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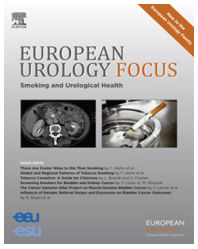

Review – Education

Training, Simulation, the Learning Curve, and How to Reduce Complications in Urology

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Abstract

Context: Urology is at the forefront of minimally invasive surgery to a great extent. These procedures produce additional learning challenges and possess a steep initial learning curve. Training and assessment methods in surgical specialties such as urology are known to lack clear structure and often rely on differing operative flow experienced by individuals and institutions.
Objective: This article aims to assess current urology training modalities, to identify the role of simulation within urology, to define and identify the learning curves for various urologic procedures, and to discuss ways to decrease complications in the context of training.
Evidence acquisition: A narrative review of the literature was conducted through December 2015 using the PubMed/Medline, Embase, and Cochrane Library databases.
Evidence synthesis: Evidence of the validity of training methods in urology includes observation of a procedure, mentorship and fellowship, e-learning, and simulation-based training. Learning curves for various urologic procedures have been recommended based on the available literature. The importance of structured training pathways is highlighted, with integration of modular training to ensure patient safety.
Conclusions: Valid training pathways are available in urology. The aim in urology training should be to combine all of the available evidence to produce procedure-specific curricula that utilise the vast array of training methods available to ensure that we continue to improve patient outcomes and reduce complications.
Patient summary: The current evidence for different training methods available in urology, including simulation-based training, was reviewed, and the learning curves for various urologic procedures were critically analysed. Based on the evidence, future pathways for urology curricula have been suggested to ensure that patient safety is improved.

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1. Introduction

Training in urology is undergoing a shift, with more classical surgical apprenticeship models becoming increasingly outdated [1]. These methods of training lack clear structure and rely on differing operative flow experienced by individuals and institutions [2]. When considering this in the context of globally decreasing training hours due to working time restrictions and the worrying signs this seems to have for patient outcomes, it is clear this shift is necessary [3]. Urology is also in the position of using minimally invasive surgery to a great extent, and that produces additional challenges with steep initial learning curves [4].

The ever-increasing scrutiny faced by surgeons combined with changes in public attitudes towards inexperienced surgeons operating on them also must not be underestimated, with ethical and legal considerations now a common concern [5]. Furthermore, it is becoming increasingly clear that the content of training requires review. We now accept that there is more to being a good surgeon than astute technical ability, with the role of nontechnical skills in operating practice increasingly understood [6]. This review article aims (1) to assess current urology training modalities, (2) to identify the role of simulation within urology, (3) to define and identify the learning curves for various urologic procedures, and (4) to discuss ways to decrease complications in the context of training.

2. Evidence acquisition

A narrative review of the literature was conducted through December 2015 using the PubMed, Embase, and Cochrane Library databases. A broad search strategy was used with the following terms (title/abstract): (*urology* OR *urological* OR *urologist*) AND (*training* OR *simulation* OR *learning curve*). Results were limited to the English language, without restrictions placed. Abstract review was conducted for relevance to the aims of the review, and full text was subsequently analysed. No formal quality assessment of the included studies was performed.

3. Evidence synthesis

This section provides an overview of (1) training modalities in urology, (2) simulation-based training, (3) learning curves for various urologic procedures, and (4) ways to reduce complications in the context of training.

3.1. Training in urology

3.1.1. Observership

Observing another surgeon perform a procedure for the purpose of training has long been common practice. It builds procedural knowledge and allows an individual to ask questions to address gaps in knowledge, providing a vital first step in training programmes [7]. Despite this hugely common practice, little evidence is available in the literature about its effectiveness or how to best utilise this method of training in urology; however, this has not stopped organisations from recommending the use of observership in curricula. Robotic curricula from the European Association of Urology (EAU) and the British Association of Urology (BAUS) state that it should be used as an initial step, allowing for the development of basic principles and knowledge relevant to robotic surgery [8,9]. Its practice, however, is limited to this initial phase of training because it allows limited opportunity for improvement of technical ability.

3.1.2. e-Learning

e-Learning is the use of the Internet and multimedia technology to deliver knowledge and to aid learning [10]. e-Learning is a flexible, easily accessed, and updatable method of training that has been demonstrated to aid learning in surgery [11]. Three identified methods use this type of teaching: instruction with virtual patients, delivery of theoretical knowledge, and teaching of surgical skills [11]. e-Learning has an established role in urology, with both the EAU and the American Urological Association offering numerous online modules [12,13]. In addition, the recently developed EAU robotic curriculum used e-learning as the initial method of teaching in combination with observership, further establishing the role of e-learning as a useful adjunct to training in urology [9].

3.1.3. Mentorship and fellowship

The process of having an experienced and competent mentor guiding a less experienced individual is an old practice in surgical teaching and forms the basis of old Halstedian models of training. Through the process of sharing knowledge, practical teaching, and feedback, a trainee can acquire significant knowledge and improve skill sets [14]. Within modern urology training, it is becoming increasingly understood how to get the most out of this age-old practice. The role of the mentor is pivotal to the success of this process, and appropriate experience and skills are vital [15]. In addition, the ability to share the expertise possessed often is not innate, and the increasing need for training of mentors is being recognised [16]. Furthermore, this training method requires a structured approach to ensure that maximal benefit is gained. Clear objectives should be identified at the outset, with a structured learning pathway in place prior to a formal sign-off process through which constructive feedback can be given [17].

Many of the structured mentorship programmes are delivered through formal fellowships. These programmes are designed to provide focused exposure to a specific area of a specialty through longer fellowships or minifellowships [18]. Urologic fellowships are offered at institutions across the globe, have been demonstrated to be educationally useful, and help urologists gain experience and confidence in incorporating new techniques into their practice [7,17,18].

An interesting extension of mentorship has recently arisen through telementoring. Through a real-time video link, an expert can interact and mentor a surgeon located in

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