CLINICAL STUDY

Fluoroscopic versus Laparoscopic Implantation of Peritoneal Dialysis Catheters: A Retrospective Cohort Study

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ABSTRACT

Purpose: A previous clinical trial showed that radiologic insertion of first peritoneal dialysis (PD) catheters by modified Seldinger technique is noninferior to laparoscopic surgery in patients at low risk in a clinical trial setting. The present cohort study was performed to confirm clinical effectiveness of radiologic insertion in everyday practice, including insertion in patients with expanded eligibility criteria and by fellows in training.

Materials and Methods: Between 2004 and 2009, 286 PD catheters were inserted in 249 patients, 133 with fluoroscopic guidance in the radiology department and 153 by laparoscopic surgery. Survival analyses were performed with the primary outcome of complication-free catheter survival and secondary outcomes of overall catheter survival and patient survival. Outcomes were assessed at last follow-up, as long as 365 days after PD catheter insertion.

Results: In the radiologic group, unadjusted 365-day complication-free catheter, overall catheter, and patient survival rates were 22.6%, 81.2%, and 82.7%, respectively, compared with 22.9% ($P = .52$), 76.5% ($P = .4$), and 92.8% ($P = .01$), respectively, in the laparoscopic group. Frequencies of individual complications were similar between groups. Adjusting for patient age, comorbidity, and previous PD catheter, the hazard ratio (HR) for catheter complications by radiologic versus laparoscopic insertion is 0.90 (95% confidence interval [CI], 0.62–1.31); the HR for overall catheter survival is 1.25 (95% CI, 0.59–2.65); and that for death is 2.47 (95% CI, 0.84–7.3).

Conclusions: Radiologic PD catheter insertion is a clinically effective alternative to laparoscopic surgery, although there was poorer long-term survival with radiologic catheter placement, possibly because of preferential selection of radiologic insertion for more frail patients.

ABBREVIATIONS

BMI = body mass index, CI = confidence interval, ESKD = end-stage kidney disease, HR = hazard ratio, PD = peritoneal dialysis

Since the introduction of continuous ambulatory peritoneal dialysis (PD) in 1976, this technique and variants have gained popularity as effective methods of renal replacement therapy that offer many advantages over hemodialysis for some patient groups (1–4). As with all dialysis therapy, appropriately timed creation of functional access is vital for successful initiation and maintenance of therapy. Techniques for surgical PD catheter insertion have evolved, and some opinion leaders now advocate laparoscopic insertion as the technique of choice (5,6). This position is not supported in clinical practice guidelines (7), and there has been continued interest in other nonsurgical insertion techniques. The motivations for this interest are logistic and clinical. In some health care systems, surgical waiting lists can result in delayed PD catheter placement. In most patients, there is appeal to nonsurgical procedures that avoid general anesthesia, and are less invasive or disruptive to the peritoneum and abdominal wall (8–10).

The technique of radiologic catheter insertion, performed by interventional radiologists under fluoroscopic guidance, has become one of the more popular

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nonsurgical methods (11–14). Potential advantages of this technique include the use of local anesthesia and lower cost than laparoscopy, but the inability to perform other surgical interventions at the time of the procedure remains a key disadvantage (15–17). Several observational studies have now reported technical outcomes with radiologic insertion that are comparable to that seen with laparoscopy in most centers (17,18). These studies have been limited by the potential for selection bias, as, in routine clinical practice, those patients at lower risk of complications are typically selected for radiologic insertion.

A previous prospective randomized trial of radiological versus laparoscopic first catheter insertion has been performed (19). That study demonstrated superior complication-free catheter survival in the radiologic group, as well as significant cost savings, and confirmed noninferiority of the radiologic technique for first catheter insertion in patients at low risk. However, this trial has questionable external validity because of a number of factors. First, the health care professionals who participated in the trial were unrepresentative, being enthusiasts and experts. Second, the participants were atypical and excluded those who were significantly overweight and those who required repeat procedures. Finally, the patients who participate in any clinical trial are likely to have received better care than usual, regardless of treatment allocation (20–24). Hence, the results of this previous randomized trial of radiological versus laparoscopic catheter insertion (19) can be regarded as an indication of efficacy, and evidence of what can be achieved under the most favorable circumstances (25).

In the present study, we review the results of radiologic catheter insertion in everyday practice to confirm effectiveness in a setting in which the technique is applied based on expanded eligibility criteria, performed by practitioners with a range of experience, and evaluated in the course of normal clinical practice. The objectives of the study were to compare the results of radiologic and laparoscopic catheter insertion in a retrospective cohort, with the primary outcome being the occurrence of catheter complications at 1 year and secondary outcomes being overall catheter survival and death from any cause.

MATERIALS AND METHODS

Study Design and Setting

We performed a retrospective cohort study by using an as-treated framework (ie, "did the exposure that the patient actually receive affect mortality?"), as opposed to an intent-to-treat framework (ie, "did exposure that the patient initially received affect mortality, irrespective of subsequent changes that occurred along the way?"). The study setting was the Counties Manukau District Health Board in Auckland, New Zealand. The service provides dialysis services to a predominantly urban, young, socioeconomically disadvantaged, and multiethnic population. As of December 31, 2009, there were 261 people receiving facility hemodialysis, 73 receiving home hemodialysis, and 142 receiving PD, with an overall end-stage kidney disease (ESKD) incidence and prevalence of 234 and 1,229 per million population, respectively.

The study was granted ethics approval by the Northern X Regional Ethics Committee (IRB00008714) of the New Zealand Ministry of Health (IORG0000895) and the institutional review board of Counties Manukau District Health Board.

Participants and Sampling Frame

All patients receiving PD catheters at our institution between September 2004 and August 2009 were screened. All patients were included who received catheters radiologically or laparoscopically, either as first or repeat procedures. Key exclusion criteria were age younger than 18 years, catheter placement for reasons other than the treatment of ESKD, and open surgical procedures.

Data Sources and Measurement

Data were sourced from routinely collected hospital operational logs and clinical records from the nephrology, surgical, and radiology departments. One author (M.R.M.) performed cross-tabulation and validation of patient and catheter procedural episodes from different data sources. Data for baseline patient characteristics and outcomes were collected from clinical records and validated against the Australian and New Zealand Dialysis and Transplant Data Registry, which has prospectively collected data on patients with ESKD in these countries since 1963 (www.anzdata.org.au). Another author (S.A.A.) performed the collection of procedural data from the radiologic or surgical clinical databases. Another (E.M.) performed the collection of outcomes data from nephrologic databases and hospital clinical information systems.

Primary Exposure Variables

The primary exposure in the present study was radiologic and laparoscopic catheter insertion. Those who required a complicated surgical cointervention such as hernia or leak repairs, or division of adhesions, would be considered for either laparoscopic or open surgical insertion, as would those with morbid obesity (body mass index [BMI] > 35 kg/m^2) or other issues that might compromise nonsurgical peritoneal access. In addition, patient-related factors, such as their medical suitability for general or local anesthesia, as well as their preferences, also affected the final decision. For uncomplicated cases, the nephrology team was responsible for decision-making, with radiologic and surgical teams providing a technical service only. For more complicated cases, the responsibility for decision-making was shared by the