS recently established a fifth sub-specialty entitled 'Academic Urology', reflecting the importance of research in urology [24]. It will be important to ensure that the research is conducted in a variety of urological sub-specialties. Close relationships between academic and clinical urologists will be necessary to facilitate the production of high-quality translational research.

Whether or not a trainee produces revolutionary research, it can be argued that the process of conceptualizing a research question, designing a study, analysing the results and presenting the work are all valuable skills that every clinician should have. Exposure to research is useful for clinicians to be able to critically appraise information and use evidence-based medicine in their clinical practice; however, faced with public and governing body pressures to achieve high standards of clinical competency in a short time, the expectation that every urologist should also be involved in research during the

TABLE 2 Recommendations for the future of urology training

Recommendations
1. Greater use of validated simulation methods, particularly VR simulation, in core urology training and assessment.
2. Development of curricula for training in newer technologies, e.g. robot-assisted surgery.
3. Protected research time for trainees.

training process is perhaps somewhat impractical.

EVOLVING STRUCTURE OF TRAINING

As training time pressures mount and the array of treatment methods expand, there is a trend towards increased sub-specialization in urology to optimize patient care. The current aim of training in the UK is to provide training to be a consultant urologist, with less exposure to sub-specialist practice than before [11]. It has been shown that fellowships enhance the quality of the urology training programme. In future, urological sub-specialty societies could set the national curriculum for each sub-specialty and define what knowledge and skills should be acquired during fellowship training.

Increasing sub-specialization with time means that procedures such as open-stone surgery, which are not commonly performed, may be carried out in specialist centres by people who have more experience, potentially leading to improved patient care [25]. The disadvantage of this is that sub-specialization means than urologists could become deskilled in a range of procedures that they are not practising regularly. It should be remembered that although the merits of sub-specialization within surgery are thought to be both self-evident and in the interests of the patients, neither of these assertions have been proven [26].

Several key issues have been identified that need to be taken into account when developing urology training programmes [27,28]. Firstly, whilst the number of urological surgical procedures has remained the same, the demand for diagnostic work and consulting has increased significantly. Secondly, the role of consultants within the NHS has changed. As the modern consultant is expected to deliver some of the work that was previously carried out by less experienced members of the team, an expansion in the number of consultants is needed to meet the increased demand for consultant time. Thirdly, the majority of urology departments in the UK consist of four or more consultants, making sub-specialization a requirement.

The changing relationships between primary and secondary care, whereby there is a government-driven shift of care towards primary care could affect urologists. It is possible that future community general urological care will be delivered by general practitioners (who have received additional urological training), instead of being delivered by urologists in a hospital setting [27]. If this is the case, there is a risk that hospital urologists could potentially lose practice of basic procedures. In addition this could lead to changes in the numbers and types of urology posts available.

CONCLUSIONS

Urology has come a long way in the past few decades and methods of training and assessment are adapting according to these changes. Training and assessment still relies heavily on experience gained from clinical practice. Increasing emphasis on competency-based assessment rather than time or volume-based assessment is crucial. Medical simulation, especially VR and bench-top models, is particularly suited to future training and assessment in urology. Newer technologies such as telementoring and eye-tracking also deserve further evaluation in future training programmes. The cost of these newer technologies, however, may limit their use in the immediate future.

Advances in urological care have meant that that the knowledge and skills required by surgeons today are different from those required previously. This must be taken into consideration when designing new curricula for training urologists. The importance of evidence-based medicine is increasingly being recognized and protected research time in training would allow urologists to develop research skills that may be very valuable for their practice. Table 2 summarises our recommendations for changes to urology training.

The structure of urology training and the number and nature of consultant posts is likely to change. There is a trend towards sub-specialization in urology which will probably continue in the near future. The number of consultant posts will have to increase in response to the increasing responsibility placed on them. Government policies are pointing towards a shift in simple urological procedures to primary care settings (Table 2).

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CONFLICT OF INTEREST

None declared.

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Abbreviations: **GMC**, General Medical Council; **ISCP**, Intercollegiate Surgical Curriculum Programme; **VR**, virtual reality.