

Research Article



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Incidence of peritonitis, causative organism, catheter and patient outcome, single center experience.

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Abstract

Introduction: Peritonitis in the peritoneal dialysis (PD) patient is defined by the International Society for Peritoneal Dialysis (ISPD) as the presence of two of the following three criteria: (1) signs and symptoms such as fever, abdominal pain/tenderness; (2) >100 white blood cells/mL dialysate fluid, of which >50% are neutrophils; and (3) identification of the organism in the PD fluid (1). Peritonitis still represents the main acute complication of peritoneal dialysis (PD) and is a leading cause of hospitalization catheter loss, and technique failure (2). **Patients and Methods:** Quantitative approach, retrospective study. We analyzed a database of patients from the Nephrology Service at Dubai hospital, Dubai health authority from January 1999 till December 2012 The analysis included patients in PD for more than 3 months and with complete information. We collected data regarding the catheter and patient outcome following recorded peritonitis episodes. The rate of peritonitis was expressed as risk of a peritonitis episode per year (ep./year) and calculated in accordance with the ISPD recommendations. **Results:** 54 patients studies over 13 years 29 female patients (56%) and 23 male patients (44%) , higher number of patients in 40-60 and > 60 years groups 46.2% & 36.5% respectively . the calculated peritonitis episode per patient year where total peritonitis episodes were 0.408 episodes per patient year With highest recorded for gram positive organism in patient culture 0.132 followed by culture negative 0.126 episodes per patient year and the lowest incidence found for fungal infection 0.024 episodes per patient year . prevalence of causative organism as per culture results , the highest was for gram positive organisms and culture negative episodes 35.3 % and 30.7% respectively . outcome of catheter post peritonitis episodes we found that the episodes resulted in catheter removal in 54 episodes (35.3%) and catheters were salvaged in 99 episodes (64.7%) . patients continued on peritoneal dialysis following peritonitis episodes in 90 (58.8%) while 32 episodes needed temporary Hemodialysis (HD) , permanent HD in 24 episodes (15.7%) and mortality was reported in 7 episodes (4.6%). **Discussion:** This study provides an overview of the incidence of peritonitis and the microbiological profile of a single PD center in Dubai , UAE The incidence of peritonitis per patient year shown in our study 0.408 episode per patient year this (almost one episode every 26 patient months) which comes in accordance with The 2005 recommendations from the International Society of Peritoneal Dialysis (ISPD) recommend that the unit should have as a goal a rate not exceeding one episode every 18 months, or 0.67 ep./year (1). **Conclusion:** we may conclude that the rate of peritonitis episodes per patient year of the patients studied is within the minimum recommended by the guidelines, but short of the latest goals achieved in some centers we observed that there was an improvement over the last few years which we attribute to the improvement in training and retraining of patient and care giver enrolled in the program , staff continuous education, assignment of dedicated peritoneal dialysis nurses , higher rate of using automated peritoneal dialysis machines and the structured follow up of our patients with monthly peritoneal dialysis clinic follow up and This data reinforce the importance of training and constant monitoring for the improvement of services, with a consequent emphasis on patient safety.

Keywords: Peritonitis, peritoneal dialysis, fungal peritonitis, gram positive peritonitis, gram negative peritonitis, culture negative peritonitis

Introduction

Peritonitis remains the major complication in patients on peritoneal dialysis (PD), peritonitis rates vary in the literature, reflecting differences between countries, study design and populations (1).

Peritonitis in the peritoneal dialysis (PD) patient is defined by the International Society for Peritoneal Dialysis (ISPD) as the presence of two of the following three criteria: (1) signs and symptoms

such as fever, abdominal pain/tenderness; (2) >100 white blood cells/mL dialysate fluid, of which >50% are neutrophils; and (3) identification of the organism in the PD fluid (1).

Peritonitis still represents the main acute complication of peritoneal dialysis (PD) and is a leading cause of hospitalization catheter loss, and technique failure (2).

It is also a common cause of death in PD patients and has been described as one of the leading causes of transfer to Hemodialysis (HD) (3).

The decline of peritonitis rates during the last decades has mostly been achieved by improvements in factors relating PD technique such as the change to plastic bags, the introduction of the Y-set-twin-bag connection system (4).

Despite the significant drop in the peritonitis rates since the 1980 from approximately 6 episodes/patient years, the peritonitis rate published in the literature remains constant at approximately 0.35 episodes/patient years (5).

The development of disconnect systems has had an important effect on overall reduction of the incidence of peritonitis episodes, particularly those due to skin organisms. A variety of micro-organisms may cause PD peritonitis. Gram-positive organisms, particularly *Staphylococcus aureus* and *S. epidermidis*, have been the most frequent pathogens. However, in patients utilizing the disconnect systems, with the reduction in the incidence of gram-positive staphylococcus peritonitis; the relative incidence of gram-negative infection has increased (6).

Patients with peritonitis usually present with cloudy fluid and abdominal pain. However, peritonitis should always be included in the differential diagnosis of the PD patient with abdominal pain, even if the effluent is clear. However, in the PD patient with abdominal pain and clear fluid, other causes such as pancreatitis should be investigated (7).

Cloudy effluent will almost always represent infectious peritonitis but there are other causes. The differential diagnosis include: Culture-positive infectious peritonitis, Infectious peritonitis with sterile cultures, Eosinophilia of the effluent, Hemoperitoneum, Malignancy, Chylous effluent (8).

The international society of peritoneal dialysis constantly emphasize the importance of early

diagnosis and prompt management of episodes of peritonitis to prevent membrane damage and subsequent failure and the morbidity and mortality associated with peritonitis (8).

Patients and Methods

Quantitative approach, retrospective study. We analyzed a database of patients from the Nephrology Service at Dubai hospital, Dubai health authority from January 1999 till December 2012. The analysis included patients in PD for more than 3 months and with complete information.

We collected clinical and demographic data such as age, gender, time on PD, reason for being taken off therapy, number of peritonitis episodes, and causing microorganism.

We collected data regarding the catheter and patient outcome following peritonitis episodes. The rate of peritonitis was expressed as risk of a peritonitis episode per year (ep./year) and calculated in accordance with the ISPD recommendations (8).

To determine the rate of peritonitis and/or peritonitis culture result, we calculated the number of patients/day (pat.day), peritonitis episodes per patient/year (episodes/pat.year) and peritonitis episodes per year (episodes/year). To calculate the number of pat.day, we summed up the total number of days each patient was followed up. To determine the number of episodes/pat.year and episode/year, we used specific formulas, where episode/pat.year is equal to the total number of pat/day divided by 365 and the result is divided by the number of peritonitis episodes.

Protocol was reviewed and approved by ethical and research committee, patient and medical records confidentiality were assured.

All data were tabulated, computerized and gone through statistical analysis using SPSS 16 Program.

Results

Demographic data shown in figure (1) for patients involved demonstrating higher number of females 29 patients (56%) and the patient age group distribution showing higher number of patients in 40-60 and > 60 years groups 46.2% & 36.5% respectively.

Figure 2 showed the number of peritonitis episodes per year, table (1) demonstrate the distribution of peritonitis episode each year by peritoneal fluid culture result.

Table (2) showed the calculated peritonitis episode per patient year where total peritonitis episodes were 0.408 episodes per patient year.

With highest recorded for gram positive organism in patient culture 0.132 followed by culture negative 0.126 episodes per patient year and the lowest incidence found for fungal infection 0.024 episodes per patient year.

Figure (3) and table (3) showing the prevalence of causative organism as per culture results, the highest was for gram positive organisms and culture negative episodes 35.3% and 30.7% respectively.

As we followed the outcome of catheter post peritonitis episodes we found that the episodes resulted in catheter removal in 54 episodes (35.3%) and catheter were salvaged in 99 patients (64.7%) as shown in figure (4) and table (4). Figure (5) and table (5) demonstrate Follow up patient outcome post peritonitis episodes the majority of patients continued on peritoneal dialysis following peritonitis episodes 90 (58.8%) while 32 patients needed temporary Hemodialysis (HD) after catheter removal till the insertion of new catheter after infection clearance.

Patients were shifted permanently to HD post peritonitis episodes in 24 episodes (15.7%) and mortality was reported in 7 episodes (4.6%).

Figure (6-7) and table (6-7) showed Further analysis of the data to define the catheter outcome and patient outcome for different causative organisms demonstrated the highest rate of catheter removal reported with fungal culture and gram negative culture (100%) & (48.8%) respectively.

The patient outcome analysis showed highest mortality rate with fungal infection episodes 2 (22%) followed by gram negative culture 3 episodes (7%) and gram positive 2 episodes (3.7%).

Most of the patient who experienced gram positive peritonitis continued on peritoneal dialysis 38 (70.4%) where the patient with gram negative culture needed temporary HD in 16 episodes (37.2%) and shift to permanent HD IN 6 EPISODES (14%).

Peritonitis caused by fungal infection ended in cessation of peritoneal dialysis in higher proportion of episodes 6 (66.7%) and temporary HD in 1(11.1%).

Patient with culture negative peritonitis showed higher proportion of continuation on PD 34 episodes (72.3%) with no recorded mortality with temporary HD in 6 episodes (12.8%) and permanent HD IN 7 episodes (14.9%).

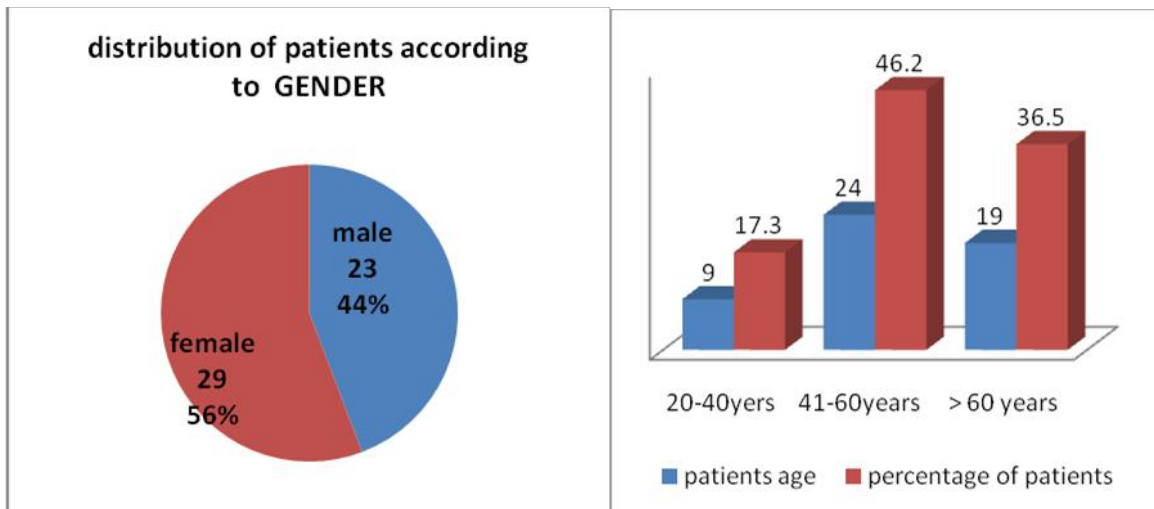


Figure 1 Patient distribution by gender and age group

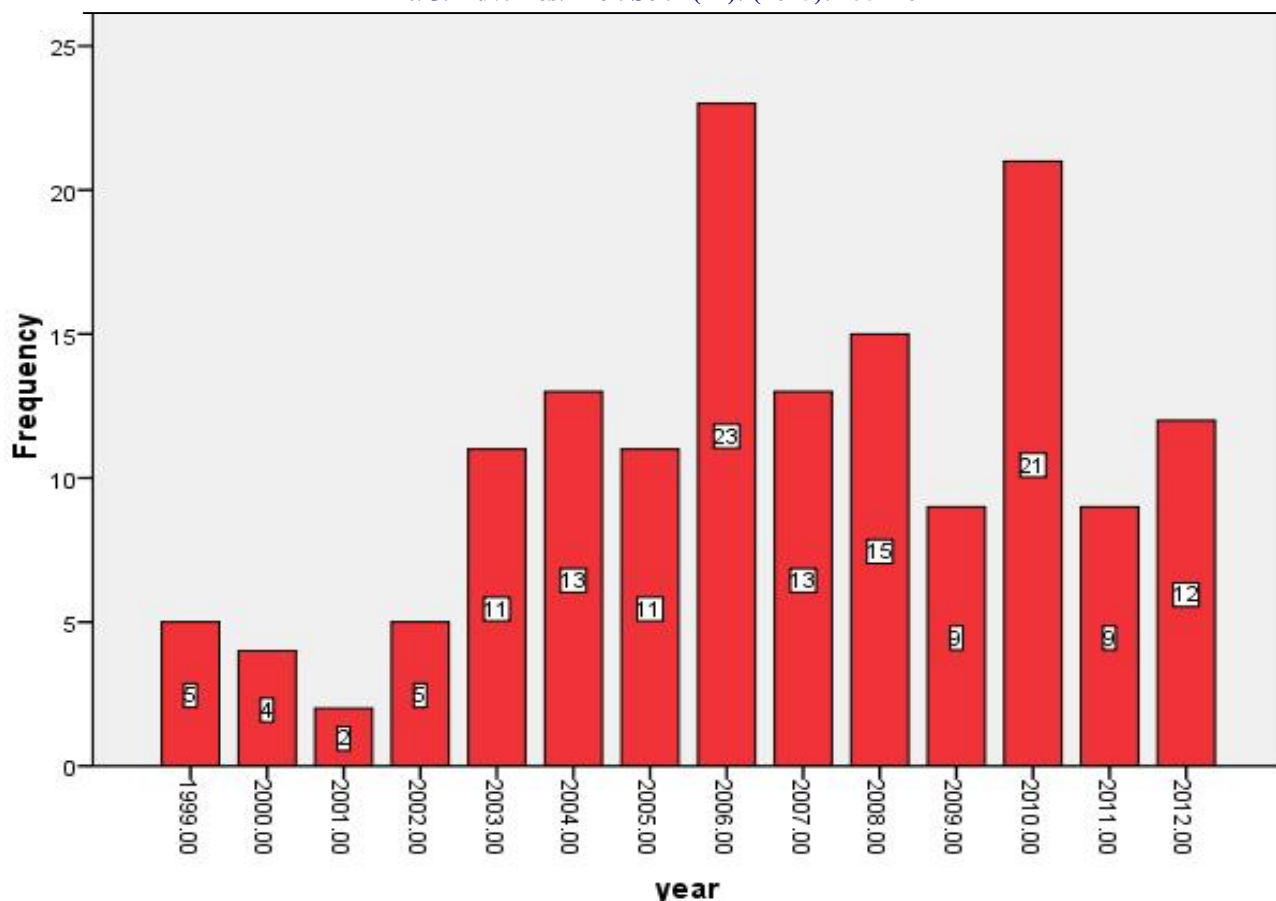


Figure 2 Peritonitis episodes 1999-2012

Table (1) Peritonitis episodes 1999-2012 by causative organism

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Episodes of peritonitis	5	4	2	5	11	13	11.00	23.00	13	15	10	20	9	12
Gram +ve	2	1	0	0	4	3	4.00	7.00	4	6	4	6	3	6
Gram-ve	1	1	1	2	3	2	5.00	6.00	5	5	3	4	4	4
Fungi	0	0	0	0	2	0	1.00	2.00	0	1	0	2	1	0
Culture -ve	1	2	1	3	2	8	1.00	8.00	3	3	3	10	1	2

Table (2) Peritonitis episodes by causative organisms per patient year

	Episodes Numbers	Episode/ Patient year
Total peritonitis episodes	153.00	0.403
Gram +ve episodes	50.00	0.132
Gram-ve episodes	46.00	0.121
Fungi episodes	9.00	0.024
Culture -ve episodes	48.00	0.126

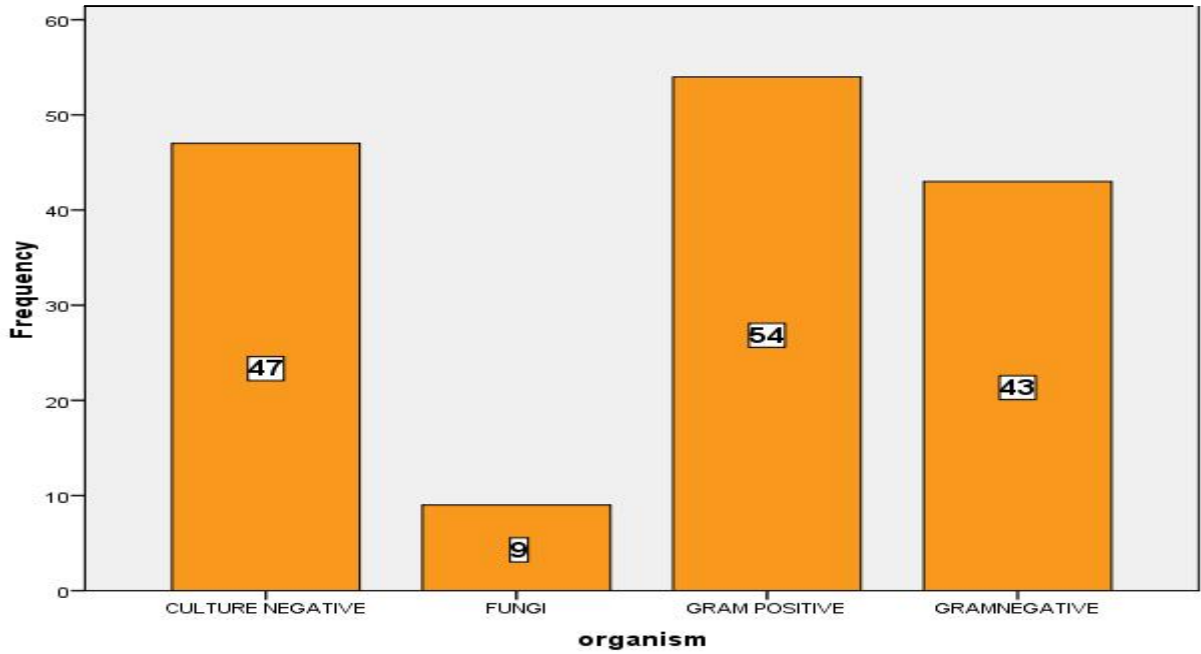


Figure 3 Peritonitis episodes culture results

Table (3) Peritonitis episodes culture results

		Count	Percent
Organism	Culture negative	47	30.7%
	Fungi	9	5.9%
	Gram positive	54	35.3%
	Gram negative	43	28.1%

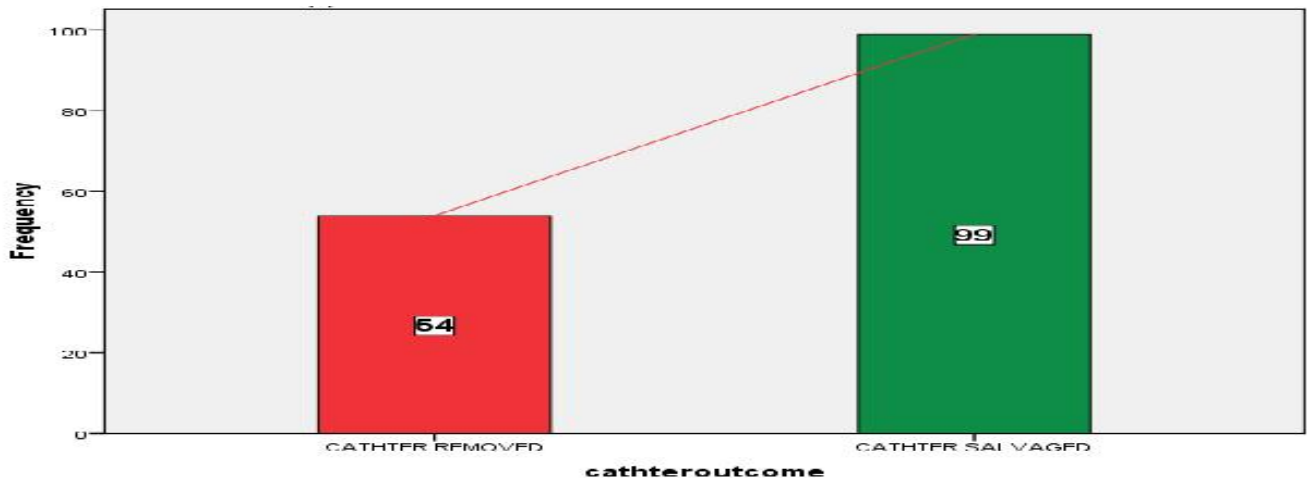


Figure 4 Peritoneal catheter outcome post peritonitis episodes

Table (4) Peritoneal catheter outcome

	Frequency	Percent
Catheter removed	54	35.3%
Catheter salvaged	99	64.7%
Total	153	100.0

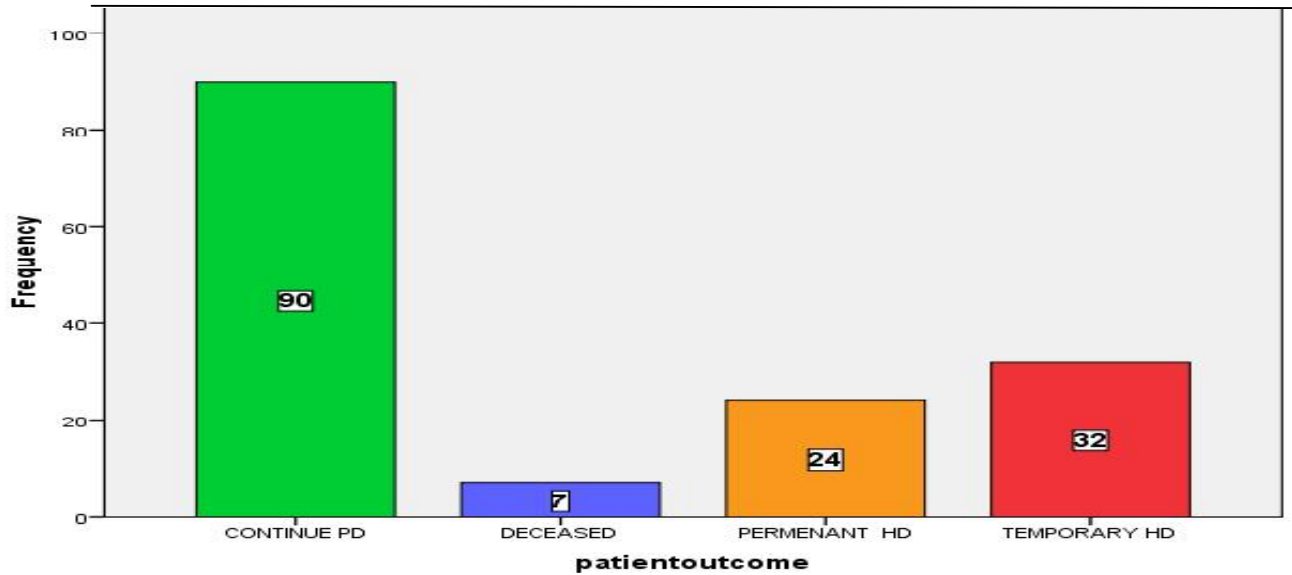


Figure 5 patient outcome post peritonitis episodes

Table (5) Patient outcome post peritonitis episode

	Frequency	Percent
Continue PD	90	58.8%
Deceased	7	4.6%
Permanent HD	24	15.7%
Temporary HD	32	20.9%
Total	153	100.0%

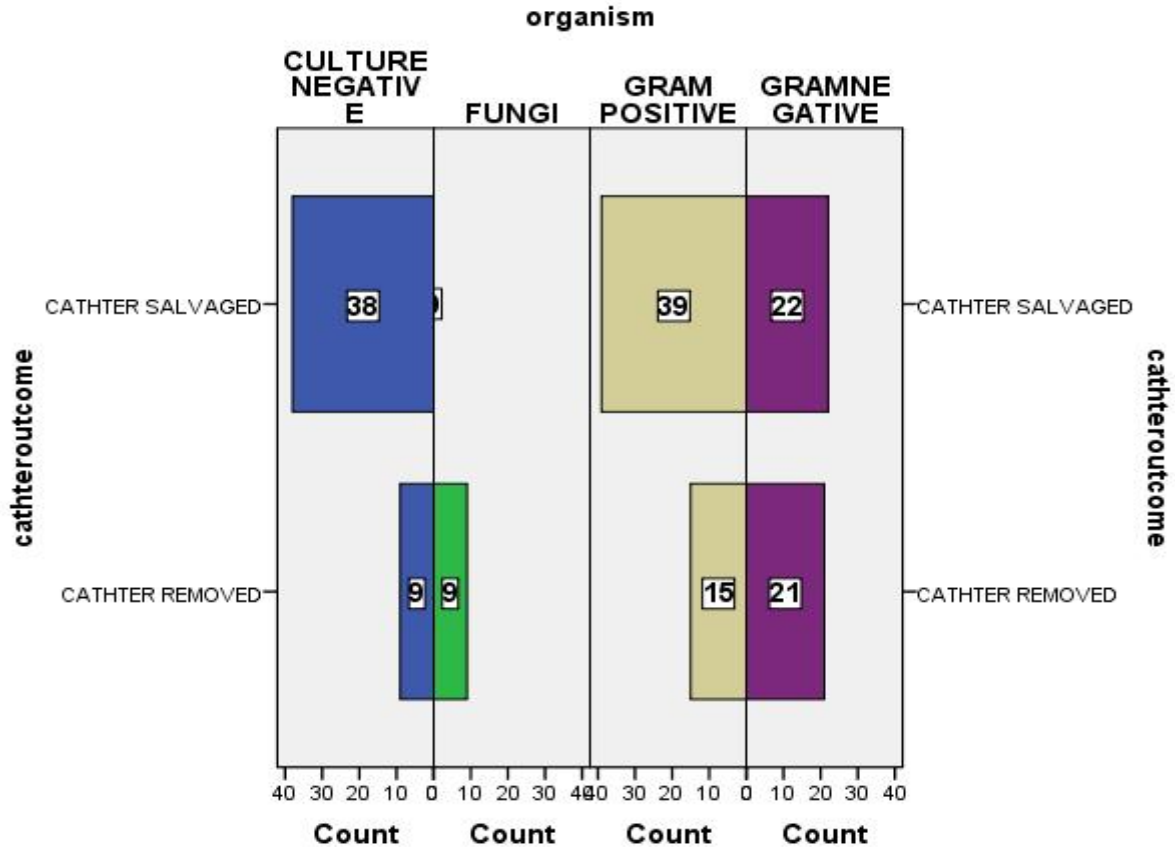


Figure 6 Cathter outcome accounting to culture results

Table (6) cathter outcome according to culture result

	cathter salvaged	cathter removed	% cathter salvaged	% cathter removed
Gram positive	54.0	39.0	72.2%	27.8%
Gram negative	43.0	22.0	51.2%	48.8%
Fungi	9.0	0.0	0.0%	100.0%
Culture negative	47.0	38.0	80.9%	19.1%

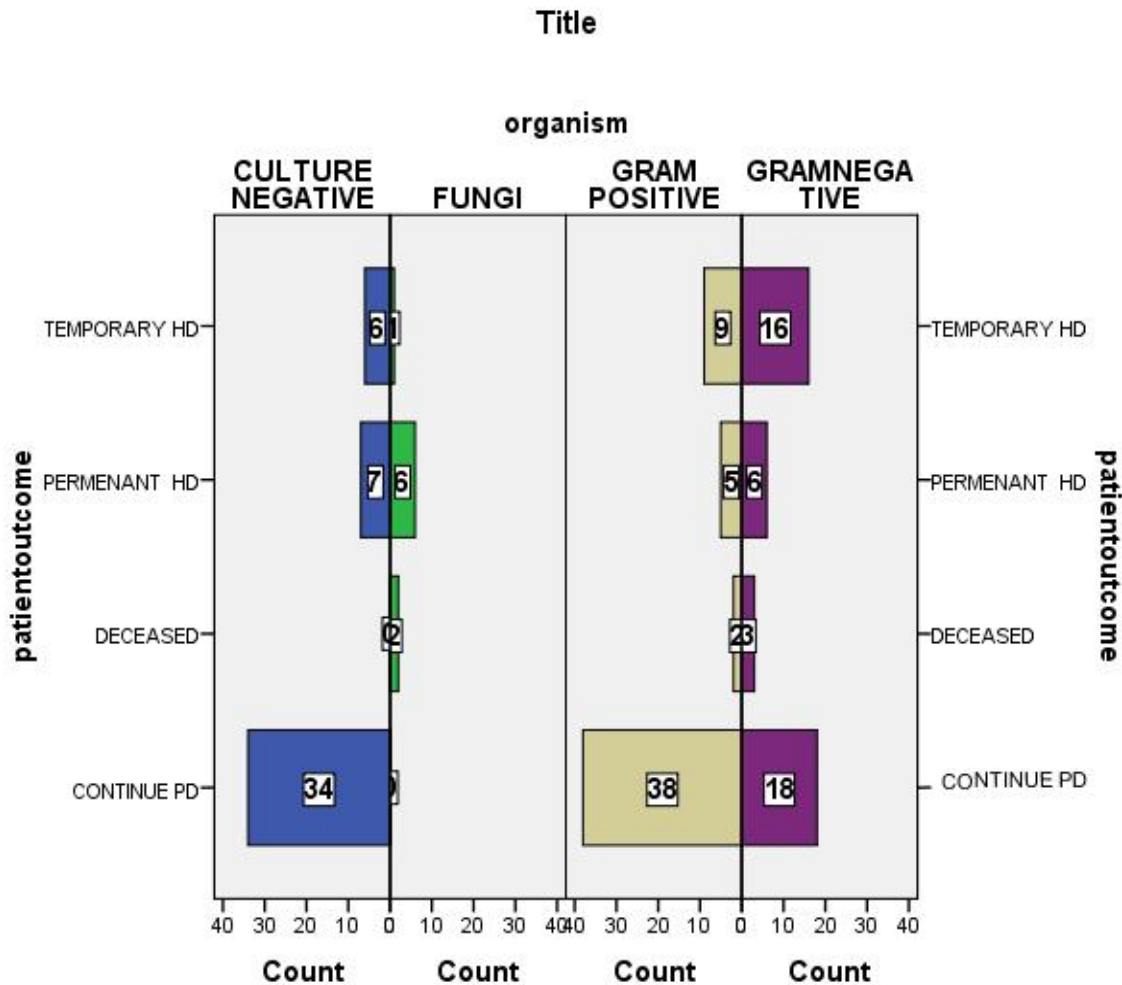


Figure 7 Patient outcome accounting to culture result

Table (7) Patient outcome according to culture results

	Conyinue PD	Deceased	Temporary HD	Permanent HD
Gram positive	38	2	9	5
Gram negative	18	3	16	6
Fungi	0	2	1	6
Culture negative	34	0	6	7
	Conyinue PD	Deceased	Temporary HD	Permanent HD
Gram positive	70.4%	3.7%	16.7%	9.3%
Gram negative	41.9%	7.0%	37.2%	14.0%
Fungi	0.0%	22.2%	11.1%	66.7%
Culture negative	72.3%	0.0%	12.8%	14.9%

Discussion

This study provides an overview of the incidence of peritonitis and the microbiological profile of a single PD center in Dubai, UAE

Our sample group similar to studies in Latin America (Brazil and Argentina) with regards to higher proportion of elderly patients > 60 years. However our patients showed a higher proportion of female (56%) while the literature showed male predominance (9-10).

The incidence of peritonitis per patient year shown in our study 0.403 episode per patient year this (almost one episode every 26 patient months) which comes in accordance with The 2005 recommendations from the International Society of Peritoneal Dialysis (ISPD) recommend that the unit should have as a goal a rate not exceeding one episode every 18 months, or 0.67 ep./year (8) .

However, in 2011, the ISPD published a document for risk reduction of peritoneal infections associated with dialysis, which suggests that the rate of 0.36 ep./year, or one episode every 33 months, can be achieved by most programs a rate much lower than achieved currently by our center (11).

Other centers in Taiwan showed even a lower rate of peritonitis per year 0.06 episodes per patient year , while some centers in Scotland showed higher 0.60 episodes per patient year , these variations in rate of peritonitis among different centers is multifactorial but they are most likely associated with differences in training, patient selection and protocols to prevent infection. (12).

Moraes *et al.*, in a retrospective analysis of a single center in Brazil, reported a rate of 0.74 ep./year in the period between 2000 and 2005, but when they considered the 25-year experience, the rates were 0,84 episode per patient year , rate higher than reported in our study (13).

Multicenter brazilian study showed peritonitis rate of 0.4 episodes per patient year almost similar to results obtained from our study (14).

According to Barreti *et al.* the main causative agent of peritonitis in the world is the gram positive coagulase negative staphylococci ; however *Staphylococcus aureus* is associated with more severe episodes and increased risk of hospitalization, catheter removal and death This come in accordance of our results with

gram positive culture the main cause of peritonitis episodes 54 (35.3%).(15)

Episodes of gram positive peritonitis are generally related to contamination at the time of connection or line contamination. Since these are germs from the skin natural microflora, *Staphylococcus aureus* and coagulase negative staphylococci are present mainly in the hands, which is the primary means of intraluminal contamination, demonstrating the relevance of effective training in which continuing education is important; thus preventing patients from forgetting the skills acquired during training - resulting in later damage (16).

Our culture negative episodes of 30.7 % results is higher than recommendation by international society of peritoneal dialysis of culture negative episodes not exceeding 20% of cultures which can be attributed to collection techniques or lower threshold of considering patients diagnosis of peritonitis hence collecting culture on suspicious of peritonitis with abdominal pain with or without cloudy effluent (11) .

Our subsequent data analysis of the studied population showed the higher proportion of patient continued peritoneal dialysis post peritonitis episodes 58.8% with 20.9 % patient needed temporary hemodialysis post peritoneal catheter removal till clearance of infection and introduction of new catheter , 15.7% of patients were shifted permanently to haemodialysis.

Mortality rate was 4.6% among the peritonitis episodes a rate slightly higher than reported mortality of 4% in current literature (13).

Our fungal peritonitis series constituted 5.9% of all peritonitis episodes in our PD unit. It was similar to the reported other prevalence changing from 2% to 10.2%.

Subsequent analysis found catheter was removed in 100% of peritonitis episodes immediately after culture growth of fungal species, the highest mortality rate among other groups 22.2% with 66.7% patients shifted permanently to Hemodialysis. this come in accordance with the ISPD guidelines for management of Fungal peritoneal dialysis which recommend catheter removal on fungal growth in culture as there is high recurrence rate and higher mortality among those cohort of patients (11).

The main limitation of our study is its retrospective aspect. However, our data indicate the need to implement measures aimed at reducing peritonitis rate per patient year and the rate for culture negative

peritonitis to the rates recommended by ISPD guidelines, by improving the selection, implementing training and retraining implementing catheter care techniques and education for care giver for improving outcome.

Conclusion

We may conclude that the rate of peritonitis episodes per patient year of the patients studied is within the minimum recommended by the guidelines, but short of the latest goals achieved in some centers, as well as the characterization of by microorganisms episodes per patient and median value of the program. with respect to the median of peritonitis episodes of the program, we observed that there was an improvement over the last few years which we attribute to the improvement in training and retraining of patient and care giver enrolled in the program, staff continuous education, assignment of dedicated peritoneal dialysis nurses, higher rate of using automated peritoneal dialysis machines and the structured follow up of our patients with monthly peritoneal dialysis clinic follow up and This data reinforce the importance of training and constant monitoring for the improvement of services, with a consequent emphasis on patient safety.

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