

# Microbiological aspects of peritonitis in patients undergoing chronic peritoneal dialysis at the dialysis unit of Sri Jayawardenapura General Hospital

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(Index words: High incidence, leucocyte and neutrophil counts in dialysis effluent, causative organisms).

## Abstract

**Background** Peritoneal dialysis (PD) is an established form of therapy in the management of end stage renal disease. Peritonitis is the main complication of PD.

**Objectives** To study the incidence and microbial aetiology of peritonitis in patients undergoing chronic PD at the dialysis unit of Sri Jayawardenapura General Hospital (SJGH); to assess the diagnostic value of the Gram's stain; and to study the relationship of the total white cell count of effluent to peritonitis.

**Design** A prospective study over three months.

**Setting** Dialysis unit of SJGH.

**Patient population** The study involved 18 patients undergoing manual intermittent peritoneal dialysis (IPD), 4 patients undergoing chronic ambulatory peritoneal dialysis (CAPD), and 1 patient undergoing nocturnal intermittent peritoneal dialysis (NIPD).

**Measurements** Clinical presentation of patients with peritonitis; total and differential white blood cell counts of effluent samples; Gram stain and culture of the centrifuged deposit to determine microbial aetiology; incidence of peritonitis in different categories of dialysis.

**Results** 32 samples were examined from patients on IPD, and 17 from patients on CAPD. In IPD most episodes were due to Gram negative organisms whereas in CAPD most episodes were due to Gram positive organisms. Sensitivity of Gram's stain in relation to culture was 32.4%. 98% of effluent samples had white blood cell counts of >100/ml and none showed neutrophil counts of <49%.

**Conclusions** The incidence of IPD associated peritonitis was 11.1 episodes per patient year, and the incidence of CAPD associated peritonitis was 14 episodes per patient year. *Flavobacterium spp.* were the predominant organisms in IPD associated peritonitis, whereas CAPD associated peritonitis was commonly caused by coagulase negative staphylococci. Gram's stain was not useful in the initial identification of the causative agent, but the white cell and neutrophil counts were found to be sensitive indicators of peritonitis.

## Introduction

PD is an established form of therapy in the management of end stage renal disease (1,2).

In manual intermittent peritoneal dialysis (IPD), dialysis is carried out 2 to 3 times a week intermittently in hospital, and about 20 one litre exchanges are carried out within 24 hours. In continuous ambulatory peritoneal dialysis 2 litre exchanges are carried out continuously 3 to 4 times a day. Chronic cyclic peritoneal dialysis (CCPD) and nocturnal intermittent peritoneal dialysis (NIPD) are automated techniques of dialysis where a cyclor is programmed to deliver the fluid and exchanges are done in the night.

Peritonitis is the main complication of PD (3,4), and remains a cause of technique failure, hospitalisation and transfer to haemodialysis (HD), with mortality rates varying from 2 to 25% (5). There are no previous studies in Sri Lanka on peritonitis in chronic PD systems, hence the need for the present study.

## Methodology

The PD effluents processed in the study were from patients who had symptoms and signs of peritonitis or cloudy dialysate. 49 effluent samples were examined during the 3 months. A white blood cell count was performed on the uncentrifuged sample, and the centrifuged deposit was used to inoculate culture plates and make smears for the Gram's stain and Leishman's stain.

API 20E was used to identify members of the family *Enterobacteriaceae*. Non-fermenting oxidase positive organisms such as *Pseudomonas spp.*, *Flavobacterium spp.* and Gram positive organisms were identified using standard microbial identification procedures (7). The single yeast culture was identified by Gram stain and germ tube tests. Antibiotic sensitivity tests were performed using the modified Kirby Bauer technique.

Patients were considered to have peritonitis if they met at least two of the following criteria (2,6).

1. Signs and symptoms of peritonitis (abdominal pain, rebound tenderness, fever, vomiting, diarrhoea)

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2. A cloudy dialysate with a leucocyte count of more than 100/ml.
3. A positive culture or a positive Gram's stain

## Results

Of the 49 samples studied, 47 were from patients who had peritonitis and 2 from patients who had cloudy dialysates but did not have peritonitis. Of the 47 effluent samples, 32 were from patients on IPD and 15 from patients on CAPD. The patient on NIPD did not have peritonitis during this period.

Clinical presentation of patients with peritonitis varied. All patients with symptomatic peritonitis had diffuse abdominal pain (80%). Abdominal tenderness was found in 48%, fever in 36%, vomiting in 14% and diarrhoea in 6%.

Of the samples processed, except for one effluent sample which was not turbid and showed a cell count of <100/ml, the others were turbid and had white cell counts of >100/ml. 94% showed neutrophil counts of >70%, and none showed neutrophil counts of ≤49%.

The Gram stain was positive in only 12 effluent samples giving a sensitivity of 32.4% compared to culture. The specificity and positive predictive values of Gram stain

were 100%, and the negative predictive value 35%. Table 1 and 2 show the microbial aetiology in IPD and CAPD associated peritonitis. In this study 21.2% of cases of peritonitis were culture negative. Studies have shown that 10 to 50% of clinically infected PD effluents are culture negative (1,4,8).

## Discussion

Accurate diagnosis of peritonitis is an important requirement for a successful dialysis program. Symptoms and signs are an important component of the definition that aid in the diagnosis, and the frequency of different symptoms in the present study was similar to previous studies reported (1,4).

Cell count and Gram stain are also important in the preliminary diagnosis of peritonitis as the clinical presentation is variable and sometimes patients are asymptomatic. A cell count indicates whether the turbidity of the dialysate is due to the presence of increased number of leucocytes. Since 98% of samples from patients with peritonitis had leucocyte counts of >100/ml and none showed neutrophil counts of ≤49%, this study indicates that a leucocyte count of >100/ml and >50% neutrophils are sensitive indicators of peritonitis.

**Table 1. Microbial aetiology in IPD-associated peritonitis**

Organism	Number of episodes	Percentage	
Gram negative	1. <i>Flavobacterium spp</i>	10	31
	2. <i>Acinetobacter calcoaceticus</i>	3	9
	3. <i>Pseudomonas spp.</i>	2	6
	4. <i>Serratia marcescens</i>	1	3
	5. <i>Aeromonas caviae</i>	1	3
	6. <i>Pseudomonas aeruginosa</i> + <i>Acinetobacter calcoaceticus</i>	1	3
	Total	18	56
Gram positive	7. Coagulase negative staphylococcus	4	13
	8. <i>Staphylococcus aureus</i>	3	9
	9. <i>Enterococcus faecalis</i>	2	6
	10. Diptheroids	1	3
	11. β-haemolytic streptococcus Group-C + Diptheroids	11	3
	Total	11	34
Total culture positive	29		
Sterile	3		
Total	32		

**Table 2. Microbial aetiology in CAPD-associated peritonitis**

Organism		Number of episodes
Gram positive	Coagulase negative staphylococcus	4
	Total	4
Gram negative	<i>Pseudomonas aeruginosa</i>	2
	<i>Klebsiella spp.</i>	1
	Total	3
Fungal	<i>Candida spp.</i>	1
Total culture positive		8
Sterile		7
	Total	15

As the sensitivity of the Gram stain was only 32.4%, it is not a sensitive indicator of peritonitis. In other studies reported the sensitivity of Gram stain in relation to culture varies between 10 and 50% (4,5,8,10). The Gram stain though only positive in a low percentage of cases should be performed routinely because of its simplicity and its value in making a preliminary identification of the organism in a short time to aid in the choice of antibiotics.

The organisms responsible for IPD associated peritonitis were those found in the hospital environment. *Flavobacterium spp.*, the commonest isolate, was isolated from a sink in the dialysis unit. *Flavobacterium spp.* have been increasingly associated with infectious complications in hospital settings, especially in immunocompromised patients (11). In a study at the National Hospital of Sri Lanka of complications of acute peritoneal dialysis, 86.7% of culture positive peritonitis were due to coliforms and 10% to *Staphylococcus aureus* (12).

As in previous studies most cases of peritonitis in CAPD patients in the present study were due to skin commensals, with the predominant isolate being *Staphylococcus epidermidis*.

The most likely portal of entry of the causative organism in IPD and CAPD associated peritonitis in our study is the lumen of the catheter. In IPD contamination occurs during multiple connections and disconnections of the PD transfer set to the catheter. We observed that there was no adherence to strict sterile conditions during this procedure. As a result the incidence of IPD associated peritonitis was 11.1 episodes per patient year. The incidence of CAPD associated peritonitis was 14 episodes per patient year. This is high compared to centres in the West where it occurs on average 1 to 2 episodes per patient year (4,12,13). Poor hygienic conditions, associated with poor socioeconomic status, compared to patients in the West, as well as inadequate training in CAPD procedure, have contributed to the high incidence of CAPD associated peritonitis.

## Conclusions

The incidence of peritonitis in patients undergoing chronic PD at SJGH is high in comparison to that reported from the West.

*Flavobacterium spp.* were the commonest organisms causing peritonitis in patients undergoing IPD, while coagulase negative *Staphylococcus* was the commonest in CAPD associated peritonitis. Gram stain was not very useful in the initial identification of the causative agent, while the leucocyte count and neutrophil count were sensitive indicators of peritonitis

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