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SHORT COMMUNICATION

Results of application of the ISPD guidelines to the management of peritoneal dialysis in a single center in Sudan

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Summary The culture negative peritonitis in Sudan 2010 was 46% exceeding 20% of the recommended ISPD (International Society for Peritoneal Dialysis) guidelines. This study reports an update after applying the standard ISPD protocol. The routine method was replaced by ISPD protocol. The culture negative rate using the ISPD guidelines dropped from 46% in the year 2010, to 39% in the year 2011, to 5% in the 2012 and to zero percent in the year 2013. Bacterial and fungal species represent (86.76%) and (13.23%) of infection and most isolates showed low resistance rate to antibiotics. Touch contamination added significantly ($p = 0.0006$) to the risk of contracting Peritonitis. The risk of contracting Peritonitis was 1.53 times higher in the group exposed by touch contamination. None of the other risk factors contributed significantly to Peritonitis. The study highlights the importance of implementing high hygiene practice.

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Introduction

Peritonitis and exit site infection represents an obstacle in the management of patients undergoing continuous ambulatory peritoneal dialysis (CAPD) [1] and stress the need for rapid and reliable diagnostic methods. The ISPD guidelines are developed to improve diagnosis [2]. CAPD was launched in Sudan as a national service in 2005. It is considered as an alternative method to hemodialysis treatment due to its low cost; require less dietary restrictions and not requiring a hospital/center care, as well as offering a better quality of life. A Peritonitis rate of 1 episode/14 month was reported in Sudan [3]. The rate of culture negative after lunching CAPD in Sudan in 2007 was 53% [3]. Obtaining a false negative result may be serious and cost the patient his life. That is why over the past few years the diagnostic tools were improved and the ISPD guidelines were implemented in our center, in an effort to reduce the culture negative rate. Based on this improvement we thought to analyze the current situation regarding the negative culture rate, causative agents and antimicrobial profile of microorganism isolated from patients undergoing CAPD in our peritoneal dialysis centers in Khartoum State, Sudan.

Material and methods

Study design

This retrospective cross-section study was conducted at a single PD center in Khartoum State, Sudan from January 2010 to December 2013. All the 53 patients undergoing CAPD are routinely given questionnaires by medical staff to identify predisposing factors for peritonitis. Data about causative agent, age, gender, predisposing factors for peritonitis and incidences of peritonitis and exit site infections were also analyzed.

Laboratory diagnosis

The diagnosis of peritonitis was based on the presence of abdominal pain, signs of peritoneal irritation and peritoneal fluid turbidity and effluent white blood cell count >100 cells/ml, with >50% neutrophils.

The previous protocol used from 2005 to 2010 consists of 10 ml withdrawn from peritoneal dialysis (PD) bags of patients. Samples were centrifuged at 3000 g for 10 min and deposit was inoculated directly onto MacConkey agar, blood agar and chocolate agar. From 2010, this protocol was modified by the ISPD guideline, whereas the peritoneal dialysis fluids were increased to 50 ml and centrifugation parameters were changed to 3000 g for 15 min. In addition to the use of brain heart infusion and Thioglycolate broth. Briefly, the dialysate bags were delivered to the laboratory immediately after the diagnosis of peritonitis case. A total white cell count was performed using an improved Neubauer ruled chamber. Differential white cell count was done. Fifty ml or more (maximum 100 ml) of the dialysate fluid was taken with a sterile syringe under aseptic conditions. This fluid was centrifuged in sterile container at rate of 3000 g for 15 min using (EBA 21 Hettich, Germany) centrifuge, the supernatant was discarded and the deposit was resuspended in 3—5 ml of dialysate fluid instead of the normal saline [2]. Then divided into three parts, the first part was used for direct smears, stained with Ziehl-Neelsen (ZN) and gram stain. The second part was inoculated into blood agar, chocolate agar in 5% CO_2 and MacConkey agar incubated at 37 °C for 24—48 h, in addition to Sabouraud-dextrose slopes incubated at 37 °C and examined daily for growth for up to 7 days. The third part was inoculated into brain heart infusion broth, Thioglycolate broth and incubated at 37 °C for 7 days. Exit site swab was taken with the presence of purulent discharge with or without the erythema of the skin [2]. Species identification performed using conventional phenotypic methods [4].

Susceptibilities to cefazolin, vancomycin, gentamicin, ciprofloxcin, amikacin, ceftazidime, and meropenem antibiotics were determined using a standard disc diffusion method (Kirby Bauer) according to the National Committee for Clinical Laboratory Standard [5].

Statistical analysis

Data are expressed as percentages for categorical variables and as mean ± standard deviation for continuous variables. For each risk factor the proportion test, as implemented in the function prop.test in S-Plus 8.2, was used for, to test if the factor increased the risk of contracting Peritonitis. *p*-Values less than or equal to 0.05 were considered statistically significant.

Results

The total number of patients receiving CAPD during January 2010 to December 2013 was 53 patients. 46 (86.7%) had a previous episode of

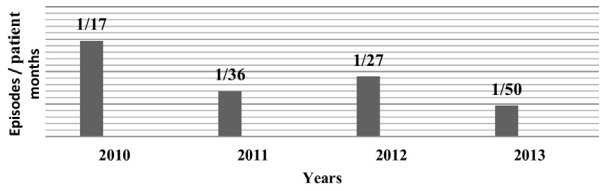

Figure 1 Peritonitis rates in Ribat center during period from 2010—2013. The maximal peritonitis rate accepted by the ISPD is one episode per 18 patient months. The fraction indicates episodes/patients — month (e.g. 1 in 17 months).

peritonitis (61% males and 39% females), while 7 (13.2%) had no previous episode of peritonitis (57% males and 43% females). The mean age of the patients was 50 ± 14.6 (60.4% males and 39.6% females). The overall peritonitis rate was reduced from one episode per (17.0) patient-month followed by (36.0), (27.0), to one episode per 50.6 patient-month consecutively (Fig. 1). Total number of patients with exit site infection was 29 (65.5% males and 34.5% females). Touch contamination added significantly ($p = 0.0006$) to the risk of contracting Peritonitis. The risk of contracting Peritonitis was 1.53 times higher in the group exposed by touch contamination. None of the other risk factors contributed significantly to Peritonitis (Table 2).

Causative organism

We report here the culture negative rate using the ISPD guidelines, which dropped from 46% in the year 2010, to 39% in the year 2011, to 5% in the 2012 and to zero percent in the year 2013. A total of 68 microorganisms causing peritonitis were isolated, out of this the bacterial species represent (86.76%) while fungal species represent (13.23%). In the present study the results show that Gram-positive bacteria are the most commonly detected in exit site infection (75.51%) while Gram-negative bacteria were the most common cause, accounting for (54.41%) of all peritonitis cases (Table 1).

Table 1 The cumulative frequency of microbial causes of peritonitis and exit site infection among the studied population during the period of 2010—2013. NI, not isolated.

Organisms	Peritonitis		Exit site	
	Frequency	Percent	Frequency	Percent
Gram positive				
Staphylococcus aureus	8	11.76	8	16.33
Staphylococcus epidermidis	4	5.88	10	20.41
Staphylococcus aureus MRSA	2	2.94	1	2.04
Staphylococcus haemolyticus	NI	0	1	2.04
Streptococcus faecalis	4	5.88	1	2.04
Streptococcus viridans	1	1.47	NI	
Streptococcus agalactiae	NI	0	1	2.04
Streptococcus sp	NI	0	1	2.04
Micrococcus	1	1.47	1	2.04
Diphtheroid	1	1.47	12	24.49
Mycobacterium abscessus	1	1.47	1	2.04
Gram negative				
Escherichia coli	16	23.52	4	8.16
Coliform	1	1.47	NI	0
Serratia marcescens	2	2.94	1	2.04
Klebsiella pneumoniae	4	5.88	NI	0
Pseudomonas aeruginosa	14	20.6	4	8.16
Proteus mirabilis	NI	0	1	2.04
Fungi				
Candida albicans	2	2.94	2	4.08
Non candida albicans	2	2.94	NI	0
Aspergillus flavus	2	2.94	NI	0
Aspergillus fumigatus	2	2.94	NI	0
Aspergillus terreus	1	1.47	NI	0
Total	68		49	

Table 2 Evaluation of possible risk for development of peritonitis.

	Exposed	Not exposed	Relative risk (exposed/not exposed)	*p*-Value
Touch contamination	100%	65%	1.53	0.0006201
Neglected hand wash	100%	86%	1.16	0.3468541
Used damaged bag or line	100%	86%	1.16	0.3468541
Dialysis done by untrained person	100%	86%	1.16	0.4826641
Dialysis done in un suitable place	100%	85%	1.18	0.3540273
Recent exit site or tunnel infection	100%	86%	1.16	0.286925
Constipation	100%	86%	1.16	0.286925
Diarrhea	100%	85%	1.18	0.4119238
Dusty weather	100%	84%	1.19	0.2640908
Disconnecting antibiotic	100%	86%	1.16	0.2433276

One patient had recurrent *Diphtheroid* exit site infection. *Serratia marcescens* was isolated from patient died with septic shock as consequence of exit site infection after application of ashes as healer advice. Furthermore, non-infectious culture negative peritonitis due to use of icodextrin (7.5%) was observed in two patients. This peritonitis is due to chemical irritation. Stopping icodextrin promptly relieved the symptoms.

Antimicrobial sensitivity

The isolates exhibited various phenotypic profiles against different classes of antibiotics. The antimicrobial profile test showed that the gram negative isolates were (100%) sensitive to ceftazidime followed by amikacin (80%, 75%, and 83%), Gentamicin (80%, 75%, and 77.7%) and ciprofloxacin (65%, 50%, and 55%) for *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* respectively. Notably, cefazolin was tested only against *E. coli* and were all resistant. As for gram positive isolates, vancomycin was drug of choice with sensitivity of (81.2%, 92.8%, 80%) followed gentamicin (87.5%, 78.5%, 60%) and ciprofloxacin (81.25%, 64.5%, 60%) for isolates of *Staphylococcus aureus*, *Staphylococcus epidermidis* and *Streptococcus faecalis* respectively. Notably, cefazolin was tested only against *S. aureus* (62.5%) and *S. epidermidis* which were all resistant.

Discussion

The validity of our results is based on strict follow up of standard microbiological technique and ISPD procedure, which enabled the isolation of fastidious microorganisms such as *Mycobacterium*. Therefore, results reported herein were interpreted as reliable. This technique increases isolation rate of pathogens. Limitations in the present study include retrospective study design, describing relatively small sample size from single center.

Peritonitis and exit site infection represents an obstacle to patients undergoing CAPD [1] and stress the need for rapid and reliable diagnostic methods. The ISPD guidelines are developed to improve diagnosis [2]. This reduction of culture negative peritonitis reported herein is due to following the ISPD procedure and probably also due to decrease in antibiotic use before cultures are obtained in the laboratory. The culture negative rate at our center is below the recommended rate of 20% of ISPD guidelines. The current antibiotic therapy protocol is administered according to the Sudan program guidelines [6]. The antimicrobial profile test showed low resistant rate to antibiotics used in our center. When the spectrum of causative agents before and after implementing of ISPD guideline was compared, the distribution of the causative agents differed. In 2005 at the beginning of our dialysis program, *Pseudomonas* species were the most common organisms responsible for 13.3% and *S. aureus* was responsible for 6.7% of the cases [3], while in the our study the main causative agent changed to *E. coli* which account for 23.52%. Considering the diversity of isolates, we observed that *E. coli*, *Pseudomonas aeruginosa*, *S. aureus* and *K. pneumoniae* are the most frequently encountered pathogen in peritonitis. These results indicate the potential presence of bacteria of fecal, environmental and skin origin, which explain why the touch contamination represents the main risk factor for peritonitis. Touch contamination our main problem and account for (46.7%) as reported previously [3]. Touch contamination added significantly ($p = 0.0006$) to the risk of contracting Peritonitis. The risk of contracting Peritonitis was 1.53 times

higher in the group exposed by touch contamination. None of the other risk factors contributed significantly to Peritonitis.

We conclude that the current improvement of diagnostic tools in our center lowered the culture negative rate. Furthermore, it enables us to have better picture regarding antimicrobial profile and predisposing peritonitis factors.

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Competing interests

None declared.

Ethical approval

Not required.

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