Peritonitis in patients with end-stage renal disease on continuous ambulatory peritoneal dialysis

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To the Editor: We investigated the experiences with continuous ambulatory peritoneal dialysis (CAPD)-related peritonitis in patients with end-stage renal disease (ESRD) at the nephrology unit of Dr George Mukhari Hospital. In this study population, the mortality rate from peritonitis is high, Gram-negative sepsis predominates and the recurrence rate was also high. Age is a risk factor for mortality.

Background

CAPD is an established therapy for ESRD. No costly equipment is required, the technique is easily learned by patients, and frequent hospital visits are not necessary. CAPD does not immobilise patients for prolonged periods of time, requires less rigid fluid and dietary restrictions, and tends to preserve residual renal function longer than haemodialysis.[1] Therefore, CAPD is an important option for treatment of ESRD in developing countries.[2,3]

A study from Groote Schuur Hospital, Cape Town, found peritonitis to be the major limiting factor for CAPD. Increased frequency of peritonitis was associated with poor socioeconomic conditions, age and diabetes.[2] In contrast, peritonitis rates among patients at Chris Hani Baragwanath Hospital in Soweto were similar to those of the developed world. Socioeconomic factors did not appear to play a role in peritonitis rates or CAPD failure.[3]

The nephrology unit at Dr George Mukhari Hospital has experienced increased pressure on the limited number of haemodialysis 'slots' as a result of decreases in live donor transplants and the utilisation of cadaveric donors because of the HIV/AIDS epidemic. This has resulted in an expansion of the CAPD programme.

Despite increased experience and advances in peritoneal dialysis, peritonitis remains a major cause of morbidity in patients on long-term CAPD and is the major cause of treatment failure and the need to transfer to haemodialysis.[2-4]

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This study documents the recent experience with peritonitis in patients receiving CAPD for ESRD in a busy South African tertiary hospital.

Methods and study design

Thirty-one patients with ESRD on CAPD, who had peritonitis between March 2004 and March 2006, were included. The demographic data, primary renal disease, date of Tenckhoff catheter insertion, date of commencing renal replacement therapy, peritoneal infection, biochemistry and microbiology of peritoneal fluid, antimicrobial agents used, mortality rates and the glomerular filtration rate were recorded in each case.

Quantitative data are presented as means and standard deviation (SD). Qualitative data are summarised in percentages. Where comparisons were made, a p-value of <0.05 was considered to be indicative of statistically significant differences. Comparison of means was done using Student's t-test. Categorical variables were compared using Fisher's exact test.

Results

A total of 40 patients with ESRD on CAPD were admitted for peritonitis. Thirty-one files were available for evaluation. Females comprised 68% of the patients; the mean age was 41±22 years, and the mean number of years subsequent to catheter insertion before the development of infection was 1.5±3.1 years. Hypertension was the leading cause of renal disease in 21 patients (68%); adult polycystic kidney disease in 4 (13%); chronic glomerulonephritis and chronic pyelonephritis in 2 each (6.5% each); and nephrotic syndrome and unknown in 1 (3%) each.

Sixty-five episodes of peritonitis were recorded between March 2004 and March 2006. Twenty-one (68%) patients had from 2 to 5 episodes of peritonitis during this period. Seven patients (27%) had 1 episode, 14 (45%) had 2 episodes, and 10 (32%) had >3 episodes.

All 31 patients presented with abdominal pain; 52% were pyrexial; vomiting occurred in 6 (19%); 84% presented with a cloudy dialysate fluid; and in 2, the dialysate fluid was cloudy and had strands. In 3 patients, the dialysate fluid was reported to be clear.

Most of the episodes (65%) were culture-negative. *Klebsiella pneumoniae* was found in 16%, Gram-positive cocci in 10%, other Gram-negative pathogens in 6%, and *Candida albicans* in 3%.

The mean peritoneal fluid polymorphonuclear cell count was 270±756/µl, and the mean fluid lymphocyte count 240±409 per µl. All patients under review had an HIV test, and only 1 (3%) was positive.

Ten patients (32%) died during the study period (Table I); their age was 47±6.3 years, which was significantly higher than that of the survivors (38±10.9) (p=0.0236). Patients who died had an average of 2.4 episodes of peritonitis, which was not significantly different from those who survived (p=0.2701). The male and female mortality rates were similar (5/10 v. 5/21, p=0.2220).

Table I. Characteristics of survivors and non-survivors

	Survivors (21)	Non-survivors (10)	*p*-value
Age (mean)	38±10.93	47±6.3	0.0236
Catheter duration	2.8±2.4 yrs	4.87±3.5 yrs	0.0651
Number of episodes	2±0.83	2.4±1.1	0.2701

Three patients (10%) were transferred to haemodialysis owing to multiple episodes (4 on average) of peritonitis and intra-abdominal sepsis. One of these 3 patients died. The remaining 2 patients continued with haemodialysis.

Serum creatinine ranged from 326 to 1 775 µmol/l (mean 1 071) and urea from 8.1 to 40.8 mmol/l (mean 22) on admission to the programme. High values predict poor outcome. Serum albumin concentration ranged from 12 to 42 g/l (mean 27) and total protein from 39 g/l to 85 g/l (mean 61). Patients with normal values had a good outcome. Haemoglobin ranged from 7.2 g/l to 14 g/dl (mean 9.5). White cell counts ranged from 3.9 to 84.8×10^9/l (mean 12.2); patients with chronic myeloid leukaemia, who both died, had the two highest counts.

Discussion

Abdominal pain (the most common presenting symptom in our study) was found to be a reliable sign of peritonitis in most other studies.[8,10,11] The high number of Gram-negative pathogens in our study contrasts with others that reported high numbers of Gram-positive bacteria.[8,9,20] Non-adherence to infection control protocols by the training staff and patients could have contributed to this finding.

Our mortality rate of 32%, which is higher than the 10 - 20% reported mortality rates,[9,10,18] may be due in part to the high incidence of Gram-negative sepsis[9,11] and to late presentation. Most patients received intraperitoneal vancomycin and amikacin for an average of 10 days. Patients with fungal peritonitis were treated with intravenous fluconazole. One patient who was allergic to vancomycin received ceftriaxone.

Most patients in our study had culture-negative peritonitis, which confirms reports that most cases of peritonitis in this setting tend to be culture-negative.[10,18,20] Important reasons for this include recent antibiotic therapy or technical problems during peritoneal dialysate effluent (PDE) culture.[5,18] Sewell *et al*. and Eisele *et al*. found that more than half of patients with culture-negative peritonitis had antimicrobial activity detected in their PDE.[18,19] (It should be noted that prior antibiotic usage was not specifically studied in our project.) It is probable that some patients were given antibiotics by their general practitioner or clinic doctor. Eisele *et al*. reported that surreptitious use of antimicrobial agents was common among peritoneal dialysis patients.[19] An incidence of more than 50% of culture-negative peritonitis was reported by Szeto *et al*.[10] Other reasons for high negative culture rates are PD exchange technique, exit-site care, and growth of fastidious organisms.[11,18] We could not study the effect of HIV as only one patient tested positive.

More than one episode of peritonitis occurred in 68% of our patients, which is higher than other studies where multiple episodes occurred in 18 - 35%.[8,9,11,18] Katz *et al*. reported that black patients tended to have high recurrence rates.[3] Blacks have been shown to have an increased risk of developing peritonitis compared with whites, even after adjusting for socioeconomic and co-morbid factors.[8]

Only 2 patients in our study had their dialysis catheter removed because of intra-abdominal sepsis. One of these patients had peritonitis due to *C. albicans* and was treated with intravenous fluconazole and the dialysis catheter removed as part of the standard protocol. Fungal peritonitis is an uncommon but potentially life-threatening complication of CAPD, with a reported incidence of fungal peritonitis of 3 - 6%.[16]

Conclusion

Our study confirms that CAPD is a useful and practical alternative to haemodialysis in our setting. However, CAPD-related peritonitis remains a major threat and carries a high mortality rate, especially in older patients. Our findings suggest that catheter insertion should be performed by trained dialysis unit staff; patients should be educated to present to the unit if they experience any abdominal pain; peritoneal dialysate fluid should be inoculated directly into blood culture bottles; and patients should be told to avoid antibiotics unless prescribed by dialysis unit staff.

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