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Surgical outcomes analysis of pediatric peritoneal dialysis catheter function in a rural region

Matthew L. Stone^a, Damien J. LaPar^a, John P. Barcia^b, Victoria F. Norwood^b, Daniel P. Mulloy^a, Eugene D. McGahren^a, Bradley M. Rodgers^a, and Bartholomew J. Kane^{a,*}

^aDepartment of Surgery, University of Virginia Health System, Charlottesville, VA, USA

^bDepartment of Pediatrics, Division of Nephrology, University of Virginia Health System, Charlottesville, VA, USA

Abstract

Purpose—The purpose of this study was to analyze the experience with peritoneal dialysis (PD) at a high-volume, single center institution that supports a rural population.

Methods—From 2000 to 2010, 88 children (median age: 1.98 years, [range: 2 days–20.2 years]) received 134 PD catheters for the management of acute and chronic renal failure. The primary outcome of interest was the incidence of primary PD catheter failure (replacement or revision within 60 days). Operative technique, longitudinal outcomes, and time intervals to transplantation were analyzed.

Results—Median time to transplant from the institution of dialysis was 1.4 years [range: 0.3–6.4 years]. Primary catheter failure occurred in 24.6% of cases. Infants less than 6 months of age demonstrated an increased incidence of primary catheter failure ($p=0.02$). The operative technique for catheter placement was not associated with the incidence of primary failure. Postoperative complications included peritonitis (22.7%), omental plugging (11.9%), pericatheter drainage (9.0%), and exit site infection (3.0%).

Conclusion—Peritoneal dialysis provides a safe and effective renal replacement therapy for regional pediatric centers that serve a rural population. However, primary catheter failure rates remain high at 24.6%. The surgical technique for placement had no effect on this failure rate in our patient population. Infants less than 6 months of age are at increased risk for primary catheter failure and warrant intensive surveillance.

Keywords

Peritoneal dialysis; Renal transplantation; Dialysis; Renal failure

Chronic renal failure is a rare condition in children with an estimated mean annual incidence and point prevalence of 12.1 and 74.7 cases per million children, respectively [1]. With a limited number of skilled pediatric tertiary care and transplantation centers, nephrologists

and surgeons are often faced with the challenge of treating children across expansive and diverse geographic areas. Committed multi-disciplinary care is imperative to meet this need and is considered the primary determinant of favorable outcomes for children with renal failure [2].

Peritoneal dialysis (PD) is often considered the preferred mode of renal replacement for children, in part because it enables at-home therapy [3]. Peritoneal dialysis is, however, dependent on patient compliance and at-home support. Hemodialysis may, therefore, be considered the optimal therapy for certain patients. Recent retrospective study has demonstrated an association of prolonged renal graft survival in patients with pre-transplant PD compared to hemodialysis, suggesting potential patient or therapy-related effects on post-transplant graft function [4]. These considerations are critical to the appropriate selection of renal replacement therapy for children with both acute and chronic renal failure awaiting potential future renal transplantation.

Catheter-related complications limit the effectiveness of PD, particularly when children are geographically isolated from a tertiary care center. Prolonged interruption in therapy or a delay in the treatment of systemic infection imposes a significant mortality risk to children in rural communities. Primary catheter failure is defined as catheter failure within the first two postoperative months after placement. Two recent studies estimate this early failure rate to be 30%–40% [5,6]. The purpose of this study was to scrutinize the surgical experience with peritoneal dialysis at a high-volume, single-center institution that serves a rural region. The operative techniques of laparoscopy, omentectomy, and intra-operative fluoroscopy were evaluated to determine the effects on primary catheter failure rate, as significant variability of practice exists among pediatric surgeons [7]. This study was performed in a single-center institution that is uniquely positioned as a tertiary care center within a broad and predominately rural population (Charlottesville, Virginia, 2010 Population: 43,475 people), thereby enabling the determination of PD efficacy in that setting [8].

1. Methods

A retrospective medical and surgical record review was performed for all children receiving peritoneal dialysis catheter placement at The University of Virginia Children's Hospital from April 2000 to August 2010. Appropriate Institutional Review Board approval was obtained. Five attending, board certified pediatric surgeons performed PD catheter placement operations. Single-cuffed catheters were placed through a standard open incision with localization techniques that included laparoscopy, fluoroscopy, or Luque wire positioning for catheter tip placement within the pelvis depending on surgeon preference. A partial omentectomy was selectively performed through the open incision by delivering the omentum until tension was achieved, with subsequent ligation of the visible omental segment. After placement of the peritoneal component of the catheter within the peritoneal cavity, the Dacron cuff of the catheter was commonly sutured to the posterior abdominal wall fascia and the anterior fascia sutured over the cuff. The catheter was always tunneled through the subcutaneous tissue to a separate exit site. With the use of single-cuffed catheters, a downward orientation was not always achievable and therefore this variable was not standardized during the study period. Peritoneal dialysis was initiated on the day of

placement according to the institutional protocol at an initial flow rate of 10 mL/kg with subsequent advancement to 30–50 mL/kg.

The primary outcome of interest was the incidence of primary PD catheter failure, defined as replacement or revision within 60 days of placement. Children with acute and chronic renal failure were included in the analysis. Chronic renal failure was defined as a requirement for transplantation or ongoing renal replacement therapy for greater than 90 days or dialysis dependence at the last date of follow-up. Functional catheters removed for renal function recovery, transplantation, or at the time of mortality were not deemed to have failed. Renal transplantation rates were reviewed for children with chronic renal failure to determine successful bridge-to-transplantation on PD. Donor graft type was recorded with corresponding one-year patient and graft survival status. Chronologic data were analyzed for catheter complication events and time intervals to transplantation. Secondary postoperative complications included: peritonitis, omental or fibrinous plugging, persistent pericatheter dialysate drainage, and catheter exit site infection. Operative catheter revision and replacement surgeries were included in the analysis to determine the timing and frequency of these procedures. The attending surgeon made intraoperative determination of catheter replacement candidacy. Catheter revisions were defined as re-operations that involved the manipulation of catheter location or unplugging of a catheter of fibrinous material or omentum with partial omentectomy in some instances to relieve an obstruction without replacement of the affected catheter. Peritonitis was determined by clinical evaluation and the presence of positive peritoneal cultures. Relapsing peritonitis was defined as the recurrence of positive peritoneal cultures following PD catheter replacement for peritonitis in the same patient. The predominant microorganism present from the culture was recorded to determine pathogen epidemiology within the region of the institution. The primary surgeon defined omental plugging at the time of catheter revision or replacement. Superficial infection and pericatheter drainage were determined by physician examination, with pericatheter erythema or tunnel site purulence denoting the presence of infection. Children with no postoperative institutional follow-up records were excluded from the surgical outcomes analysis; however, total catheter numbers per child were calculated. Fisher's exact test was used to compare categorical variables and to determine the significance of operative technique on primary catheter failure rate. Continuous variables were compared utilizing the Student's *t*-test or Mann–Whitney *U* test as appropriate.

2. Results

From April 2000 to August 2010, 88 children (Table 1A) received 134 peritoneal dialysis catheters for the management of acute (ARF, *n*=51) and chronic (CRF, *n*=37) renal failure at a median age of 1.98 years (range: 2 days–20.2 years). Indications and etiology of ARF and CRF are provided in Table 1B. Primary catheter failure occurred with 24.6% (*n*=33/134) of PD catheters, with no significant difference in primary catheter failure rates between ARF and CRF cohorts (ARF= 10/59, 17.0%; CRF=23/75, 30.7%; *p* = 0.07). Primary catheter failure most commonly resulted from omental plugging (*n*= 12/33, 36.4%) (Table 2).

Peritoneal dialysis catheters were placed most frequently in infants less than 6 months of age (*n*=49). This cohort demonstrated a higher primary catheter failure rate in comparison to

children greater than 6 months of age (36.7% vs. 17.7%, $p=0.02$) (Fig. 1). Pericatheter drainage was the most common defined etiology for primary catheter failure in infants less than 6 months of age (Table 3). Infants with unspecified obstruction likely represent omental or fibrinous plugging of the catheter; however, this was not definitively concluded from the corresponding operative notes.

Peritoneal dialysis was initiated on the day of catheter placement in all but one patient, in whom initial drainage of peritoneal ascites was required. Operative records describing the techniques utilized for PD catheter placement were available for 132 (98.5%) operations (ARF, $n=58$; CRF, $n=74$). Operative technique for catheter localization was not associated with the incidence of primary catheter failure (Table 4). 25 catheters were revised at the discretion of the primary operative surgeon, eliminating the need for future catheter replacement in 48% ($n=12/25$) of children. An average of 1.6 ± 1.1 catheters were required per patient for PD maintenance (ARF = 1.2 ± 0.4 , CRF = 2.3 ± 1.4 catheters; $p < 0.0001$). Throughout the study period, composite catheter revisions (ARF, $n=6$; CRF, $n=19$; $p=0.03$) occurred at 15 [range: 0–133] days following initial catheter placement (ARF median: 13 [0–29] days; CRF median: 15 [0–133] days; $p=0.29$), while catheter replacement (ARF, $n=6$; CRF, $n=36$; $p < 0.0001$) was necessitated at 82 [0–589] days (ARF median: 16 [0–56] days, CRF median: 158.5 [0–589] days; $p=0.01$) (Table 5). Six children within the study population are maintained on chronic PD (2 of 6 after failed transplantation) with a current median catheter duration of 142 [range: 65–691] days. Patients with acute renal failure with recovery of renal function following PD ($n=30$) had an uncomplicated median catheter duration of 15 [range: 5–56] days. 21 children required hemodialysis (HD) for renal replacement therapy (ARF: 5, CRF: 16 children), and 6 children with ARF necessitated extracorporeal membrane oxygenation support. 5 children within the CRF cohort were transitioned from PD to HD secondary to inadequacy of treatment (pre-transplant, $n=4$; post-transplant, $n=1$). Within the ARF cohort, 19 (37.3%) patients died during the study follow-up period as a result of significant co-morbid disease (median: 22 days after initiation of therapy [range: day 0–56]), while 2 children were transferred to another institution for ongoing medical care. 2 children within the CRF cohort suffered resultant mortality at a median 214 days following therapy initiation.

Children receiving peritoneal dialysis treatment lived a mean distance of 85.6 ± 46.9 miles (range: 2.6–176 miles) from the institution. Renal transplantation has been performed in 83.8% ($n=31/37$) of children with chronic renal failure following PD treatment. Median time to transplantation for children with chronic renal failure was 1.4 years [range: 0.3–6.4 years] following initial PD catheter placement. One-year graft survival demonstrated satisfactory function in 64.7% ($n=11/17$), 100.0% ($n=11/11$), and 100.0% ($n=4/4$) of children for cadaveric, living-related, and living-unrelated donors, respectively. 2 children required a second transplant, while one patient died within the first postoperative year following cadaveric renal transplantation.

Children received multidisciplinary follow-up for catheter surveillance over a median follow-up period of 37 days [range: 0 days–7.6 years]. Culture-positive peritonitis was the most significant overall postoperative complication, affecting 22.7% ($n=20/88$) of children. Relapsing peritonitis affected 11 (12.5%) patients. Peritoneal culture specimens identified

Staphylococcus aureus as the predominate pathogen in our patient population (Table 6). Omental plugging (n = 16/134, 11.9%), pericatheter drainage (n = 12/134, 9.0%), and exit site infection (n=4/134, 3.0%) comprised additional postoperative complications necessitating medical care or surgical treatment (Table 7). Partial omentectomy was performed at the PD catheter placement operation in 6 of 16 (37.5%) catheters with omental plugging. No catheter complication related mortalities occurred in children maintained on outpatient chronic PD.

3. Discussion

Preemptive kidney transplantation from a living-related or living-unrelated donor provides the best one-year graft survival for children with chronic renal failure [4]. In children with limited immediate transplantation candidacy or no living donor source, multivariable analysis has demonstrated adverse graft outcomes for children receiving pre-transplant hemodialysis [4]. Peritoneal dialysis (PD) provides a well-tolerated bridge-to-transplantation and renal replacement therapy, offering a better quality of life compared to hemodialysis for children [9]. Success of PD, however, is dependent on maintaining catheter function and sustaining freedom from infectious complication. Multi-disciplinary knowledge of short and long-term outcomes guides the development of standardized surgical techniques and catheter surveillance protocols for regional pediatric centers. This study evaluates a multidisciplinary strategy for peritoneal dialysis in children geographically isolated from a pediatric kidney center.

Pediatric surgical literature has proposed the application of routine omentectomy and laparoscopy as potential localization techniques for reducing rates of primary catheter failure. Institutions adopting laparoscopy for catheter localization have failed to demonstrate a statistically significant advantage to this technique for failure rate reduction in comparison to traditional open catheter placement [5,10–12]. These studies suggest that laparoscopy enables improved visualization of the abdominal cavity, while providing a technical advantage for catheter revision in comparison to the standard open approach. The initial experience with laparoscopy for PD catheter placement does not demonstrate a statistically significant reduction in the primary catheter failure rate. This finding, however, warrants further study and cannot be substantiated from the limited experience within the current patient population. An additional strategy for failure rate reduction is the routine performance of omentectomy. Previous retrospective experiential reports have demonstrated a statistically significant decrease in catheter failure rates with omentectomy [5,6]. A significant decrease in primary catheter failure rate with this technique across a comparable number of catheter placements was not demonstrated in this study. The finding that partial omentectomy was performed in 37.5% of failed catheters with diagnosed omental plugging warrants further consideration and study regarding the efficacy of partial versus complete omentectomy at the initial catheter placement operation.

Intra-operative fluoroscopy with a comparably small abdominal wall incision has been utilized in several patients as a non-invasive technique to diagnose inguinal hernias at the initial operation while providing confirmatory catheter localization [13]. This technique was initially proposed as an effective strategy for catheter repositioning at the time of failure

[14]. While a statistically significant reduction in catheter failure rates was not demonstrated with this technique, fluoroscopy provides a similar advantage to laparoscopy in the diagnosis of inguinal hernias and the definitive localization of the catheter to the pelvis. The technique for catheter placement had no effect on the primary catheter failure rate within our patient population, implicating perioperative care as a primary determinant of successful PD catheter function.

Primary catheter failure imposes a significant threat to any infant or child dependent on PD for fluid and electrolyte balance. This series establishes that infant age less than 6 months significantly increases the incidence of primary catheter failure. This finding parallels the established risk factor of infant weight less than 10 kg for primary catheter failure [5,15]. Pericatheter drainage was the primary defined etiology for therapy failure in these children, with drainage likely occurring secondary to the lack of abdominal wall musculature. These findings support careful operative planning and committed postoperative surveillance in infants less than 6 months of age.

The predominant etiology for primary catheter failure across all age groups in this series was catheter obstruction, the same mechanism demonstrated in a previous retrospective analysis [5]. Definitive omental plugging was demonstrated in 12 of 33 patients. This study demonstrated freedom from catheter replacement in 48% (n=12/25) of catheters with a defined obstruction that received catheter revision. Catheter revisions were predominately performed by a laparoscopic approach (n = 15, 60.0%). These findings suggest a role for catheter revision should a positional or functional occlusion be identified at the replacement operation. While omental plugging was the defined etiology for many of the cases reviewed here, many catheters failed without a defined positional or omental obstruction. Further study is warranted to evaluate postoperative catheter maintenance protocols with specific emphasis on consistent catheter usage, as internal catheter patency is an important determinant of optimal catheter function.

The study of long-term catheter function is imperative as PD gains acceptance as the primary renal replacement therapy for children awaiting kidney transplantation. In the largest retrospective review of PD catheter function encompassing 9048 dialysis-months, catheter failure resulted from exit-site and/or tunnel infection in 75.4% of catheter complications [16]. In contrast, the study outlined herein demonstrates a significantly lower rate of catheter-site infection (3%), suggesting that catheter surveillance and perioperative antibiotics may decrease superficial and tunnel infections [17]. Peritonitis, however, remains a significant threat to the maintenance of optimal PD treatment. Prospective analysis of relapsing peritonitis has demonstrated an incidence of 11% with PD. Of these children, 17% necessitate discontinuation of therapy [18]. This rate of relapse showed no correlation between primary pathogen and risk of peritonitis relapse, and demonstrated a similar pathogen profile to that found in the cases reported in this series.

The primary motivation for this study was to analyze the effectiveness of PD among a predominately rural region. Although no patients were identified within our analysis as non-compliant, national data have estimated that as many as 45% of pediatric patients are non-adherent to prescribed peritoneal dialysis regimens [19]. This disappointing statistic

threatens the efficacy of this treatment strategy, especially in children geographically isolated from a tertiary care center. Our program strictly adheres to a standardized, Centers for Medicare and Medicaid Services (CMS) compliant regimen of patient and parent education, catheter monitoring, and scheduled follow-up clinic visits. While adherence to such a regimen is associated with decreased catheter failure rates and an increase in duration of catheter use, the primary catheter failure rate at our institution remains 24.6%. The presented findings do not support alteration in our surgical approach to PD catheter placement, as surgical technique was not associated with a decrease in primary catheter failure rate. This study does, however, implicate perioperative management as a critical component to primary catheter failure rate reduction. Important to the findings of this study, we have adopted a standardized approach to both exit site dressing changes and antibiotic application. With regard to increased failure rates in infants less than 6 months of age, our program has transitioned to the use of preemptive PD catheter placement in select infants to achieve early control of abdominal wall edema. In addition, it is our practice to lower fill volumes and pause dialysis should leakage occur to enable potential healing of the pericatheter site. Our principal objective is to achieve prevention of abdominal wall edema with multi-disciplinary education regarding the importance of both early consultation and intervention.

In an attempt to minimize the PD catheter failure rate, our program is currently considering the institution of a more aggressive outpatient catheter monitoring and educational effort designed to identify and support those children who are at-risk for declining catheter function or infectious complications. This increase in the intensity of monitoring and follow-up may enable increased PD catheter salvage, thereby sustaining renal replacement therapy and preventing physiologic compromise.

While this study provides a comprehensive understanding of PD catheter function and renal transplantation, there are inherent limitations of this retrospective review. Initially, the inclusion of acute and chronic renal failure patients was based on a primary aim of catheter function outcome analysis. In order to consistently report surgical outcomes, a comprehensive review was deemed necessary and comparable rates of primary catheter failure for ARF and CRF are demonstrated. A recognized limitation to this approach is the potential confounding effect of multiple failure modes on PD catheter function. In addition, acute renal failure resolution and subsequent catheter removal limit the long-term potential for catheter complication in this patient population. The decision to include patients with both ARF and CRF may also limit definitive application of the conclusions to outpatient catheter maintenance. The presented incidence of mortality in the ARF cohort also reflects the significance of co-morbid disease, while also supporting further study of PD efficacy in select high-risk infants. In addition, the primary nephrologist directed the type of single-cuffed catheter to be placed based on the projected treatment course and the surgeon determined catheter placement location in each case. While these characteristics have been shown in previous series to not affect primary catheter failure rates, these operative variables are important considerations for the PD catheter placement operation [5]. It should be noted that our practice has transitioned to the use of double-cuffed catheters given the lower incidence of penetrating infection compared to single-cuffed catheters [20]. In addition, the presented data regarding the incidence of peritonitis are reflective of children with positive

peritoneal cultures. Additional factors suggestive of complicated peritonitis that should be considered are: concomitant exit-site infection, greater than 5 days with a peritoneal dialysis effluent cell count greater than $100 \times 10^6/L$, prior antimicrobial use, and low serum total protein level [21]. The use of laparoscopy during the experience reviewed in this study was limited and does not provide a sufficient volume to enable definitive conclusions regarding its effectiveness in reducing the rate of primary catheter failure. A significant long-term consequence of PD is encapsulating peritoneal sclerosis (EPS), particularly in children receiving therapy for greater than 8 years [22]. No children with EPS were encountered during the experience reviewed in this article. This is likely because all children with chronic renal failure were transplanted well before the time where EPS is commonly experienced.

4. Conclusion

Pediatric peritoneal dialysis is a safe and effective renal replacement therapy for children geographically isolated from tertiary care centers. The surgical technique for catheter placement had no effect on primary catheter failure rate in our patient population, implicating perioperative care as a primary determinant of successful PD catheter function. Primary catheter failure is most often the result of functional catheter obstruction, warranting revision or replacement in 24.6% of children. This study demonstrates an increased risk for primary catheter failure in infants less than 6 months of age, supporting intensive monitoring in this patient population. A multi-disciplinary commitment to evidence-based practice and family education promises to support decreased rates of long-term catheter function complications. While peritonitis represents the most common overall complication of this therapy, research commitment to antimicrobial therapy and pathogen epidemiology is needed and may decrease catheter replacement rates. A future commitment to these aims will maintain optimal renal transplant recipient candidacy and sustain this well-tolerated and effective regional treatment strategy for children with renal failure. This study demonstrates that the use of PD as a bridge-to-renal transplantation transcends geographic limitations.

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Fig. 1.
PD catheter placement and primary failure by age at placement.

Table 1A

Baseline population characteristics.

Patient demographic	ARF *	CRF *	Overall *	<i>p</i> - value
	n=51	n=37	n=88	
Male gender	25 (49.0%)	27 (73.0%)	52 (59.1%)	0.03
Age at PD catheter insertion	115 days [2 d.–16.1 yrs.]	3.3 yrs. [3 d.–20.2 yrs.]	1.98 yrs. [2 d.–20.2 yrs.]	<0.001
Therapy initiation blood urea-nitrogen (BUN), md/dL	71.1±42.0	67.5±33.4	69.9±37.8	0.98
Therapy initiation creatinine (Cr), mg/dL	4.2±3.5	5.8±4.1	4.4±3.6	0.04
Immunosuppressive medication	22 (43.1%)	8 (21.6%)	30 (34.1%)	0.04

Note: *p*-value comparison for ARF versus CRF patients.

* expressed as N (%) or mean±standard deviation; age presented as median [range].

Table 1B

Renal failure diagnoses for children with ARF and CRF.

ARF Diagnosis	Number, n	CRF Diagnosis	Number, n
Post-cardiac surgery	23	Renal dysplasia	6
Hemolytic uremic syndrome	13	Focal segmental glomerulosclerosis	5
Sepsis	6	Congenital nephrotic syndrome	3
Caval thrombosis	1	Post-cardiac surgery	3
Pre-cardiac surgery	1	Polycystic kidney disease	2
Intra-abdominal mass	1	Cystinosis	2
Myocarditis	1	Hypoxic renal injury	2
Polycystic kidney disease	1	Posterior urethral valves	2
Posterior urethral valve	1	Unilateral kidney	1
Tacrolimus toxicity	1	Membranoproliferative glomerulonephritis	1
3p minus syndrome	1	Vesicoureteral reflux	1
Unknown	1	Chronic glomerulonephritis	1
		Renal agenesis	1
		Intrauterine ischemia	1
		Hemolytic uremic syndrome	1
		IgA nephropathy	1
		Denys-Drash syndrome	1
		VACTERL	1
		Wilms' tumor	1
		Hypertensive nephropathy	1

Table 2

Etiologic factors for primary catheter failures.

Primary Catheter Complication	ARF n=10	CRF n=23	Total n=33	p-value
Omental plugging	4, 40.0%	8, 34.8%	12, 36.4%	>0.99
Obstruction, unspecified	2, 20.0%	8, 34.8%	10, 30.3%	0.68
Pericatheter drainage	3, 30.0%	3, 13.0%	6, 18.2%	0.34
Peritonitis	1, 10.0%	2, 8.7%	3, 9.1%	>0.99
Exit site infection	0, 0.0%	1, 4.4%	1, 3.0%	>0.99
Dislocation	0, 0.0%	1, 4.4%	1, 3.0%	>0.99

Note: *p*-value comparison for ARF versus CRF patients.

Table 3

Etiology for primary catheter failure in infants less than 6 months of age (n=18).

Primary Catheter Complication	Number of Children, n	Percent of Primary Failures, %
Dysfunction, unspecified	8	44.4%
Pericatheter drainage	6	33.3%
Omental plugging	3	16.7%
Peritonitis	1	5.6%
Exit site infection	-	0.0%

Table 4

Primary catheter failure as a function of operative localization technique, n=132 catheters.

Operative Technique	Number of initial catheter placements (n=#)	Primary PD catheter failures (n=#, %)	p-value
Omentectomy	46	14, 30.4%	0.30
No omentectomy	86	19, 22.1%	
Intraoperative fluoroscopy	35	9, 25.7%	>0.99
No fluoroscopy	97	24, 24.7%	
Laparoscopy	6	2, 33.3%	0.64
No laparoscopy	126	31, 24.6%	

Note: *p* value represents comparison of primary PD catheter failure rates as a function of the corresponding operative technique.

Table 5

Incidences and time points for total PD catheter revisions and replacements throughout the entire study period.

	Catheter Revisions (n, %)	Post-operative time point (median days, [range])	Catheter Replacements (n, %)	Post-operative time point (median days, [range])
Acute RF, n=58	6, 10.3%	13 [0–29]	6, 10.3%	16 [0–56]
Chronic RF, n=74	19, 25.7%	15 [0–133]	36, 48.6%	158.5 [0–589]
Overall, n=132	25, 18.9%	15 [0–133]	42, 31.8%	82 [0–589]
<i>p</i> value	0.03	0.29	<0.0001	0.01

Note: *p* value represents comparison between ARF and CRF cohorts.

Table 6

Predominant pathogen isolates from peritoneal culture specimens in patients with peritonitis.

Primary Pathogen	Number, N (%)
<i>S. aureus</i>	22 (44%)
<i>S. epidermidis</i>	6 (12%)
<i>C. albicans</i>	4 (8%)
<i>P. aeruginosa</i>	3 (6%)
<i>Enterobacter</i>	3
<i>C. parapsilosis</i>	2 (4%)
<i>S. marcescens</i>	2
<i>S. caprae</i>	1 (2%)
<i>C. lusitaniae</i>	1
<i>K. pneumoniae</i>	1
<i>K. oxytoca</i>	1
<i>Citrobacter</i>	1
<i>H. influenzae</i>	1
<i>Corynebacterium</i>	1
<i>S. maltophilia</i>	1

Table 7

Overall PD catheter complication rates during PD catheter follow-up period.

	ARF n=51	CRF n=37	Total n=88	p-value
Overall Complication				
Peritonitis	2, 3.9%	18, 48.7%	20, 22.7%	<0.001
	ARF n=59	CRF n=75	Total n=134	p-value
Catheter Complication				
Omental plugging	4, 6.8%	12, 16.0%	16, 11.9%	0.12
Pericatheter drainage	6, 10.2%	5, 6.7%	12, 9.0%	0.54
Exit site infection	1, 1.7%	3, 4.0%	4, 3.0%	0.63
Median follow-up (days)	15 [0–56]	510 [34–2790]	37 [0–2790]	<0.001

Note: Peritonitis expressed as percent of patients. Omental plugging, pericatheter drainage, and superficial infection expressed as percent of catheters.

p value represents comparison between ARF and CRF groups.