

Original Article

Peritoneal Dialysis Associated Peritonitis in Children With End-stage Renal Disease: A Single Center Experience in Iran



Ahmad Shajari^{1*}, Marzieh Amiri Bakhtiari¹, Mohammad Golshan-Tafti¹

1. Department of Pediatric Nephrology, Faculty of Medicine, Yazd Branch, Islamic Azad University, Yazd, Iran.

2. Department of Pediatrics, Faculty of Medicine, Yazd Branch, Islamic Azad University, Yazd, Iran.



Citation Shajari A, Amiri Bakhtiari M, Golshan-Tafti M. Peritoneal Dialysis Associated Peritonitis in Children With End-stage Renal Disease: A Single Center Experience in Iran. *Journal of Pediatric Nephrology*. 2022; 10(4):171-174. <https://doi.org/10.22037/jpn.v10i4.41123>

doi <https://doi.org/10.22037/jpn.v10i4.41123>



Article info:

Received: 17 Apr 2022

Accepted: 29 Sep 2022

Publish: 01 Dec 2022

Corresponding Author:

Ahmad Shajari
Address: Department of Pediatric Nephrology, Faculty of Medicine, Yazd Branch, Islamic Azad University, Yazd, Iran.
E-mail: a_shajari@iauyazd.ac.ir

ABSTRACT

Background and Aim: The present study aimed to evaluate the frequency and risk factors of peritonitis end-stage renal disease (ESRD) pediatrics on peritoneal dialysis (PD) in Yazd City, Iran.

Methods: This cross-sectional study was conducted on ESRD pediatrics on PD in Shahid Sadoughi hospital, Yazd City, Iran from 2016 to 2020. Demographic characteristics, such as age, sex, body mass index (BMI) at the commencement of PD, underlying medical conditions, the microbiology of peritonitis, and the recovery rate were investigated. Results were evaluated using SPSS software, version 26 (SPSS Institute, Inc., Chicago, IL, USA).

Results: A total of 23 children (56.5% females) were included in this study. The Mean±SD age was 13.30±4.38 years, and the mean BMI was 15.71±5.53. PD-associated peritonitis was diagnosed in 18 cases (78.3%). A total of 21.7% had at least one underlying disease. No significant relationship was observed between sex (P=0.9), mean age (P=0.41), mean BMI (P=0.24), and underlying condition (P=0.29) according to pediatrics with and without PD-associated peritonitis. Bacterial and fungal infections were responsible for peritonitis in 15 (62.5%) and 3 (13%) pediatrics on PD, respectively.

Conclusion: The frequency of PD-associated peritonitis in the ESRD children of our study was 78.3%.

Keywords: Peritoneal dialysis, Peritonitis, End-stage renal disease, Pediatrics

Introduction

Childhood end-stage renal disease (ESRD) is rare and based on recent studies, accounting 1% of ESRD patients in the US [1], which is almost 10,000 [2] individuals but remains a leading cause of death among them [3]. Few studies have focused on the epidemiology of childhood ESRD in the Iranian popula-

tion. A national registry study shows an increase in the incidence and prevalence from 1991 to 2009 [4] and no further reliable statistics are available. In addition, early diagnosis, and treatment of ESRD in children is crucial due to its severe effects on growth, bone metabolism, and cardiovascular system development [5]. Peritoneal dialysis (PD) is a low-cost and home-based dialytic technique, these benefits along with low dependency on health professionals and the child's ability to attend

school, made it an initial ESRD treatment in children, especially those aged 9 years and younger [6, 7]. Based on North American pediatric renal trials and collaborative studies (NAPRTCS), of 9108 recorded dialysis cases between 1992 to 2010, 58% had PD [7]. Despite the beneficial aspects of PD, its association with peritonitis as a frequent complication is a significant concern [8]. In addition, it is necessary to investigate the microbiology and risk factors of peritonitis in children with PD to determine the effective treatment for them. However, despite the concern about the increasing prevalence of this disease [9], few studies have investigated it during the last 10 years [10]. Here in this study, we aimed to investigate the frequency of peritonitis in ESRD pediatrics on PD in Yazd City, Iran.

Materials and Methods

This cross-sectional study was conducted on ESRD pediatrics on PD in [Shahid Sadoughi hospital](#), Yazd City, Iran from 2016 to 2020. Informed consent was obtained from their parents and the study protocol was approved by the Ethics Committee of [Shahid Sadoughi University of Medical Sciences](#). The diagnosis of peritonitis was based on Warady et al.'s guideline [11] and confirmed by the pediatrician. Patients with peritonitis caused by any reason other than PD, for example, appendicitis, were excluded from the study. The collected data included de-

mographic characteristics, such as age, sex, body mass index (BMI) at the commencement of PD, underlying medical conditions, the microbiology of peritonitis, and the recovery rate.

Data analysis

Results were evaluated using SPSS software, version 26 (SPSS Institute, Inc., Chicago, IL, USA) and presented as Mean±SD, frequency, and percentages. Chi-squared test and t-student were used to compare the frequency and mean, respectively. $P < 0.5$ was considered statistically significant.

Results

A total of 23 ESRD pediatrics, including 13 women (56.5%), were on PD during the study period. The etiology of ESRD was identified in 18 patients and hereditary renal diseases, such as renal agenesis, hypoplasia or dysplasia, hemolytic uremic syndrome (HUS) and polycystic kidney disease were the most common (Table 1). The mean age was 13.30 ± 4.38 years, and the mean BMI was 15.71 ± 5.53 . PD-associated peritonitis was diagnosed in 18 cases (78.3%). The dialysis duration in these patients was 12.4 ± 3.75 days. At the beginning of PD, the mean systolic blood pressure was 113 ± 2.1 mmHg, and the mean diastolic blood pressure was 75.3 ± 0.6 mmHg (Table 2). No significant relationship was observed between

Table 1. Etiology of ESRD in study pediatrics

Etiology of ESRD	No. (%)
Renal agenesis /hypoplasia/dysplasia	9(39.1)
HUS	5(21.7)
Polycystic kidney disease	2(8.7)
Unknown	7(30.5)
Total	23(100)

Abbreviations: ESRD: End-stage renal disease; HUS: Hemolytic uremic syndrome.

Table 2. Demographic information

Variables	Mean±SD	Unit	No.
Systolic blood pressure	113 ± 2.1	mmHg	23
Diastolic blood pressure	75.3 ± 0.6	mmHg	23
Dialysis duration	12.4 ± 3.7	Day	18
Hemoglobin	132.4 ± 10.2	g/dL	23

Table 3. Mean BMI and age in pediatrics with and without PD associated peritonitis

Variables	Mean±SD		P
	With Peritonitis	Without Peritonitis	
Mean age (y)	12.88±4.70	14.80±2.86	0.41
Mean BMI (kg/m ²)	14.56±3.16	19.40±9.65	0.24

BMI: Body mass index.

sex (P=0.9), mean age (P=0.41), mean BMI (P=0.24), and underlying condition (P=0.29) according to pediatrics with and without PD-associated peritonitis (Table 3 and 4). Bacterial and fungal infections were responsible for peritonitis in 15(62.5%) and 3(13%) pediatrics on PD, respectively. A total of 91.3% of patients completely recovered after treatment.

Discussion

Infection is one of the leading complications of PD in children with ESRD and can be a cause of mortality in these patients. In addition, among the infections associated with PD, peritonitis has a significant frequency and incidence rate in adults and pediatrics [9]. In 2000, the international society for peritoneal dialysis (ISPD) [12] presented a guideline on the prevention and treatment of peritonitis caused by PD in children, in which the peritonitis episodes were reported in 47 dialysis centers in Europe, Asia, America, and Turkey. Although the frequency of peritonitis in children is less common, its investigation should be considered because it can cause death [13]. Considering that many studies have investigated the incidence of peritonitis, the results of our study were only comparable to the study by Lee et al. [13], which was conducted in Korea. In this study, the frequency of peritonitis during the first 6 months following initiation of PD was 73.9% and similar to our results. In our study, no significant difference was observed based on mean age and mean BMI between patients with and without peritonitis, as well as sex and underlying disease. It was

similar to Bordador et al. study [14] However, Nishina et al. [15] reported age at the start of PD as a risk factor for the development of peritonitis. A total of 62.5% of our patients had PD-associated peritonitis caused by bacterial infection. Statistically, in several countries, such as Japan [15], Greece [6], Korea [13], and China, 71.3%, 63.7%, 83.9%, and 96% have been reported, respectively. Also, a worldwide study in 2007 identified bacteria as the cause of 69% of PD-related peritonitis in the United States, Mexico, Europe, Asia, Argentina, and Turkey [16]. As in our study, fungal infection was the leading cause of PD-associated peritonitis in 13% of our patients. This result is remarkable since previous studies [13, 14, 16, 17] conducted before 2013 have stated this frequency to be less than 5% of their cases. For this difference, we can hypothesize that the prevalence of this infection has increased compared to the past, or it can be more frequent in Iran than in other countries. However, these results cannot be compared due to the lack of available information.

This study had limitations, such as significantly small sample size and more patients needed to obtain more accurate results, and insufficient information was found about antibiotic therapy and classification of bacterial infection in terms of gram-positive and gram-negative. In conclusion, the frequency of peritonitis which remained a common complication in pediatrics on PD is significant. But no significant relationship was observed between age, gender, BMI, and underlying disease in them, and in causing peritonitis caused by PD, bacte-

Table 4. Sex and underlying disease in pediatrics with and without PD associated peritonitis

Variables	No. (%)		P
	With Peritonitis	Without Peritonitis	
Sex	Male	8(80)	0.9
	Female	10(76.9)	
Underlying disease	With	3(60)	0.29
	Without	15(83.3)	

rial infections are more common than fungal infections. Further prospective studies with a more significant number of patients are required to confirm the results of our research.

Ethical Considerations

Compliance with ethical guidelines

The protocol of this study was confirmed by Ethics Committee of Shahid Sadoughi University of Medical Sciences.

Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

Authors' contributions

All authors equally contributed to the preparation of this article.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgments

We thank our patients and their parents for their cooperation and help in conducting this study.

References

- [1] Leonard MB, Grimm PC. Improving quality of care and outcomes for pediatric patients with end-stage kidney disease: The importance of pediatric nephrology expertise. *JAMA*. 2022; 328(5):427-9. [DOI:10.1001/jama.2022.11603] [PMID]
- [2] Rasmussen SK. An overview of pediatric peritoneal dialysis and renal replacement therapy in infants: A review for the general pediatric surgeon. *Semin Pediatr Surg*. 2022; 31(3):151193. [DOI:10.1016/j.sempedsurg.2022.151193] [PMID]
- [3] Shahdadi H, Sheyback M, Rafiemanesh H, Balouchi A, Bouya S, Mahmoudirad G. Causes of chronic kidney disease in iranian children: A meta-analysis and systematic review. *Ann Glob Health*. 2019; 85(1):34. [DOI:10.5334/aogh.2391] [PMID] [PMCID]
- [4] Ataei N, Madani A, Esfahani ST, Otoukesh H, Hooman N, Hoseini R, et al. Chronic kidney disease in Iran: First report of the national registry in children and adolescences. *Urol J*. 2020; 18(01):122-30. [DOI:10.22037/uj.v16i7.5759]
- [5] Sugianto RI, Memaran N, Schmidt BM, Doyon A, Thurn-Valsassina D, Alpay H, et al. Findings from 4C-T Study demonstrate an increased cardiovascular burden in girls with end stage kidney disease and kidney transplantation. *Kidney Int*. 2022; 101(3):585-96. [DOI:10.1016/j.kint.2021.11.032] [PMID]
- [6] Dotis J, Myserlis P, Printza N, Stabouli S, Gkogka C, Pavlaki A, et al. Peritonitis in children with automated peritoneal dialysis: A single-center study of a 10-year experience. *Ren Fail*. 2016; 38(7):1031-5. [DOI:10.1080/0886022X.2016.1183256] [PMID]
- [7] Neu AM, Warady BA, Schaefer F. Infectious complications of peritoneal dialysis in children. *Pediatr Nephrol*. 2021:265-90. [DOI:10.1007/978-3-030-66861-7_16]
- [8] Saxena AB. Infectious complications in peritoneal dialysis. In: Rastogi A, Lerma EV, Bargman JM, editors. *Applied peritoneal dialysis: Improving patient outcomes*. Cham: Springer; 2021. [DOI:10.1007/978-3-030-70897-9_15]
- [9] Sahlawi MA, Wilson G, Stallard B, Manera KE, Tong A, Pisoni RL, et al. Peritoneal dialysis-associated peritonitis outcomes reported in trials and observational studies: A systematic review. *Perit Dial Int*. 2020; 40(2):132-40. [DOI:10.1177/0896860819893810] [PMID]
- [10] Marshall MR. A systematic review of peritoneal dialysis-related peritonitis rates over time from national or regional population-based registries and databases. *Perit Dial Int*. 2021; 42(1):39-47. [DOI:10.1177/0896860821996096] [PMID]
- [11] Warady BA, Bakkaloglu S, Newland J, Cantwell M, Ver-rina E, Neu A, et al. Consensus guidelines for the prevention and treatment of catheter-related infections and peritonitis in pediatric patients receiving peritoneal dialysis: 2012 update. *Perit Dial Int*. 2012; 32(2 suppl):32-86. [DOI:10.3747/pdi.2011.00091] [PMID] [PMCID]
- [12] Warady BA, Schaefer F, Holloway M, Alexander S, Kandert M, Piraino B, et al. Consensus guidelines for the treatment of peritonitis in pediatric patients receiving peritoneal dialysis. *Perit Dial Int*. 2000; 20(6):610-24. [DOI:10.1177/089686080002000607]
- [13] Lee KO, Park SJ, Kim JH, Lee JS, Kim PK, Shin JI. Outcomes of peritonitis in children on peritoneal dialysis: A 25-year experience at Severance Hospital. *Med J Yonsei*. 2013; 54(4):983-9. [DOI:10.3349/ymj.2013.54.4.983] [PMID] [PMCID]
- [14] Bordador EB, Johnson DW, Henning P, Kennedy SE, McDonald SP, Burke JR, et al. Epidemiology and outcomes of peritonitis in children on peritoneal dialysis in Australasia. *Pediatr Nephrol*. 2010; 25(9):1739-45. [DOI:10.1007/s00467-010-1510-5] [PMID]
- [15] Nishina M, Yanagi H, Kakuta T, Endoh M, Fukagawa M, Takagi A. A 10-year retrospective cohort study on the risk factors for peritoneal dialysis-related peritonitis: A single-center study at Tokai University Hospital. *Clin Exp Nephrol*. 2014; 18(4):649-54. [DOI:10.1007/s10157-013-0872-y] [PMID]
- [16] Schaefer F, Feneberg R, Aksu N, Donmez O, Sadikoglu B, Alexander S, et al. Worldwide variation of dialysis-associated peritonitis in children. *Kidney Int*. 2007; 72(11):1374-9. [DOI:10.1038/sj.ki.5002523] [PMID]
- [17] Lee SE, Han KH, Jung YH, Lee HK, Kang HG, Cheong H-I, et al. Peritonitis in children undergoing peritoneal dialysis: 10 years' experience in a single center. *Child Kidney Dis*. 2010; 14(2):174-83. [DOI:10.3339/jkspn.2010.14.2.174]