COMMENTARY

COMMENTARIES ON MEDICAL INNOVATIONS, NEW TECHNOLOGIES

Comprehensive flexible ureteroscopy (FURS) simulator for training in endourology: The K-box model

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INTRODUCTION

Over the last two decades there has been an increase in the incidence of kidney stone disease with a simultaneous rise in the use of ureteroscopy for its management [1]. Flexible ureteroscopy training is variable and still largely dependent on high fidelity models and virtual reality (VR) simulation, both of which are expensive and not readily available in many parts of the world. There is also a lack of good quality bench trainers. In a recent survey of endourologists worldwide, flexible ureteroscopy was considered as a first line treatment for stones <2 cm [2]. With this in mind, we have developed a new portable bench-training box model for training in flexible ureteroscopy and endourology. This is a low-cost reusable model for flexible ureteroscopy training allowing the user to manipulate the scope, place a guidewire and access sheath, use a basket to catch/relocate the stone and finally to use a Holmium YAG laser to fragment the stone.

K-box

The K-box (K – Box®, Porgès-Coloplast, France) is a new generation portable bench-training model for flexible ureteroscopy. It is made of polyurethane and consists of 4 independent boxes with each of these boxes representing a different training model with three separate entry and exit points (Figures 1, 2). It also comes with a 'tool tray', which can be used within the boxes for various training exercises. To use the K-box and perform the exercises, the trainees need to have an endoscope, camera system and screen, light source and disposables such as guidewires, access sheaths, baskets and stents. Trainees can familiarize themselves with different flexible ureterscope movements such as pronation/supination, forward/backward movement, scope deflection and grasping/releasing of objects/stones mimicking the movements in the renal pelvicalyceal system. In addition to this, it allows step-by-step guidewire and access sheath placement along with stone fragmentation (Figures 3, 4). Although the exercises are done with the box closed while the trainee is watching the screen, when a trainee is unsure or lost in the training model they have the option of opening the flap which enables them to see their position (almost being a surrogate for a radiological image/fluoroscopy). The newly designed flexible ureteroscopy training model allows the surgeon to make the

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specific movements required when performing flexible ureteroscopy in humans.
These boxes can either be used separately or in combination in any random order. A silicone aerosol spray can be used to make the inside surfaces of K-box smoother to minimize friction. To enable laser use, the K-box can be used with water allowing fragmentation of stones.

DISCUSSION

Endourological simulators can be separated into low-fidelity and high-fidelity models [3, 4]. While the low-fidelity trainers are bench models such as the K-box model, the high-fidelity models can be divided into biological (animal/cadaveric), non-biological (bench models) and virtual reality models. The reusability, low cost and portability seem to be the key advantages of low fidelity trainers.
This model could be the way forward in basic simulation training and assessment for endourology trainees. Using specifically designed tasks on scope handling, stone capture, extraction, and time taken for the procedure, a scoring system can be designed to help trainees improve their skills and trainers to examine and test their trainees.
Previous studies show that hands-on-training using bench models can help novices learn complex endou-

Figure 1. *K-box and its components (1.1 – portable K-box, 1.2 – box open (left) and closed (right), 1.3 – tool tray, 1.4 – K-box with water to use with laser for stone fragmentation).*

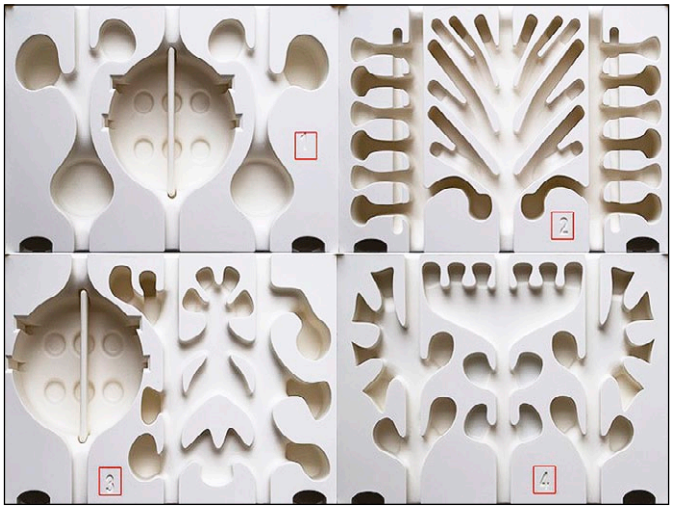

Figure 2. *K-box with all four boxes with embossed markings (opened view) showing various configurations for manipulation of the objects within it.*

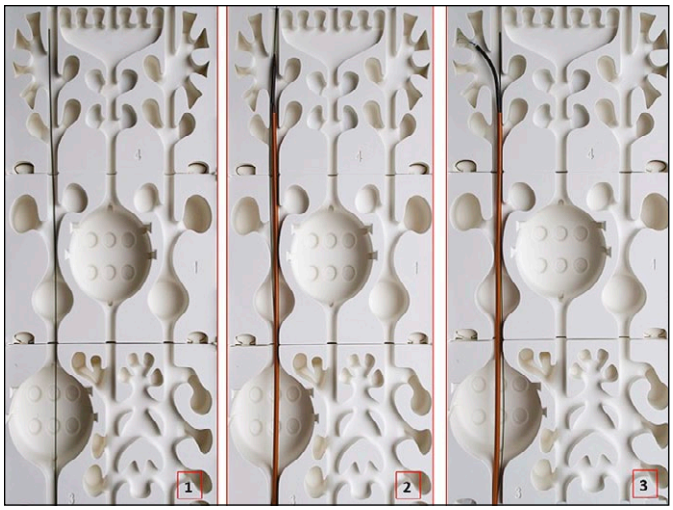

Figure 3. *Step by step technique (3.1 – placement of guidewire, 3.2 – placement of access sheath, 3.3 – placement and manipulation of flexible ureteroscope).*

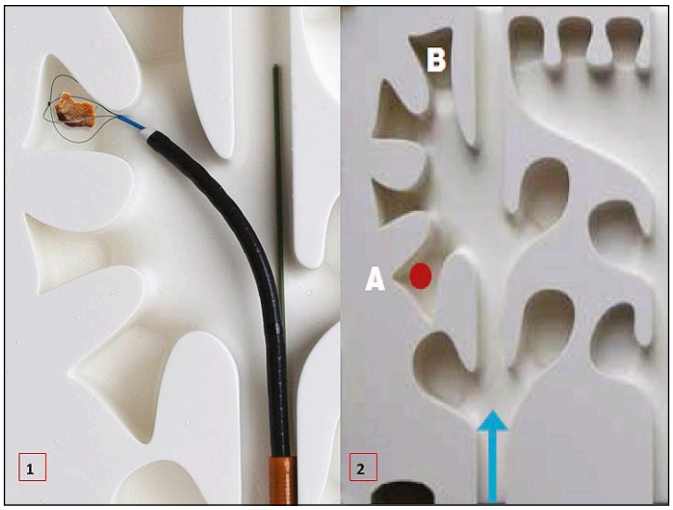

Figure 4. *Manipulation in the pelvicalyceal system (4.1 – stone basketing with a flexible ureteroscope via the access sheath, 4.2 – movement of object from A to B).*

rological skills [5]. Although simulation virtual reality training improves clinical skills, they are limited by their high cost [6]. Models such as the K-box may be a way forward to teaching these skills in a standardized way and having a more global appeal compared to their expensive counterparts. Simulated hands-on-training in ureteroscopy has shown to significantly improve performance in the operating theatre. It allows training in a stress-free environment away from the operating theatre with supervised repeated practice to a minimum set standard. Studies are needed to establish the validity of this simulator model as an endourological training tool. The real challenge will be to include these into a comprehensive training curriculum [7].

CONCLUSIONS

Surgical skills in flexible ureteroscopy could be improved by using this low-fidelity trainer. Using this portable, low-cost simulator, repeated exercises to improve the FURS skills could reduce the cost of training endourologists and potentially reduce the time taken for these procedures during surgery. The K-box not only allows training in ureteroscopy but also is a tool that can potentially be used for trainee assessment of different ureteroscopic skills.

CONFLICTS OF INTEREST

This has been developed in collaboration with Porgès-Coloplast, France.

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