STONES/ENDOUROLOGY
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Modular training for percutaneous nephrolithotripsy: The safe way to go

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Abstract   Objectives should be describe a modular training scheme (MTS) which aims to provide training in percutaneous nephrolithotripsy (PCNL) and ensure the safety of the patients.

Subjects and methods: Two trainees with no experience in PCNL attended the MTS under the supervision of an experienced mentor. The MTS included five modules, comprising an initial animal laboratory course (using pigs), to acquire basic skills (Module 1), and Modules 2–5 included making the puncture, tract dilatation, single-stone and large-stone management in clinical cases, respectively. Each participant progressed from one module to the next under constant mentoring and evaluation by the mentor. When the trainees completed the MTS they proceeded to perform 60 PCNL procedures independently while the mentor performed 25 for comparison purposes. A global rating scale was used for the objective evaluation of the trainees. Peri-operative variables were recorded and statistically compared as appropriate. Statistical significance was defined as $P < 0.05$.

Results: One pig and 16 patients, and two pigs and 22 patients, were necessary to complete the MTS by each subject. There were no significant differences among the

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characteristics of the independently performed operations. The duration of surgery and fluoroscopy achieved a plateau similar to those of the mentor after ≈ 30 patients. The decrease in haemoglobin level, stone-free and complication rates in the patients were similar among the two trainees and the mentor. The complication rate of the trainees and the mentor never exceeded 13.3%.

Conclusion: The MTS successfully combined animal and stepwise clinical training based on a standardised technique and objective evaluation.

Introduction

Percutaneous nephrolithotripsy (PCNL) is a standard of treatment for renal stones and the technique is associated with a steep learning curve [1]. Reports of structured training programmes including both laboratory and clinical practice are currently lacking [2–4]. In the present study we assessed a training scheme for PCNL which is based on stepwise training.

Subjects and methods

The modular training scheme (MTS) was divided into five modules. The main concern of the MTS design was to guarantee the safety of the patients. The aim of the first module was to obtain the necessary technical skills in a pig model, with no involvement of patients. The remaining modules were based on the performance of the PCNL steps by the trainees under the supervision of the mentor, until the trainee reached a satisfactory level of competence. After successfully accomplishing the MTS, a series of independent clinical patients were operated on by the trainees to evaluate the efficacy of the MTS and to estimate the learning curve for PCNL.

For the purpose of the MTS a standardised PCNL technique was divided into specific steps that were followed by all participants for all procedures of this study. A ureteric catheter was placed with the patient in the lithotomy position. The patient was placed prone and the collecting system was punctured at 30° from the perpendicular of the long axis of the patient, under fluoroscopic guidance. The puncture depth was monitored through a 0° fluoroscopic view, the entrance to the collecting system was confirmed by urine aspiration, and appropriate guidewires were inserted. The tract was dilated to 30 F using Amplatz dilators. A Malecot catheter was inserted at the end of the procedure.

One resident and one fellow in endourology with no previous experience of PCNL attended the MTS (Table 1). The mentor had a long experience of > 1500 PCNLs.

For each step of the MTS the trainee was scored by the mentor. The scoring system was based on a previously described global rating scale (GRS) [5]. For the purpose of this study, we expanded the GRS, and it consisted of six domains using a 5-point Likert-type scale (Table 2, intermediate scores 2 and 4 not shown). Different variables of the PCNL procedure were assessed, e.g., knowledge of renal anatomy and planning the trajectory. If the trainee achieved an average overall performance of 4 in the procedures undertaken in both kidneys of a pig, the trainee was considered to be competent enough to proceed to operating on patients. Otherwise, the animal laboratory course was repeated.

The MTS

Module 1 included renal puncture, tract dilatation using the Amplatz dilators, and orientation with the nephroscope in a pig. The live pig model was chosen as it closely replicates the human kidney and simulates realistically the performance of PCNL under both fluoroscopy and ultrasonographic guidance [3]. The renal puncture is extremely close to the clinical setting in terms of the anatomy and 'tissue feel', and the only difference is that the pelvicalyceal system is relatively smaller and more fragile [3,6]. Three to four punctures per kidney could be made before contrast extravasation distorted the fluoroscopic vision. There were multiple punctures and insertion of guidewires, then each tract was dilated and nephroscopy followed. The tasks were repeated for the contralateral kidney of the pig. The mentor scored the trainee using the GRS after each access.

Clinical modular training (modules 2–5)

When the trainees successfully completed module 1, they proceeded to making the puncture in patients (module 2). The mentor then performed the remaining steps of the procedure with the trainee as an assistant. The schedule was repeated during subsequent procedures until the mentor decided that the trainee could continue to the next module. The trainee then proceeded to modules 3, 4 and 5 consecutively, performing all previous modules and the new module for each case. Eventually