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Kronik Periton Diyalizi Uygulanan Çocuklarda Peritonitlerin Değerlendirilmesi; Tek Merkez Deneyimi

Outcome of Peritoneal-Dialysis Related Peritonitis in Children: A Single Center Experience

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ÖZ

GİRİŞ ve AMAÇ: Bu çalışmada, periton diyaliz ünitemizdeki peritonit ataklarının etyolojisi, klinik bulgusu, tedavisi, görülme sıklığı ve mikrobiyolojik profili incelenmiştir.
YÖNTEM ve GEREÇLER: Ocak 2004 – Aralık 2011 tarihleri arasında merkezimizde, kronik periton diyalizi ile izlenen, peritonit atağı geçirmiş olan 55 hastayı retrospektif olarak incelendi. *BULGULAR:* Hastalarımızda toplam 157 atak saptandı. Peritonit atak sıklığı incelendiğinde; 23,9 hasta ayında 1 atak olarak saptandı. SAPD uygulanan hastalarda atak sıklığı 26,8 hasta ayında 1 iken, APD uygulanan hastalarda 20,1 hasta ayında 1 olarak saptandı.
Atakların %30,5'inde (n=48) üreme saptanmadı,%42,6'sında (n=67) gram pozitif üreme, %19,7'sinde (n=31) gram negatif üreme, % 3,8 'inde (n=6) polimikrobial gram pozitif üreme, %0,6 'sında (n=1) polimikrobial gram negatif üreme, % 0,6 'sında (n=1) polimikrobial kombine üreme ve % 1,9 'unda (n=3) diğer grup üremeler saptandı. Swanneck çift cuff periton diyaliz katateri takılı olan 42 hastada ortalama peritonit atak sayısı 3 ± 2,34 iken, tenckhoff çift cuff periton diyaliz katateri takılı olan 13 hastanın ortalama peritonit atak sayısı 2,38 ± 1,60 olarak saptandı.
TARTIŞMA ve SONUÇ: Çalışmamızda, hasta yaşının, cinsiyetinin, diyalize başlama yaşının, periton diyaliz tipinin, katater tipinin, katater takılma şeklinin peritonit atak sayısını etkilemediğini gördük. Bu tespit peritonit atak sıklığını azaltmada uygulayıcı ebeveyn eğitimini sorgulamanın önemine işaret edebilir.

Anahtar Kelimeler: kronik, periton, diyaliz, peritonit

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SUMMARY

INTRODUCTION: The aim of this study was to clarify the etiology, clinical presentation, treatment of peritonitis, peritonitis rate, and to analyze the microbiologic profile of peritonitis in our pediatric dialysis unit.

METHODS: This study was performed with children treated with chronic peritoneal dialysis and diagnosed for peritonitis during the period from January 2004 to December 2011 at the Peritoneal Dialysis Unit of our Pediatric Nephrology Department.

RESULTS: The patient cohort comprised 55 patients (30 males, 25 females) who were treated for peritoneal dialysis related peritonitis. The total number of peritonitis episodes was 157. The mean peritonitis rate was one episode per 23.9 patient-months; one episode per 26.8 patient-months for continuous ambulatory peritoneal dialysis and one episode per 20.1 patient-months for automated peritoneal dialysis. The yield of culture positivity was 69.5% with %42.6 gram-positive, 19.7% gram-negative, 3.8% polymicrobial gram-positive, 0.6% polymicrobial gram-negative, 0.6% polymicrobial mixed, 1.3% fungal and 0.6% anaerobic organisms. Coagulase-negative staphylococcus was the most common cause, accounting for 17.1% of all episodes.

The mean number of peritonitis episodes was 3±2.3 in 42 patients with double-cuffed swan neck catheter whereas the number of peritonitis episodes was 2.3±1.6 in 13 patients with double-cuffed tenckhoff catheter. There was no relation between catheter type and the number of peritonitis episodes ($p>0.05$).

DISCUSSION and CONCLUSION: In conclusion, neither the dialysis modality, catheter type, nor the catheter insertion techniques have a definite effect on the development of a perionitis episode. This directs us to consider the importantance of the training program given to the caregivers.

Keywords: chronic, peritoneal, dialysis, peritonitis

INTRODUCTION

Peritoneal dialysis (PD) is the preferred method of renal replacement therapy for end-stage renal disease in children because of technical ease, improved preservation of residual renal function compared to haemodialysis and enhanced autonomy (1). Peritonitis is a major complication of chronic peritoneal dialysis (CPD) therapy. Peritonitis and catheter exit-site infections are the most common infections of PD related infections, with the rate of these infections to be greater in children than in adults (2). Although the incidence of CPD-related infectious complications has decreased in children as well as in adults within the past two decades, peritonitis remains the most important cause of morbidity in pediatric population (3). Data on peritonitis associated with peritoneal dialysis in pediatric patients is limited in developing countries. The aim of this study was to clarify the etiology, clinical presentation, treatment of peritonitis, peritonitis rate, and to analyze the microbiologic profile of peritonitis in our pediatric dialysis unit.

MATERIALS and METHODS

This study was performed with children treated with CPD and diagnosed for peritonitis during the period from January 2004 to December 2011 at the Peritoneal Dialysis Unit of the Pediatric Nephrology Department of our University. Patient data were reviewed retrospectively. Children were younger than 18 years of age at the commencement of PD. Peritoneal dialysis catheters were placed by three methods: surgical, laparoscopic or by trocar with a downward-facing or parallel subcutaneous tunnel. A prophylactic antibiotic (cefazolin) was administered preoperatively. Diagnosis of peritonitis was made based on the following three criteria and diagnosed when any two of the three criteria are present: 1) cloudy peritoneal fluid and abdominal pain; 2) peritoneal fluid containing more than 100 white blood cells/mm^3 with at least 50% polymorphonuclear cells; and 3) microorganisms in the peritoneal fluid (4,5,6). Ten ml of peritoneal fluid were cultured into the BACTEC Peds Plus culture bottles (Becton Dickinson). The collected data included information on gender, age at commencement of PD, causes of end stage renal disease (ESRD), age at peritonitis, catheter placement techniques, catheter types, symptomatology, microbiology of peritonitis episodes, initial treatment modality, need to change to second or third antibiotic regimen and outcomes. Disease severity scores (DSS) were established (7).

Antibiotics were administered by intraperitoneal injection. The outcomes examined were incidence of PD peritonitis, rate of clinical response to initial empiric antibiotic therapy, status of nasal carriage, rates of relapse, recurrent peritonitis, and catheter removal, temporary or permanent transfer to hemodialysis, catheter revisions and patient death. Peritonitis relapse was defined as an episode of peritonitis with the same organism as in the preceding episode, according to antibiotic susceptibilities, within 4 weeks of completion of antibiotic treatment (5,6). Recurrent peritonitis was defined as an

episode of peritonitis due to a different organism occurring within 4 weeks of administration of the last antibiotics (5). Peritonitis related death was recorded if the patient's death was directly attributable to peritonitis in the clinical opinion of the treating nephrologist. A peritonitis episode was considered cured by antibiotics if the patient was symptom free and the cultures were negative.

Statistical analysis was performed using a computer based program (SPSS for Windows version 21; SPSS,Chicago, IL). Quantitative variables were expressed as means, and qualitative variables were expressed as percentages. Univariate comparison between continuous variables was performed with Student's *t* test or the Mann-Whitney *U* test, and categorical data were compared using the $\chi 2$ test or Fisher's exact test. A *P* value <0.05 was considered statistically significant. Written informed consent was obtained from the parents of every child participating in the study. The study was approved by the institutional research committee.

RESULTS

The patient cohort comprised 55 patients (30 males,54,5%;25 females,45,5%) who were treated for PD related peritonitis. The classification of the patients according to the age was shown in Figure 1.

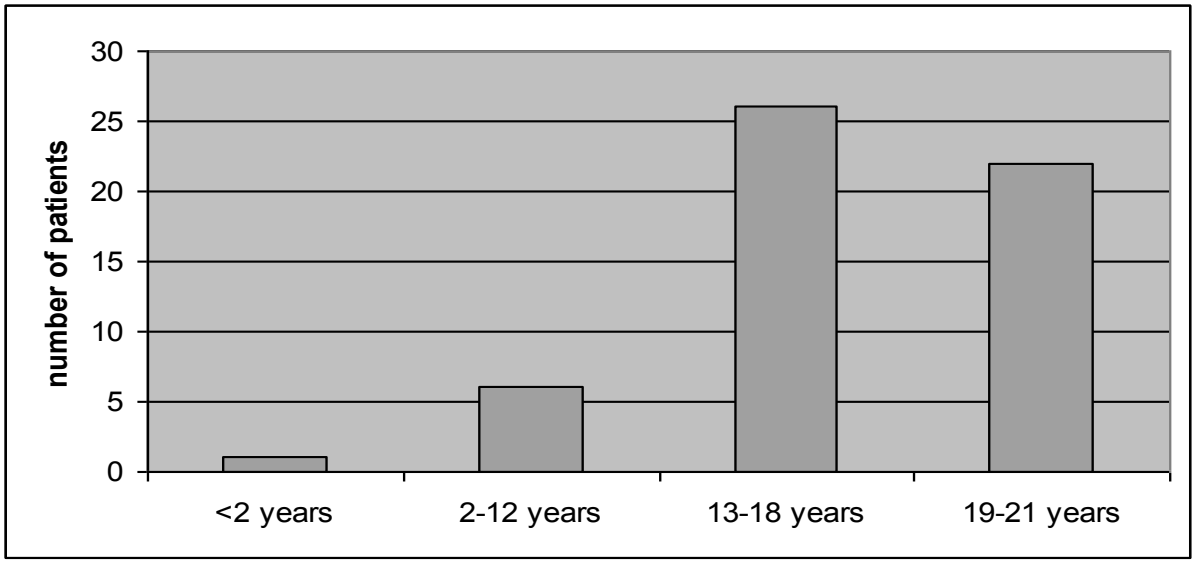

Figure 1. Age distribution of patients enrolled in the study

Assessing the etiology of end stage renal disease (ESRD) in our study, the most common causes of ESRD were chronic glomerulonephritis (43,6%), reflux nephropathy (25,5%) and pyelonephritis/interstitial nephritis (18,2%) followed by familial nephritis (9,1%), posterior urethral valve (1,8%) and congenital hypoplasia/dysplasia (1,8%). The total number of peritonitis episodes was 157. The mean peritonitis rate was one episode per 23,9 patient-months (one episode per 26,8 patient-months for CAPD and one episode per 20 patient-months for APD). The frequency of CAPD patients

with culture negative peritonitis were higher than patients with Gram-negative and Gram-positive infections (p=0,01 and 0,02 respectively) (Table 1).

Table 1. Association between type of dialysis and microorganism in patients with peritonitis.

		Microorganism		Microorganism	
		Gram (+)	Culture negative	Gram (-)	Culture negative
Type of dialysis	CAPD	36	32	16	32
	APD	33	11	19	11
p		**0.02**		**0.01**	

CAPD; Continuous ambulatory peritoneal dialysis APD; Ambulatory peritoneal dialysis

Tunnel or exit site infections occurred in 21,8% of the patients once and in 1,8% of the patients twice. Episodes were presented with mixed symptoms like fever (>38˚C), abdominal pain, vomiting and cloudy peritoneal fluid in 56,7% of the attacks, only with cloudy peritoneal fluid in 42% of the attacks and only with vomiting in 0,6% of the attacks. Disease severity score was found 2.1±1.2 for Gram positive, 2.42±1.3 for Gram negative and 1.3±1.1 for culture negative infections ($p<0.05$).

Initial empiric therapy was cefazolin-ceftazidim in 139 episodes, and ceftazidim-vancomycin in 18 episodes. Clinical response on day 3 was observed in %72.6 of the patients. The third day clinical response was significantly poorer in Gram-positive and Gram-negative infections than culture-negative infections (p=0.03; Table 2). Switch to 2nd antibiotic regimen was required in 26.8% of the patients and switch to 3rd antibiotic regimen was required in 10.2% of the patients. The yield of culture positivity was 69.5% with 42.6% gram-positive, 19.7% gram-negative, 3.8% polymicrobial gram-positive, 0.6% polymicrobial gram-negative, 0.6% polymicrobial mixed, 1.3% fungal and 0.6% anaerobic organisms.

Table 2. Third day response in Gram-positive and negative infections and culture-negative infections.

	3th day response	
	(+)	(-)
Gram (+)	51	17
Gram (-)	22	13
Culture negative	38	5

p= 0.03

Coagulase-negative staphylococcus was the most common cause, accounting for 17.1% of all episodes. Other organisms isolated were gram-positive other group (15.9%), staphylococcus aureus non-MRSA (3.2%), staphylococcus aureus MRSA (3.2%), enterococci (0.6%), gram-negative other

group (8.9%), pseudomonas aeruginosa (2.5%), enterobacter species (7.6%), klebsiella species (0.6%), polymicrobial organisms (7.6%), fungal (1.3%) and anaerobic organisms (0.6%) (Figure 2).

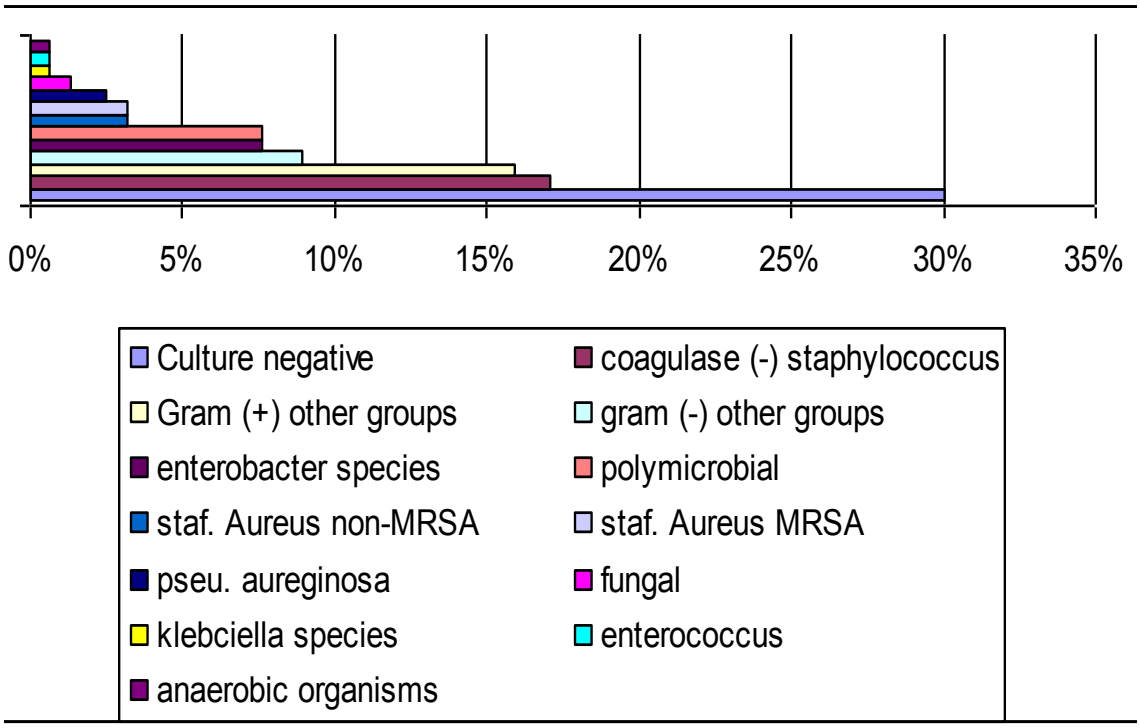

Figure 2. Classification of causative organisms

Nasal carriage of staphylococcus aureus was found in 21.8% of the patients whereas mothers of the patients had also nasal carriage of staphylococcus aureus in 1.8% of the patients. Oral prophylactic antibiotic therapy was given to 10.9% of the patients. Relapses occurred once in 12.7% (n=7) of the patients, twice in 1.8% of the patients, 3 times in 1.8% of the patients and 5 times in 1.8% of the patients. There was recurrence in 3.6% (n=2) of the patients. The dialysis catheter had to be removed once in 27.3% of the patients, twice in 1.8% of the patients and 3 times in 3.6% of the patients. Assessing the methods of catheter placement in our study, 35 patients (63.6%) had their catheters placed by trocar, 17 patients (30.9%) had their catheters placed surgically, and 3 patients (5.5%) had their catheters placed by laparoscopic method. During the 7 years follow-up period, 22 patients had catheter revision once, 3 patients had catheter revision twice, 3 patients had catheter revision 3 times and 3 patients had catheter revision 4 times. Twenty patients had also omentectomy. The mean number of peritonitis episodes was 3±2.3 in 42 patients with double-cuffed swan neck catheter whereas the number of peritonitis episodes was 2.3±1.6 in 13 patients with double-cuffed tenckhoff catheter. Catheter type was not associated with the number of peritonitis episodes (p=0.38). Peritonitis led to a switch to temporary hemodialysis in 4 patients. Seven patients switched to permanent hemodialysis.

DISCUSSION

Peritoneal dialysis is still the most preferred renal replacement therapy for children with ESRD worldwide. Peritoneal dialysis related peritonitis is the most common and significant infectious complication of the therapy and often compromise the continued function of the procedure. Following the consensus guidelines by the International Society of Peritoneal Dialysis (ISPD) and multicenter studies, data from various centers, especially from developing countries is essential to assess the global variations of clinical manifestations, microbiologic profile, rate of peritonitis and other outcomes (3-7,10,12,14).

We found that our peritonitis rate was one episode per 23.9 patient-months, similar to the studies of Cleper et al (one episode per 18 patient-months) and Vidal et al (one episode per 20.7 patient-months) whereas it was reported one episode per 4.3 patient-months in the study of Raaijmakers et al (8-10). Comparing our center's data in 1997-2002 and 2004-2011, the frequency of peritonitis was slightly higher in the first data, 1 episode per 18 patient-months and 1 episode per 23.9 patient-months subsequently. Rates of gram positive, gram negative and culture negative episodes were similar in the two periods (11).

Culture positivity was higher in episodes presenting with mixed symptoms like fever (>38˚C), abdominal pain, vomiting, and cloudy peritoneal fluid ($p<0.001$) supporting the relationship between the disease severity score (DSS), culture positivity, and type of infection mentioned in the study of Warady et al (5).

The most common causative organisms in PD-associated peritonitis are noted as coagulase –negative staphylococcus, mainly staphylococcus epidermidis and staphylococcus aureus in the literature (3, 5, 12, 14). In our study, the most common cause of peritonitis was found to be coagulase-negative staphylococcus similar to the studies of Warady et al, Akman et al, and Lee et al (5, 12, 13). Our study is compatible with the study of Mujais which declared coagulase-negative staphylococcus was three times more common than S. aureus as the cause of peritonitis (15).

Polymicrobial peritonitis rates were 7.6%, similar to the rates of polymicrobial peritonitis in the study of Bordador et all which is 6% (12). Fungal peritonitis rates were lower than in the studies of Warady et al, and Akman et al, probably due to our smaller group of patients (13, 16).

Culture negativity was 30.5 %, similar to that of the literature but higher than ANZDATA study where culture negativity was reported as 14% (4-6, 12). It is shown that by following recommended culture techniques, culture-negative peritonitis should not account for >20% of peritonitis episodes (6).

The third day clinical response was significantly poorer in Gram-positive and Gram-negative infections than culture-negative infections ($p=0.03$), also mentioned in the study of Warady et al (5).

Similar to the study of Warady et al, the frequency of CAPD patients with culture negative peritonitis was higher than patients with Gram-negative and Gram-positive infections (p=0.01 and 0.02 respectively) (Table 2) (5).

With a higher omentectomy rate (53%) than in our study (36%), Ladd et al mentioned that their study did not allow for the determination of any direct or indirect benefit of omentectomy in the development of peritonitis (17). In our study, we did not find any association between the number of peritonitis episodes and omentectomy.

It was concluded that age, gender, catheter type, and catheter insertion techniques were not associated with the number of peritonitis episodes (p>0.05). Type of catheter was also found to have no effect on peritonitis rates in the study of Chand et al (18).

In the study of Schaefer et al, swan-neck catheters were presented as being used more commonly in Turkey (73%) than in Eastern (15%), Western (15%) Europe, and Mexico (0%) which is compatible with our study with 76% of patients with double-cuffed swan-neck catheter (3). Catheter insertion by percutaneous trocar method has prominently increased in our center from 14% to 63.6% through the years 1997-2002 and 2004-2011 as a result of nephrologists performing the procedure (11). Of 157 episodes of peritonitis, 17 (10.8%) were followed by a relapse, concordant with the literature (19).

In studies of Locatelli et al and Huang et al, patients on automated peritoneal dialysis (APD) had lower peritonitis rates than those on continuous ambulatory peritoneal dialysis (CAPD), contrary to our study (20,21). The peritonitis rate was one episode per 15.4 patient-months for APD and one episode per 15.6 patient-months for CAPD in the study of Akman et al (13) suggesting almost no difference between the two modalities for the risk of peritonitis. Between the years 1997-2002, peritonitis rate had been one episode per 8.3 patient-months for APD in our center while it was found one episode per 20 patient-months for APD in 2004-2011 (11). This is probably due to the increasing number of APD patients. Reviewing the effect of the dialysis modality on peritonitis, there are some studies favoring APD (20-24), some CAPD (25, 26) and a few others finding peritonitis rates to be similar for both modalities (13, 27, 28).

In conclusion, neither the dialysis modality, catheter type, nor the catheter insertion techniques have a definite effect on the development of peritonitis. This directs us to consider the importance of the training program given to the caregivers. Lack of data on the training schedule of the caregivers is a limitation of this study. Future outcome studies are needed to focus on the possibility of preventing peritonitis with a periodic retraining program to all caregivers.

Conflict of interest; none

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