Using a Peritoneal Dialysis Access Simulator in Surgical Training for Nephrologists

In Japan, peritoneal dialysis (PD) catheter insertion has been performed by both nephrologists and surgeons. However, nephrologists have fewer opportunities to train in the insertion procedure. We therefore used a PD access simulator to provide training in this operative technique for nephrologists.

A PD access simulator developed by Terumo Medical Corporation was used for the training. The simulator uses a mannequin made of acrylic resin. The abdominal wall of a pig is attached to the abdominal area, and a plastic bag represents the abdominal cavity. The simulator enables the surgical procedure to be performed from skin incision to PD catheter insertion.

Between October 2011 and December 2013, 3 supervising doctors used the simulator to guide 17 nephrologists with no experience through a PD catheter insertion. One-on-one training was provided in a single 2- or 3-hour session. In a questionnaire survey after the training, trainees gave high marks to the handling of surgical instruments, the environment of the operating room, and the surgical guidance during training. However, the supervising doctors required the ability to respond flexibly, because trainees had individual differences in skills.

The PD access simulator might be useful for providing guided training in operative technique for PD catheter insertion.

Key words
Peritoneal dialysis catheter insertion, nephrologists, peritoneal access simulator

Introduction
At the end of 2011, the number of patients in Japan regularly undergoing dialysis reportedly exceeded 300,000, and that number is continuing to rise (1). Compared with dialysis therapy in the United States and Europe, dialysis therapy in Japan is characterized by the use of hemodialysis in most patients; only a small number of patients undergo peritoneal dialysis (PD). At the end of 2011, only 3.2% of dialysis patients in Japan were using PD.

In Japan, PD catheter insertion has traditionally been performed by nephrologists and surgeons. Nephrologists have been taught surgery mostly through preceptor-based intra-operative instruction, eagerly learning every step of the procedure in the operating room. However, given the considerably lower number of PD patients in Japan, nephrologists have fewer opportunities to train in the insertion procedure. We therefore used a PD access simulator to provide nephrologists with training in the operative technique.

Methods
Between October 2011 and December 2013, we recruited inexperienced nephrologists who wished to undergo surgical training. A PD access simulator developed by Terumo Medical Corporation in Japan was used for training at the Terumo Medical Pranex facility, a comprehensive medical care training facility managed by Terumo Medical Corporation. The wet laboratory contains three operating rooms in which actual surgery can be performed.

The PD access simulator uses a mannequin made of acrylic resin. The abdominal wall of a pig that has already been humanely euthanized in another experiment is attached to the abdominal area of the mannequin, and a plastic bag is used to represent the abdominal cavity (Figure 1). The simulator is designed to provide a realistic tactile and visual experience, and it enables the surgical procedure, from skin incision to PD catheter insertion, to be performed.

A double-cuffed straight PD catheter was used in the training. Site marking was performed before surgery. A right or left paramedian incision, 5 cm in
length, was subsequently made in the lower abdomen. Next, the peritoneum was opened to insert the PD catheter. The lower portion of the PD catheter was inserted deep into the pelvis. The deep cuff was fixed to the peritoneum by a purse-string ligature using 3-0 Polysorb suture material (Covidien Japan, Tokyo, Japan). Finally, the exit site in the upper abdomen, a standard at our hospital, was created using a Gore tunneler (W.L. Gore and Associates, Tokyo, Japan) and trocar.

Results
Training in PD catheter insertion was performed over a total of 10 days. The 3 supervising doctors guided 17 nephrologists with no experience in PD catheter insertion (mean postgraduate experience: 5.8 ± 3.0 years; range: 2 – 13 years) in the procedure. The nephrologists came from 4 unaffiliated hospitals or facilities: Dokkyo Medical University Hospital, Tomishiro Central Hospital, University of the Ryukyu, and Inagi Municipal Hospital. The supervising doctors had all performed 5 or more PD catheter insertions.

One-on-one training was provided in a single 2- or 3-hour session (Figure 2). During the training, the supervising doctors instructed trainees in subcutaneous pathway diversion (2) as well as in conventional PD catheter insertion.

In a questionnaire survey after the training, the nephrologists gave high marks to the handling of surgical instruments, the environment of the operating room, and the surgical guidance during training. However, their responses indicated that the time allotted for training was too short and that public transportation to the training facility was inconvenient. Despite those complaints, all the nephrologists would have wanted to undergo the training again.

Discussion
In Europe and the United States, PD catheter insertion is carried out mainly by surgeons (3,4). However, around the world, interventional nephrologists have also started to perform the insertion procedure, achieving good outcomes (5–8). In contrast, PD catheter insertion in Japan is performed by surgeons, urologists, and nephrologists. Taro et al. (9) reported the importance of proactively engaging nephrologists in PD management as part of the operating team. Clinical practice guidelines for peritoneal access from the International Society for Peritoneal Dialysis also recommend that training in PD catheter insertion should be available to all trainees with an interest (10). However, PD catheter insertion by an experienced operator is strongly recommended to reduce complications (11).

Preceptor-based intra-operative instruction does not allow for the training of a large number of young doctors to the competence level within a short time. Other problems of preceptor-based intra-operative instruction include the requirement that the instructor possess both teaching ability and surgical technique; the fact that operating time can be prolonged when giving detailed instruction, increasing the burden on the patient; and the fact that opportunities to actually
perform the procedure are limited. As a result, proficiency takes a great deal of time to acquire, leading us to use a simulator in a wet laboratory in an attempt to provide training in peritoneal access.

Training by surgery simulation was introduced into medical education quite a long time ago. Simulation holds the promise of enhancing the efficacy of learning in a safe environment, of providing reliable instruction without burdening patients, and of allowing medical trainees to gain clinical experience without depending on chance encounters with real patients. Simulators have become accepted and are increasingly demanded by trainees across disciplines (12,13). Training on a simulator can help the trainee gain confidence and build valuable skills, although there really is no substitute for surgery in an actual patient (14).

Our simulator does have some problems. First, it is not intended to be used just anywhere. Second, there are costs and equipment requirements attached to using the simulator. Third, attention to animal welfare is necessary. Finally, the supervising doctors must also evaluate the nephrologist trainees after the training. Nephrologists who learn using a simulator must understand the advantages and disadvantages.

In the United States, many surgical residency programs provide training in PD catheter insertion (15). The 17th Annual Meeting of the Japanese Society for Dialysis Access, held in September 2013, included a symposium titled “Considering the Tradition of Dialysis Access.” We believe that the training in peritoneal access provided to young nephrologists will represent an increasingly important factor for dialysis access in Japan. In September 2014, the Japanese Society for Dialysis Access held the first practical workshop at Terumo Medical Pranex using the simulator described here.

Conclusions
The PD access simulator described here might be useful for providing training in operative technique. We hope that the simulator will be used by many young doctors and will prove useful in improving their surgical skills.

Acknowledgments
We thank Mrs. Akemi Ishiyama, Terumo Corporation, for her invaluable contributions and advice concerning the dialysis access simulator.

Disclosures
The authors have no conflicts of interest to declare.

References


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