

## Risk factors for peritonitis and hospitalizations

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### ABSTRACT

**Introduction:** This study assessed 30 children and adolescents with chronic kidney disease on dialysis, cared for at the Hospital das Clínicas of UFMG, aiming at determining the risk factors for the frequency of peritonitis and hospitalizations. **Method:** Descriptive study using the SPSS (Statistical Package for Social Science) software, version 13.0. The following variables were assessed as risk factors for a higher frequency of peritonitis and hospitalizations: low educational level; low family income; inadequate level of information; inadequate hand antisepsis during PD; and lack of a sink in the dialysis room. **Results:** The *odds ratio* values were within the 95% confidence intervals, and, in some cases, were smaller than 1, indicating the possibility of a negative association between some independent variables and the variables studied, but with no statistically significant difference. **Conclusion:** No statistical significance was observed for the variables studied, despite the tendency towards that.

**Keywords:** peritoneal dialysis, peritonitis, risk factors, hospitalization.

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### INTRODUCTION

Chronic kidney disease (CKD) in childhood is the common end of several systemic or primarily renal or urologic diseases, which can be congenital or acquired, and occur in early or late childhood.<sup>1</sup> Treatment is proposed according to the stage of the disease. Patients usually search for medical care in an advanced stage, when dialysis techniques [peritoneal dialysis (PD) or hemodialysis (HD)] often become essential for life maintenance.

Peritoneal dialysis is one of the treatment alternatives and provides the following advantages to patients: better biochemical control; better control of uremia, anemia, and hypertension; preservation of residual renal function; fewer restrictions regarding nutrition and fluid intake; less need for blood transfusions; maintenance of children/adolescents in their social environment; and greater compatibility with school life.<sup>2</sup>

Despite all those advantages, PD may represent a risk for patients if some essential requirements to its success are not met, such as minimally adequate housing conditions, antisepsis of the room destined to PD, motivation, and mastering of the technique by the family members responsible for the process or aiding with it.

Peritonitis has a significant impact on pediatric patients regarding the longevity of the therapeutic modality<sup>3</sup>, and accounts for the most frequent complication of continuous ambulatory peritoneal dialysis (CAPD) or of automated peritoneal dialysis (APD).<sup>4,5</sup>

One of the first signs of peritonitis is the alteration in color and aspect of the fluid drained that changes from clear and thin to cloudy and thick. In addition, there are

fever, abdominal pain, malaise, nausea, vomiting, and a reduction in appetite. When treated early, peritonitis has a good outcome.

Approximately 50% to 60% of the episodes of peritonitis in children are caused by Gram-positive bacteria, and 20% to 30% by Gram-negative bacteria. Fungi cause 2% to 5% of the infections.<sup>3</sup>

*Staphylococcus aureus* and *Staphylococcus epidermidis* are the most common agents of peritonitis. Peritonitis is confirmed by use of laboratory findings through leukocyte count in the peritoneal effluent greater than 100 cells/mm<sup>3</sup> with at least 50% of polymorphonuclear neutrophils. The drainage bag with the cloudy fluid should be sent to the laboratory for Gram staining, cultures, leukocyte differential count (leukocytes and red blood cells), in addition to search and culture for fungi, in cases of suspected fungal infection.<sup>6</sup>

The overall incidence of peritonitis in patients on CAPD during the 1980s and early 1990s was, on average, 1.1 to 1.3 episode per year in the United States. The introduction of the dual-bag system and the Y system reduced that incidence to approximately one episode every 24 months.<sup>7</sup> The peritonitis rate in patients on CAPD in the United States is currently comparable to that reported in patients undergoing APD.<sup>8</sup>

The treatment of peritonitis includes intraperitoneal antibiotic therapy at each exchange or only at the nocturnal exchange, which makes the treatment easier and reduces the risk of new infections.<sup>6</sup>

This study aimed at determining the risk factors for peritonitis and hospitalizations in children/adolescents undergoing PD at the Pediatric Nephrology Unit of the Hospital das Clínicas da Universidade Federal de Minas Gerais (HC/UFGM).

## METHOD

The study comprised all children/adolescents with CKD cared for at the Pediatric Nephrology Unit of the Hospital das Clínicas da Universidade Federal de Minas Gerais (HC/UFGM), who were using or had already used PD as renal replacement therapy, from May 2004 to March 2006.

## DEFINITIONS

### PERITONITIS

In this study, two or more episodes of peritonitis per year was defined as an unfavorable condition, that is, a high frequency of peritonitis, and less than two episodes of peritonitis per year was defined as a favorable condition, that is, a low or acceptable frequency of peritonitis. That classification was based on the

NAPRTCS annual report<sup>9</sup>, which revised data collected up to January 2003 and detected 3,385 episodes of peritonitis in 4.395 @ [checar com autor] @ years of follow-up, yielding an annual rate of 0.77 episodes per patient per year (one infection for every 15.6 patients/month).

### HOSPITALIZATION

Three hospitalizations or more per year was defined as an inadequate condition, that is, a high frequency of hospitalizations. Less than three hospitalizations per year was defined as an adequate or acceptable condition, that is, a low frequency of hospitalizations.

### QUALITY OF PD PRACTICE

The quality of PD practice, represented by the mean of the evaluations performed by the nurse researcher and by the nurses of the Pediatric Nephrology Unit of the HC/UFGM, responsible for the training and follow-up of the caregivers and children/adolescents, was assessed based on theoretical and practice knowledge. Participative assessment was performed aiming at minimizing possible personal interpretations that could lead to overvalue or undervalue.

- The quality of PD practice was considered adequate or inadequate. It was considered adequate when the caregiver correctly followed the steps of the technique, with no modification, in accordance with the training received and the instructions provided during regular home visits, such as:

- a) choice and use of equipment and materials;
- b) hand antisepsis;
- c) way of warming the dialysis fluid for infusion;
- d) use of facial mask during PD;
- e) products used for antisepsis of the dialysis catheter;
- f) destination of the effluent (drained fluid, dialysis product).

Data were collected through an interview with the caregiver (the mother in 80% of the cases) and observation of the technique during dialysis practice, both on the occasion of home visit by the nurse researcher. A home visit guide and a questionnaire with closed and open questions were used.

The following aspects were considered for classifying the group studied:

- High and low educational level, low corresponding to four or less years of schooling;
- High or low *per capita* income, low corresponding to one minimum wage or less per person (value of March 2006 in Brazilian currency, R\$ 300.00);

- The condition of the dialysis site was considered favorable or unfavorable, and lack of a sink in the dialysis room was the most specific indicator of unfavorable condition;

- Adequate or inadequate hand antisepsis, and inadequate antisepsis occurred when hand washing (duration and number of times) required for antisepsis was not in accordance with the recommendations for the dialysis modality (CAPD or APD);

- Assessment of the caregiver's knowledge about the dialysis technique and related items according to the following questions:

1 – What do you know about peritoneal dialysis?

What is it for?

2 – What were the instructions provided?

3 – What care procedures require permanent attention?

4 – What should be the aspect of the drained fluid?

5 – When should medical aid be sought?

6 – If you were to instruct anybody, what would you say? (detailed description)

The criteria for classifying the answers were based on the theoretical and practical knowledge of the nurse researcher and specialists (advisers and nurses of the Pediatric Nephrology Unit of the HC/UFGM) about PD practice, about CKD and related issues, and the instruction provided to caregivers. The answers to the questions were classified as follows: a) unsatisfactory: the interviewee did not understand the question, provided a superficial, wrong, or non pertinent answer; and b) satisfactory: detailed and explanatory answer.

#### STATISTICAL ANALYSIS

Based on the data bank created, tables of frequency were built with odds ratio calculation for the proposed crossings and confidence interval for each result found. The confidence interval used was 95%.

The SPSS (Statistical Package for Social Science) software, version 13.0, was used.

#### ETHICAL ASPECTS

This study was approved by the Committee on Ethics of the UFGM and the parents and guardians of the children/adolescents provided written informed consent.

#### RESULTS

This study comprised 30 children/adolescents, 15 (50%) of the female sex, and mean age of  $8.2 \pm 4$  years (1 to 16.5 years). The patients were on renal replacement therapy for  $2.8 \pm 2.2$  years (0.4 to 9.7 years).

#### HOSPITALIZATIONS AND RELATED GENERAL COMPLICATIONS

Hospitalization was reported by 23 (77%) caregivers. Twelve patients (40%) were hospitalized three or more times per year, and 11 (37%) were hospitalized only once. Only seven (23%) patients were never hospitalized.

According to the interviewees, the hospitalizations were due to several complications and to catheter exchange or repositioning. Table 1 shows the complications leading to hospitalizations and their frequency distribution classified according to severity.

#### PERITONITIS

The most common causative agents of peritonitis in the patients studied were *Staphylococcus aureus* and *Staphylococcus epidermidis*, and, in some cases, *Enterococcus* sp. Peritonitis was reported by 15 (50%) caregivers at the frequency shown in Figure 1.

#### ASSOCIATIONS BETWEEN THE VARIABLES STUDIED

Based on data collected and the classification of the sample studied, possible associations were sought between the frequency of peritonitis and hospitalizations and the variables shown in Table 2 by using odds ratio calculation. The confidence interval used was 95%. The OR values were within the limits of the confidence intervals, and, in some cases, they were smaller than 1, indicating the possibility of a negative association between some independent variables and the variables studied, although with no statistically significant difference.

The possibility of association between the quality of the dialysis technique, the frequency of peritonitis (OR = 1.90 and CI = 0.38 – 9.59) and the frequency of hospitalizations (OR = 1.60 and CI = 0.35 – 7.30) was assessed and is shown in Table 3. Although the OR was > 1, indicating the possibility of a positive association between the independent variable and the variable studied in both cases, no statistically significant difference was observed.

The results shown in tables 2 and 3 did not evidence the presence of a risk factor among the variables studied.

#### DISCUSSION

##### HOSPITALIZATIONS AND PERITONITIS

Data of the USRDS<sup>10</sup> have reported infection, mainly peritonitis, as the most frequent initial cause of hospitalization for PD children, while the NAPRTCS<sup>11</sup> records have identified peritonitis as the major cause for changing dialysis technique.

Several studies have confirmed that the most common infectious complication of PD is peritonitis, in both

CAPD and APD, and it is also of great significance for hospitalization, catheter loss, malnutrition, peritoneal membrane failure, change in dialysis technique, and, eventually, death.<sup>4,10,12,13,14,15</sup>

Other dialysis complications, such as infections, especially infections of the peritoneal catheter exit site and tunnel, have been reported by six (20%) caregivers, being usually associated with poor hygiene, manipulation by patients and/or colonization by bacteria of their own skin, predisposing to peritonitis.

Peritonitis is still the major factor of morbidity and mortality of PD patients. The occurrence of peritonitis may indicate a flaw in the procedure and/or lack of commitment from the caregiver to the patient, in addition

to resulting in hospitalization and time spent away from home and family. Despite all that, with the advances in the treatments of peritonitis and changes in medical management, those patients have been benefited, and the treatment can be performed at home, with the use of antibiotics in dialysis bags during the procedure.

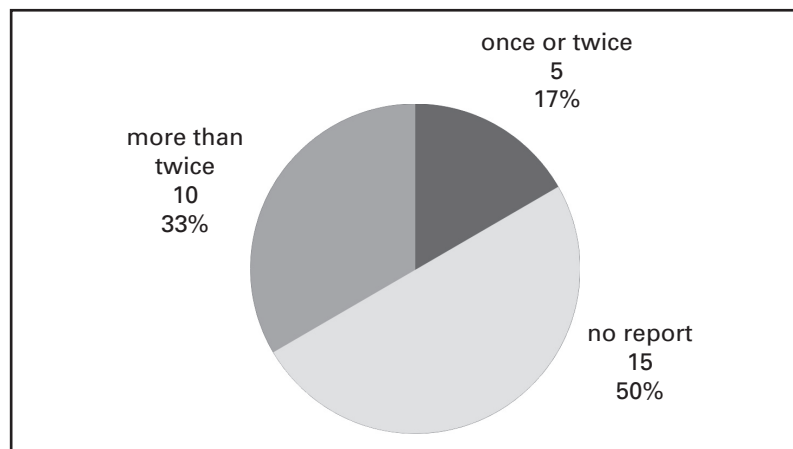
In the present study, of the 23 (77%) reports of hospitalization, 15 (65%) related to hospitalization for treating peritonitis. Despite the elevated number of episodes of peritonitis, its incidence has decreased over the years in the patients cared for at HC/UFGM, which may be explained by the intensification of home visits performed by the team responsible for training for PD, and also by the conversion from the CAPD to APD technique.

**Table 1**

COMPLICATIONS RELATED TO PERITONEAL DIALYSIS THAT CAUSED HOSPITALIZATION, REPORTED BY THE CAREGIVERS

Complications	
Severe	Non severe
Peritonitis (15)	Infection of the catheter (exit site or tunnel) (6)
Seizure (10)	Malnutrition (7)
Hypertension (4)	Abdominal pain (7)
Cardiorespiratory arrest (2)	Hernia (2)
	Non specified infections (1)
	Laboratory changes (2)
	Nausea (1)
	Vomiting (1)
	Dehydration (1)
	Diarrhea (1)
	Crust at the catheter (1)
	Anemia (1)

\*(number of reports for the respective complications informed).

**Figure 1.** Report of frequency of peritonitis.

**Table 2**

ODDS RATIO AND CONFIDENCE INTERVAL OF THE VARIABLES STUDIED AND ASSOCIATION WITH FREQUENCY OF PERITONITIS AND OF HOSPITALIZATION

Variables	Greater number of peritonitis		Greater frequency of hospitalization	
	OR	95% CI	OR	95% CI
Low educational level	0.20	0.02 - 1.98	0.40	0.06 - 2.43
Low income	0.47	0.02 - 8.46	0.64	0.03 - 11.45
Lack of sink	1.00	0.08 - 12.55	0.72	0.72 - 9.04
Inadequate antisepsis	0.58	0.09 - 3.60	1.75	0.34 - 8.98
IKQ 1	0.25	0.02 - 2.52	2.50	0.44 - 14.03
IKQ 2	1.28	0.23 - 6.96	1.75	0.34 - 8.98
IKQ 3	1.41	0.19 - 10.22	1.00	1.44 - 7.09
IKQ 4	*	*	*	*
IKQ 5	2.42	0.39 - 15.08	0.70	0.10 - 4.59
IKQ 6	0.25	0.25 - 2.52	0.18	0.18 - 1.75

OR = odds ratio; CI = 95% confidence interval; IKQ.: inadequate knowledge relating to the corresponding question. The observations number equals 30. \*Correspond to 30 adequate answers (100%) to the question proposed.

**Table 3**

QUALITY OF DIALYSIS TECHNIQUE VS. FREQUENCY OF PERITONITIS, AND QUALITY OF DIALYSIS TECHNIQUE VS. FREQUENCY OF HOSPITALIZATION

Condition	Quality of the technique		
	Inadequate	Adequate	Total
Higher number of peritonitis	38.9%	25.0%	33.3%
Lower number of peritonitis	61.1%	75.0%	66.7%
<b>Total</b>	100.0%	100.0%	100.0%
High frequency of hospitalizations	44.4%	33.3%	40.0%
Low frequency of hospitalizations	55.6%	66.7%	60.0%
<b>Total</b>	100.0%	100.0%	100.0%

The reports of peritonitis informed by caregivers corresponded to patients who were on dialysis treatment for at least 1.4 year and a maximum of 9.7 years.

The short time on dialysis may have accounted for the lack of peritonitis of six (40%) patients among 15 (50%) in that condition. Those six patients were on dialysis for slightly over three months. In addition, the short dialysis time, change to another therapeutic modality, or renal transplantation may have contributed to the lack of peritonitis in nine patients. Those data suggest an association between peritonitis and PD time.

#### DISCUSSION OF THE STATISTICAL RESULTS

The possibility of an association between the variables studied, by using the OR calculation and the

confidence interval of their values to evaluate their statistical significance, was assessed.

No association between the variables tested was observed, probably due to the sample size (30 patients).

Multicenter studies, including all the pediatric population on DP in the State of Minas Gerais or even in Brazil, may be able to confirm the associations of not only those but also other variables related to that type of treatment for CKD. Thus, more information may be provided for improving renal replacement therapies and the quality of life of that population.

#### EDUCATIONAL LEVEL OF THE MAJOR CAREGIVER

The caregiver should have a basic educational level to minimize the interferences related to the patient's

care, and also to improve the understanding of the rules and instructions provided, indispensable for treatment.

A low educational level did not interfere with the frequency of peritonitis and hospitalizations, a fact possibly explained by the reduced size of the sample studied (30 patients).

#### PER CAPITA INCOME

The *per capita* income of the families studied was lower than one minimum wage per person in 28 (93%) cases, indicating a low socioeconomic profile in most patients with CKD on dialysis cared for at the Pediatric Nephrology Unit of the HC/UFMG.

In accordance with the low *per capita* income, we observed that 13 (43%) homes visited were under construction. The household conditions were often poor, inadequate for the patient's treatment, lacking enough room for the necessary equipment.

#### PRESENCE OF A SINK IN THE DIALYSIS ROOM

In our study, the lack of a sink in the dialysis room did not prove to be a risk factor for peritonitis and hospitalizations. That may be explained not only by the small sample size (30 patients), but also by the reduced number of dialysis rooms without a sink (3/30 = 10%).

#### HAND ANTISEPSIS

Peritoneal dialysis requires the use of a product adequate and sufficient for antiseptics of the hands and peritoneal catheter. The duration and frequency of the antiseptics depends on the dialysis modality used.

The duration and frequency of hand antiseptics, according to the type of dialysis modality, recommended during the training conducted by the nurses, have fundamental importance for dialysis practice, and, when not properly performed, they jeopardize the procedure.

A tendency towards a reduction in the frequency of hospitalization is observed when hand antiseptics is adequate; however, in this study, that variable did not favor the reduction in the number of episodes of peritonitis, a situation probably concealed by other forms of contamination at least as important as that.

#### CAREGIVER'S KNOWLEDGE

Although with no statistical significance, the following was observed:

- Inadequate knowledge, assessed through questions 1 and 2 (table 2), tends to be a risk factor for a greater frequency of hospitalizations, suggesting the probable

need for retraining primary basic knowledge, aiming at contributing to the reduction in hospitalizations and a possible improvement in performing the procedure.

- Inadequate knowledge, assessed through questions 2, 3, and 5 (table 2), was characterized by the following: when the caregiver did not understand the question; did not know or forgot the instructions; did not have an appropriate notion of which care procedures required permanent attention regarding the patient and dialysis; did not know when to seek for medical aid. Those situations tend to increase the incidence of complications and be a risk factor for peritonitis. Those findings may suggest that the caregiver was not paying enough attention to important issues for minimizing the occurrence of complications.

- Regarding knowledge assessed through question 4 (table 2), all 30 caregivers knew the aspect the drained fluid should have, and responded properly to the question. That topic is highly emphasized by the caring team, as it may indicate possible flaws in the caregiver's PD practice, in addition to be, when altered, a sign of peritonitis.

- Contrary to what was expected, for knowledge assessed through question 6 (table 2), that is, the question that asked for a detailed description of the PD technique, no association was observed with peritonitis and hospitalization.

Those findings were possible through home visits, which should be frequent and represent one of the tools used not only by the primary health care in programs of family health, but also by the specialized care, represented in this study by HC/UFMG.

The home visits and the contact with patients and families inspire confidence and commitment. Good intra- and extra-hospital relations are some essential tools for caring for patients with CKD.

Home visit is a door to the knowledge of reality, and may represent a form of inviting the patient and his/her family to work their material and cultural possibilities in their own favor, improving compliance and reducing complications.

#### CONCLUSION

Despite the lack of statistical difference in the analysis of independent variables as risk factors for the dependent variables studied, the following variables are believed to play a positive role for the success of the dialysis technique: caregiver's educational level greater than four school years; family income higher than one minimum wage (R\$ 300.00) per person; adequate environment for PD practice; adequate theoretical and practical information about PD and CKD;

strict obedience to the instructions provided about PD practice; commitment and involvement of the family and especially of the caregiver. Those variables may even contribute to the reduction in the number of clinical intercurrent findings and consequent hospitalizations.

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