

Peritonitis in patients on peritoneal dialysis: analysis of a single Brazilian center based on the International Society for Peritoneal Dialysis

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ABSTRACT

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. **Objective:** This study aimed to determine the rates of peritonitis episodes per year at risk (ep./yr), ep./yr by causative microorganism and median of peritonitis in patients on peritoneal dialysis at Hospital São Lucas. **Methods:** Retrospective descriptive study, with a study sample composed of patients treated with peritoneal dialysis at the Renal Unit of São Lucas Hospital between the periods from 1984 to August 2012. Only patients with complete data were considered. **Results:** Of the 427 patients analyzed, 53.2% (227) were females, mean age was 48.0 ± 19.9 years, 13% (56) were diabetics and 71.5% (303) of the patients performed their own treatment. There were 503 episodes of peritonitis and 255 patients had at least one episode. Coagulase-negative *Staphylococcus* was the most prevalent organism. The main causes of dropout from treatment were death, renal transplantation and peritonitis with 34.4, 25.8 and 19.2%, respectively. The rate of peritonitis was 0.63 ep./yr, rates by microorganism were 0.18 ep./yr for coagulase-negative *Staphylococcus*, 0.12 ep./yr for *Staphylococcus aureus* and Gram negative. The median of peritonitis in the unit was 0.41 ep./yr. **Conclusion:** The rate of peritonitis ep./yr and median of patients studied is within the recommended minimum, but below the suggested targets proposed by the position statement of ISPD.

Keywords: peritoneal dialysis; peritonitis; renal insufficiency, chronic.

INTRODUCTION

Brazil is the third country in the world in number of patients on dialysis, according to the 2010 census of the Brazilian Society of Nephrology (SBN), it is estimated that there are around 90.000 patients on renal replacement therapy (RRT) and only 10 % were on peritoneal dialysis (PD).¹⁻³

In PD, peritonitis remains the most common cause of catheter removal, transfer to hemodialysis and antibiotic use, and it occurs most often due to inadequate technique in handling the bag or connection with the catheter.⁴ Peritonitis damages the peritoneal membrane, impairing ultrafiltration and therapy adaptation, which may be a temporary or permanent condition.⁴

The success of a PD program depends heavily on patient selection, constant monitoring of infectious complications and knowledge of the local rates of peritonitis, the microbiological profile and the resistance patterns of microorganisms in order to better conduct the clinical treatment.⁵

In Brazil, the main infectious agent associated with infections is *Staphylococcus aureus*.^{1,6,7} Although peritonitis rarely leads to death, it is a contributing factor in 16% of deaths, and 18% of mode-related mortality is associated with peritonitis.⁸

The prevalence of *Staphylococcus aureus* causing peritonitis in Brazil can be explained by the large number of negative cultures, which may hide

other germs that are more prevalent in most studies, such as coagulase negative *staphylococcus* (CNS).^{1,6,7}

The 2005 recommendations from the International Society of Peritoneal Dialysis (ISPD) determined that monitoring peritonitis episodes in the units should be done by calculating the rate of peritonitis episodes per year at risk (episode/year - ep./ Year), and they recommend that the unit should have as a goal a rate not exceeding one episode every 18 months, or 0.67 ep./year.^{9,10} 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.⁸ The 2010 guidelines introduced the recommendation to establish the incidence of peritonitis by causal microorganism and the median peritonitis rate of the PD program, wherein the rate of peritonitis is calculated as ep./year by patient.⁹

The aim of this study is to establish the rates of peritonitis episode/year, ep./year by causing microorganism and median peritonitis episodes at the Nephrology Service, Hospital São Lucas, following the ISPD 2011 recommendations.

METHODS

Quantitative approach, retrospective study. We analyzed a database of patients from the Nephrology Service at São Lucas Hospital (HSL) between the years 1984-2012; however, between January of 1989 to April of 1993, the data was not collected in a systematic way and was excluded from the study. 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, who ran the bag exchange, type of peritoneal dialysis and causing microorganism.

Categorical variables were described as frequency and percentage, and continuous variables with normal distribution were the mean and standard deviation.

The rate of peritonitis was expressed as risk of a peritonitis episode per year (ep./year) and calculated in accordance with the ISPD recommendations.⁹ To determine the rate of peritonitis and/or peritonitis microorganism, we calculated the number of patients/day (pat.day), peritonitis episodes per patient/year (episodes/pat.year) and peritonitis episodes per year (episodes/year) for each microorganism found.⁹ 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.⁹

This study was approved by the Ethics in Research Committee (CEP) of the Pontifical Catholic University of Rio Grande do Sul (PUCRS), with protocol number 09/04535. We assured the confidentiality of the data collected from medical records and databases relating to patients attending the Nephrology Service, Hospital São Lucas - PUCRS.

RESULTS

Of the 527 patients who were included in the database from January 1984 through August 2012, 427 met the inclusion criteria and were analyzed for the incidence of peritonitis episode/year and for causal microorganism, as well as the median of the episodes in the program.

The average age of the 427 patients studied was estimated at 48.0 ± 19.9 years; there was a predominance of the population over 60 years in 30.8% (n = 131). Most were females - 53.2% (n = 227). Treatment interruption happened as the result of death, transplantation and peritonitis, with 34.4% (n = 147), 25.8% (n = 110) and 19.2% (n = 82), respectively. Thirteen percent were diabetic and 71% of patients were independent to make their own treatment. The majority, 59.7% (n = 255) of patients were submitted to continuous ambulatory peritoneal dialysis (CAPD), and the remaining were submitted to automated peritoneal dialysis (APD). Regarding educational level, the data is relevant for 30.9%

of the population in the study, of which 18.3% (n = 78) had completed high school, and only 2.6% (n = 11) had higher education. The average length of stay in peritoneal dialysis was 680 days, with a median of 461 days (1-3rd quartile 239-890).

Two hundred and fifty-five patients (59.7%) had peritonitis during the period. Table 1 shows the frequency in which they occurred per patient. There were 503 episodes of peritonitis in these patients; and Table 2 presents data on the prevalence of causative organisms of the peritonitis studied.

The incidence of peritonitis in the total study period was 0.63 ep./year; equivalent to one episode every 19 months. When we consider ep./year by microorganisms, we obtained an incidence rate of 0.18 ep./year to CNS, 0.12 ep./year for *Staphylococcus aureus* and Gram-negative germs in general.

The median rate of peritonitis in the program was 0.41. Table 3 shows the incidence of peritonitis ep./year for a period of time, as well as their respective median values. The prevalence of microorganisms was similar in all periods.

The average in days for the occurrence of the first episode of peritonitis was 330 ± 199 days, with a median of 184 days (95% CI: 136.5

TABLE 3 DISTRIBUTION OF EPISODES PER YEAR AND MEDIAN IN PERIODS OF TIME

Period	# of patients	# of peritonitis episodes	Ep./year	Median
1984-1994	57	78	0.63	0.56
1995-2005	184	258	0.64	0.49
2006-2012	184	168	0.63	0.24

to 231.7), or the first peritonitis occurred in a period up to 184 days in 50% of the sample.

DISCUSSION

This study provides an overview of the incidence of peritonitis and the microbiological profile of a single PD center in the south of Brazil.

The submitted sample has characteristics similar to those of other studies, but with some differences. According to the Brazilian Dialysis Census of 2009 and 2010, the percentage of patients on renal replacement therapy aged higher than or equal to 65 years was 39.9% and 30.7%, respectively; males predominated, at 57%, which differs from the present study, in which the majority of patients were females, but similar to another study from the South of Brazil.^{2,11,12} However, the proportion of patients aged over 60 is similar to the census, also different from what happens in Argentina, where there is a predominance of males and the elderly are 18%.^{2,11,13} Several studies point to DM as one of the main causes for Chronic Kidney Disease (CKD).^{2,5,6,12} In this study, DM did not occur in the same proportion, probably because we analyzed only the patients on PD, unlike the census, which considered the etiology of CKD of all patients undergoing dialysis. Other studies carried out in the same unit, analyzing only PD-prevalent patients showed the same DM distribution (17%).^{14,15}

In a study corresponding to an overview of PD in Latin America, Chile had mortality as the main reason for interrupting dialysis, with a rate of 4%, due to peritonitis, and renal transplantation with 2%. Moraes *et al.*¹² reported a 40% mortality rate from cardiovascular causes, and peritonitis as the second most frequent cause,

TABLE 1 DISTRIBUTION OF PERITONITIS BY PATIENT

Frequency	Distribution (n = 427)	
	Absolute (n)	Relative (%)
Patients	255	59.7
1 episode	116	27.2
2	76	17.8
3	36	8.4
> 4	27	6.3

TABLE 2 MICROORGANISMS THAT CAUSE PERITONITIS

Etiological agents	Distribution (n = 503)	
	Absolut (n)	Relative (%)
Coagulase negative S. (CNS)	137	27.2
Gram negative	102	20.1
<i>S. aureus</i>	100	19.8
Negative culture	85	16.9
Others	79	15.7

with 16%. In Brazil, we also see death as the main cause for treatment interruption, followed by peritonitis.² This data is different from what we found in our study, in which transplant was the second most frequent cause for treatment interruption, and peritonitis the third most frequent cause.

Abreu *et al.*¹⁶ observed that the probability of remaining free of peritonitis was associated with the person in charge of executing the technique, which, when performed by the patient, was 54%, and when it was done by the caregiver, 78% over 12 months of treatment; in this study, the influence of caregiver training was considered an important factor in this difference; and also, the majority of patients in our study performed the bag exchange themselves, which might explain the longer follow-up in our sample. The mean follow-up of patients was 15.4 months, while Fernandes *et al.* reported a mean follow up of 13.6 months, and Moraes *et al.*, reported 14 months.^{6,12}

According to Barreti *et al.*¹⁷ the main causative agent of peritonitis in the world is the CNS; however *Staphylococcus aureus* is associated with more severe episodes and increased risk of hospitalization, catheter removal and death. In Latin American countries, *S. aureus* is the leading cause of infections, especially in Brazil - different from our sample, in which the main cause of peritonitis was the CNS. This same result has already been shown in previous publications from the same center.¹⁴ In our hospital, peritoneal fluid cultures are positive in 84% of peritonitis cases

In countries such as Colombia, Argentina, Uruguay and Chile, the CNS appeared as the primary germ causing peritonitis, which is consistent with our study, whereas in countries such as Ecuador and Peru, the most prevalent was the gram-positive *Staphylococcus aureus*, which differs from the present study, but resembles the Brazilian data. In Argentina, Uruguay and Venezuela gram-negative bacteria are the third most prevalent microorganism.¹

Episodes of CNS-caused peritonitis are generally related to contamination at the time of connection or line contamination.^{9,14}

Since these are germs from the skin natural microflora, *Staphylococcus aureus* and CNS 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.¹⁸ Russo *et al.*¹⁹ claimed that 29% of patients require strengthening the training and in their ability to exchange the bag. Li *et al.*⁹ believe that hand hygiene must be emphasized and training of washing and drying the hands is essential in preventing PD-related infections.

Some dialysis centers can reach a low level of ep./year, as is the case of a center in Taiwan with 0.06; other centers, as one in Israel, reach high levels at 1.66 ep./year.⁸ In Scotland, the rate of 0.60 ep./year is similar to the rate represented by risk of peritonitis episode per year in this study.⁴ There are many explanations for variations in different centers, but they are most likely associated with differences in training, patient selection and protocols to prevent infection.

Moraes *et al.*,¹² 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 ep./year, higher than our rates, which remained constant over the years. Barretti *et al.*⁷ reported a rate of 0.96 ep./year, the experience of a single center in the Brazilian Southeast. However, another multicentric Brazilian study, reported peritonitis rates higher than ours, with 0.4 ep./year.²⁰

Li *et al.*⁹ believe that a rate of 0.36 episodes/year can be achieved by most programs, and when it comes to peritonitis caused by *S. aureus*, this rate should be less than 0.06 ep./year.

According to Barretti *et al.*, in a study involving 682 patients between 1996 and 2010, the number of peritonitis was 0.96 ep./year; however, when they analyzed the incidence of peritonitis caused by *Staphylococcus aureus*, they observed an improvement over the years, of 0.13 episodes per patient/year in 1996-2000; 0.10 in 2001-2005 and 0.04 in 2006-2010, this

center uses prophylactic antibiotic in the catheter exit site. This may be an important variable having an impact on the rates of peritonitis due to *S. aureus*, and an approach recommended by the ISPD, which perhaps should be implemented to improve rates.^{7,9}

The data regarding episode/year by microorganism could not be compared with the national literature or Latin American, as they are innovative, but the comparison with Australia and Scotland, where this information is available, the rates for CNS are of 0.15 and 0.18 ep./year, comparable to our results. However, *S. aureus* is lower than our rates with values of 0.07 and 0.11 ep./year, respectively.^{4,5} It is clear that we still have a long way to go in order to reach the goals set by the International Society of Peritoneal Dialysis.

Of all the data analyzed, the frequency of negative cultures was the data that is within the ISPD recommendations, less than 20% of the samples, which perhaps explains the difference found between the incidence of CNS and *S. aureus*, when compared to other Brazilian studies in which negative cultures are higher than 20%.^{1,6,12,19}

The main limitation of this study is its retrospective aspect. However, our data indicate the need to implement measures aimed at reducing these rates, by improving the selection, implementing (re) training or starting with antibiotic prophylaxis in the care of the catheter exit site.

CONCLUSION

We may conclude that the rate of peritonitis ep./year of the patients studied is within the minimum recommended by the guidelines, but short of the latest goals suggested to be achieved in centers of excellence, as well as the characterization of ep./year by microorganisms 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; however short of what was expected.

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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