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Review

Surgical versus percutaneous techniques for peritoneal dialysis catheter placement: A meta-analysis of the outcomes

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HIGHLIGHTS

- Peritoneal dialysis (PD) is an effective and less costly method of renal replacement therapy for end-stage renal disease patients (ESRD). Peritoneal dialysis is more effective in preserves renal function while awaiting renal transplantation, faster restoration of diuresis and better quality of life as a home treatment than hemodialysis.
- Currently, there is no consensus for preferring type of catheter and the catheter placement method because of each modality has its pros, cons, and post-operative complication. Thus, the authors performed a meta-analysis an attempt to clarify the comparison of the outcomes of both techniques (such as a 1-year catheter survival, infectious complication, and mechanical complication).

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ABSTRACT

Background: Peritoneal dialysis (PD) is an effective method of renal replacement therapy for end-stage renal disease patients. The PD catheter could be inserted by surgical (open surgery/laparoscopic-assisted) or percutaneous techniques. However, the efficacy of the techniques, including catheter survival and catheter related complications, is still controversial.

Method: The dataset was defined by searching PubMed, EMBASE, Google Scholar and the Cochrane database that had been published until July 2014. The meta-analysis was performed using Review Manager Software version 5.2.6.

Result: The final analysis was conducted on 10 studies (2 randomized controlled studies (RCTs) and 8 retrospective studies), including 1626 patients. The pooled data demonstrate no significant difference in 1-year catheter survival (OR = 1.04, 95% CI = 0.52–2.10, P = 0.90) between surgical and percutaneous groups. However, the sensitivity analysis of the RCTs demonstrated that the incidence of overall infectious (OR = 0.26, 95% CI = 0.11–0.64, P = 0.003) and overall mechanical complications (OR = 0.32, 95% CI = 0.15–0.68, P = 0.003) were significantly lower in the percutaneous groups than the surgical groups. Furthermore, the subgroup analyses revealed no significant difference in the rates of peritonitis, tunnel and exit site infection, leakage, inflow-outflow obstruction, bleeding and hernia by comparing the methods.

Conclusion: The results showed that the placement modality did not affect 1-year catheter survival. Percutaneous catheter placement is as safe and effective as surgical technique.

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1. Introduction

Peritoneal dialysis (PD) is an effective and less costly method of renal replacement therapy for end-stage renal disease patients (ESRD). Compared to hemodialysis, PD is more effective in preserving renal function in patients awaiting renal transplant, restoring diuresis, and offering a better quality of life as a home treatment [1–3]. The peritoneal dialysis catheter is usually placed into the peritoneal cavity either by surgical technique (open surgery or laparoscopic-assisted) or by percutaneous technique (Seldinger or modified Seldinger technique), with or without fluoroscopic guidance [4–6].

Currently, there is no consensus on the preferred type of catheter and the catheter placement method as each technique has its advantages, disadvantages, and complications [7,8]. Surgical technique has the advantage of direct visualization, allowing precise catheter placement in the peritoneal cavity. However, this technique is more invasive and requires general anesthesia. In contrast, the percutaneous catheter placement technique could be performed as a bedside procedure using local anesthesia. Failure to advance the guide wire into the peritoneum, development of pain or cramp during the procedure, and limitations of use in patients with previous abdominal surgery were found to be the main drawbacks of this technique [9–12].

Catheter-related complications were categorized as infectious complications and mechanical complications. Mechanical complications, usually associated with PD technical failure, consequently affect the long-term catheter survival and ultimately patient survival [13–17].

Although several studies have attempted to compare the outcomes of PD catheter placement techniques, between surgical and percutaneous methods, there has been a significant inconsistency in the findings of these studies. We conducted a meta-analysis based on the published literature in an attempt to clarify and evaluate the comparison of outcomes between the two techniques (such as 1 – year catheter survival, infectious complication, and mechanical complication).

2. Material and methods

2.1. Data sources and search strategies

An electronic literature search was performed on July 2014 by using the PubMed, Embase, Google Scholar, and the Cochrane database. In order to evaluate the postoperative outcomes between catheters placed by percutaneous technique and directed visualized by surgical technique the search terms “Peritoneal dialysis catheter insertion,” “Laparoscopic-assisted peritoneal dialysis catheter insertion,” “Percutaneous peritoneal dialysis catheter insertion” and “Fluoroscopic guide peritoneal dialysis catheter insertion” were used as keywords to identify all relevant studies. This meta-analysis was performed according to the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2009 [18].

2.2. Study selection and eligibility criteria

The inclusion criteria were as follows: (1) performed peritoneal catheter insertion for peritoneal dialysis in End-stage renal disease patients, (2) compared the percutaneous group with the surgical group (open/laparoscopic-assisted), (3) the outcomes must evaluate infectious complications, mechanical complication, and 1-year catheter survival.

The percutaneous group was defined as the peritoneal dialysis catheters placed by the percutaneous technique with or without fluoroscopic guidance. The surgery group was defined as the catheters placed under direct visualized by open surgery or laparoscopy-assisted technique. Infectious complications were defined as postoperative peritonitis, tunnel and exit site infection. Peritoneal dialysis fluid leakage, inflow-outflow obstruction, catheter malfunction, bleeding and incisional hernia, were the definitions of the mechanical complications [19].

Studies will exclude (1) review articles, (2) non-comparative studies, (3) and studies in pediatric patients. The quality of the studies that were included in the meta-analysis was further evaluated using Newcastle-Ottawa scale. The maximum score possible was 9 points, which represents the highest methodological quality [20].

2.3. Statistical analysis

The meta-analysis was performed using the Review Manager Software (Revman version 5.2.6) provided by the Cochrane Collaboration (Nordic Cochrane Center, Cochrane Collaboration, Copenhagen, Denmark). Cochran's Q-statistic test was applied to access between-study heterogeneity and I^2 were used to test for heterogeneity between the studies included. ($p < 0.05$ is considered for significant heterogeneity).

The postoperative complications and 1-year catheter survival rate outcomes of the patients were analyzed using the Mantel-Haenszel method to generate a pooled odds ratio (OR) with 95% confidence intervals and odds ratio (OR), in order to compare the 1-year catheter survival and postoperative complications between the percutaneous and surgical group. The OR was considered statistically significant at the $P < 0.05$ level if the 95% CI did not include the value 1.

The authors adopted random-effect models, which is a more conservative way of calculating OR, assuming a high level of