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Original Article

# Analysis of the Impact of Continuous Ambulatory Peritoneal Dialysis on Nutritional Status in Pediatric Chronic Kidney Disease

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**Abstract:**

***Background***: Chronic kidney disease (CKD) is a serious problem for all age groups, particularly in children. Several studies have shown that patients with CKD who underwent dialysis, including Continuous Ambulatory Peritoneal Dialysis (CAPD), experienced malnutrition, short stature and growth retardation. This study aimed to evaluate the correlation between the indicators of CAPD regiments with the nutritional status of pediatric patients with CKD and factors that influence it.

***Method***: We conducted a cross-sectional study by collecting secondary data from medical records such as disease stage and duration, the most recent CAPD regimen, etiology, and comorbidities. Data on nutritional status was then obtained by measuring body weight, height, and upper arm circumference. The measurement was then plotted using the WHO anthropometry application or the CDC growth chart. Demographic data such as the education level of father and mother, family economic status, age, and gender were obtained by filling out the Case Report Form (CRF).

***Result:*** A total of fifteen respondents were included in this study. Children with CKD who underwent CAPD primarily had normal nutritional status with very short stature. Furthermore, no significant association was found between the CAPD regiments with the nutritional status of children with chronic kidney disease who are undergoing CAPD ($p>0.05$).

***Conclusion:*** Children with CKD who underwent CAPD primarily had normal nutritional status with very short stature. There was no correlation between the parameters of CAPD regiments with the nutritional status of CKD patients who underwent CAPD. This indicates that the regiment used in this study is already quite satisfactory as it does not impact the nutritional status of those patients.

**Keywords:** children, continuous ambulatory peritoneal dialysis, end-stage renal disease, nutritional status

## Introduction

Chronic kidney disease (CKD) is a serious problem for all age groups.[1] Children, in particular, have a remarkably high prevalence of CKD. In Europe, the incidence of CKD in pediatric patients reached around 11-12 per one million population, while the prevalence was 1.5-3.0 per one million.[2] Despite no national data, in Indonesia, specifically in the national referral center, the pediatric chronic kidney disease incidence was 150 children in 2007-2009, with 13 transplant procedures conducted in 2017-2018.[3]

Growth and development are the main differences between children and adults.[4] Children with chronic kidney disease may experience negative impacts on their growth and development, such as stunting and growth retardation during their first year of life. CKD may also cause secondary complications that significantly impact the patient's growth, development, and quality of life. Furthermore, children with CKD may also present symptoms such as pallor due to anemia, bone abnormalities, dyspnea, recurrent fever, and fatigue.[1, 3, 5] Dialysis is a treatment choice for treating pediatric CKD patients. It functions as a kidney replacement, particularly in removing body waste and water from the blood. There are two types of dialysis: hemodialysis and continuous ambulatory dialysis (CAPD). CAPD uses a semipermeable peritoneal membrane, which functions as a filter to eliminate excess body waste towards the dialysate liquid.[6] However, the use of CAPD may lead to the kidneys' inability to maintain the body's nutritional balance during the dialysis procedure.[7, 8] Several studies have shown that adult patients with CKD who underwent dialysis, including CAPD, experienced malnutrition. Dialysis was seen as the leading cause of inadequate nutritional intake, such as carbohydrates and protein, indicating a relation between dialysis, including CAPD, and the nutritional status of adult patients with CKD.[9-11] Considering the strong relation between severe malnutrition and child mortality, malnutrition due to CAPD might cause severe consequences in children.[12] Thus, this research aimed to evaluate the correlation between the indicators of CAPD regiments with the nutritional status of pediatric patients with CKD and factors that influence it.

## Method

A cross sectional study was conducted between September to October 2022 in a tertiary, national-referral teaching hospital in Jakarta, Indonesia. The research was ethically approved by the local ethics committee with the approval number: KET-915/UN2.F1/ETIK/PPM.00.02/2022. Subjects included in this study were children aged 0-18 years old with terminal kidney failure who underwent CAPD for a minimum of 3 months. Inform consent was taken before the patients were enrolled in this study. Patients who undertook a combination of CAPD and hemodialysis, who had

undergone kidney transplants, could not do body weight and height measurements with the standardized methods, and whose parents did not consent to be included in the research were excluded.

The research was carried out by collecting secondary data such as stage of disease, duration of CAPD, CAPD cycle, CAPD dwell time, CAPD filling volume, types of CAPD fluid, primary etiological factors, and comorbidities. The data were taken from the medical records one week prior to the nutritional status measurement. The nutritional status was then obtained by measuring body weight, height, and upper arm circumference performed when abdomen was emptied; using a Seca® type 763 digital weighing and measuring station and an upper arm circumference measuring tape. The measurement was then plotted using the WHO anthropometry application or the CDC growth chart. Demographic data such as parents' educational level, family economic status, age, and gender were acquired from the Case Report Form (CRF).

Statistical analysis in this study was performed using SPSS. Descriptive analysis was used to analyze the sociodemographic of this study. Normality test was conducted using Kolmogorov-Smirnov if the total subjects were under 50 or Saphiro-Wilk if the total subjects were above 50. The correlation between nutritional status and CAPD duration, cycle, dwell time, and fill volume were assessed through bivariate analysis using the Pearson correlation test if the data distribution was normal and the Spearman test if the data distribution was abnormal. Furthermore, the correlation between nutritional status with the types of CAPD liquid was performed using independent sample t-test for normally distributed data or Mann-Whitney for the data with abnormal distribution. If possible, multivariate analyses were also conducted.

## Result

A total 21 pediatric patients with chronic kidney disease were eligible for this study. However, 6 patients were excluded as they were not residing in Java Island, thus unable to undergo standardized anthropometry measurement. Overall, fifteen participants were included in this study.

Characteristics of participant could be seen in **Table 1**. Based on the demographic characteristics, majority of the subjects were male (73.3%), with the average age of 13 ± 3.64 years old. Most of the participants came from lower-middle class family (66.7%). Among the primary etiologies, congenital anomalies of the kidneys and urinary tract (CAKUT) were the main etiology between the participants of this study (66.67%), followed by chronic glomerulonephritis (13.3%), other primary causes (13.3%), and Steroid-Resistant Nephrotic Syndrome or SRNS (6.7%). Comorbidities identified among the patients were anemia (93.3%), hypertension (53.3%), and bone mineral disorder (3.3%). Based on the CAPD regiments, the patients underwent 4-7

CAPD cycles with the duration of 4-6 hours. The dwell time was 4-6 hours, and the fill volume were approximately 500 – 1300 ml/BSA. All patients conducted the dialysis outside of the hospital and only came once per month for routine check-up unless multiple visitations were considered needed.

**Table 1.** Characteristics of participants

| **Parameters** | **n (%)** |
|---|---|
| Age (years)* | 13.00 ± 3.64 |
| Gender | |
| Male | 11 (73.3) |
| Female | 4 (26.7) |
| Family Economic Status | |
| Upper middle class | 5 (33.3) |
| Lower middle class | 10 (66.7) |
| Father's Level of Education | |
| High school or equivalent | 8 (53.3) |
| University | 7 (46.7) |
| Mother's educational level | |
| High school or equivalent | 12 (80.0) |
| University | 3 (20.0) |
| Etiologies of CKD | |
| CAKUT | 10 (66.7) |
| SRNS | 1 (6.7) |
| Chronic glomerulonephritis | 2 (13.3) |
| Other | 2 (13.3) |
| Comorbidities | |
| Hypertension | 8 (53.3) |
| Anemia | 14 (93.3) |
| Bone mineral disorder | 2 (3.3) |
| CAPD Regiment | |
| CAPD Duration (hours)** | 6 (4 - 6) |
| CAPD Cycle per Day (times)** | 4 (4 - 7) |
| CAPD Dwell Time** | 6 (4 - 6) |
| CAPD fill volume (mL/m2 BSA)* | 926.70 ± 212.02 |
| Types of CAPD solution | |
| Dianeal® 1.5% | 14 (93.3) |
| Dianeal® 2.5% | 1 (6.7) |
| Nutritional Status (BMI for Age) | |
| Malnourished | 5 (33.3) |
| Normal | 9 (60.0) |
| Overweight | 1 (6.7) |

| | |
|---|---|
| Length / Height for Age | |
| Severely stunted | 6 (40.0) |
| Stunted | 5 (33.3) |
| Normal | 4 (26.7) |

*Data is presented in mean ± standard deviation. **Data is presented in median (IQR). CKD: chronic kidney disease, CAKUT: congenital anomaly of kidney and urinary tract, SRNS: steroid-resistant nephrotic syndrome, CAPD: continuous ambulatory peritoneal dialysis. BSA: body surface area.

Among 15 participants, 9 of the patients had a normal nutritional status (60.0%), while 5 of them were malnourished (33.3%), and only 1 patient was classified as overweight (6.7%). The range of BMI in this study were 13.9-20.9 kg/m$^2$. Meanwhile, based on the length or height for age, 6 (40%) patients were categorized as severely stunting, while 5 of the participants (33.3%) were stunted.

The correlation between the regiments of CAPD with the nutritional status of CKD children was explained in **Table 2**. Based on our research, none of CAPD indicators were significantly correlated with the nutritional status of the participants. Furthermore, the use of different CAPD solution were not associated with the nutritional status of the patients.

**Table 2.** Correlation between CAPD duration, cycle, dwell time, and fill volume with nutritional status

| | **Weight for Age (n=15)** | **Length / Height for Age (n=15)** | **BMI for Age (n=15)** |
|---|---|---|---|
| CAPD duration | r: -0.142<br>p: 0.613* | r: -0.247<br>p: 0.374* | r: -0.155<br>p: 0.582* |
| CAPD cycle | r: 0.236<br>p: 0.397* | r: 0.277<br>p: 0.317* | r: 0.216<br>p: 0.440* |
| CAPD dwell time | r: -0.142<br>p: 0.613* | r: 0.247<br>p: 0.374* | r: -0.155<br>p: 0.582* |
| CAPD fill volume | r: -0.08<br>p: 0.756* | r: 0.106<br>p: 0.708** | r: -0.126<br>p: 0.655** |

*Analyzed using Spearman correlation coefficient. **Analyzed using Pearson correlation coefficient. BMI: body mass index, CAPD: continuous ambulatory peritoneal dialysis.

## Discussion

CAPD is one of the dialysis methods which functions as kidney replacement in patients with chronic kidney disease. CAPD is a preferred method due to the flexibility of the procedures which allows patient to undergo dialysis from home.[6] Based on the previous research in our hospital, 25% of the adult patients who underwent CAPD were underweight.[13] Another study in pediatric patients demonstrated that protein deficiency was one of the most common complications of CAPD, causing growth disturbances. Furthermore, the duration of CAPD was correlated with the nutritional status of the patients. Pediatric patients who underwent CAPD had significantly lower prevalence of malnutrition during the first 6 months of age. However, the number increased after 12 months of therapy. The study also suggested that the addition of calorie intake for children who underwent CAPD, including those who had received higher calorie intake, to ensure the adequate intake of calorie. In addition, inadequate dialysis with less aggressive clearance may influence the nutritional status in children with CKD.[14]

Our study revealed that 33.3% of the patients who underwent CAPD were malnourished, while 11 out of 15 patients were considered as severely stunted (40.0%) and stunted (33.3%). Based on a previous study, patients with CKD tend to experience protein energy wasting (PEW) caused by the deficit of energy and protein storage due to metabolic stress. Furthermore, patients who underwent dialysis usually experience micronutrient loss due to many factors such as nephrotic syndrome, inflammation, decrease of appetite and poor nutrition consumption.[15] In relation with CAPD, a subsequent study had suggested that CKD patients undergoing CAPD had greater protein loss through the dialyzing solution which caused by the electrolyte imbalance.[16] However, due to the limitation of this study, further examination using handgrip strength measurements, documentation of food consumption over the past 3 days or the last 24 hours (Food Recall), completion of the Subjective Global Assessment scale questionnaire, as well as other laboratory parameters such as albumin serum, transferrin, and prealbumin tests should be conducted to confirm the malnutrition occurring in CKD patient who underwent CAPD.[17]

Several comorbidities were identified in this study. Interestingly, majority of the participants (93.3%) experience anemia. This finding aligns with a prior study indicating a high prevalence of anemia in CKD patients across all stages of disease.[18] Patients with the end stage of CKD commonly suffer from anemia due to a diminished level of erythropoietin resulting from kidney failure.[2] Furthermore, the severity of anemia tends to escalate alongside the progression of the disease.[19] To manage the occurrence of anemia in children with CKD, it is recommended to implement a systematic, long-term monitoring of hemoglobin levels, particularly in patients with hemoglobin levels below the fifth percentile based on the patient's age and gender.[20]

In addition, the occurrence of anemia in patients undergoing CAPD may cause symptoms such as weakness, fatigue, and growth inhibition which caused by insufficient nutritional intake, recurrent infections, and low oxygen in the cartilage. Thus, the prescription and administration of erythropoietin (EPO) are deemed crucial medications. However, it is imperative to maintain a balance in EPO administration, ensuring it is complemented by a proper diet, sufficient dialysis, controlled blood pressure, absence of bleeding, and optimal levels of iron, folic acid, and Vitamin B in the blood.[21]

Besides anemia, other comorbidities such as hypertension (53.3%) and bone mineral disorder (3.3%) were also identified in this study. Hypertension in patients with CKD develop due to the progressive kidney damage, which cause fluid overload and production of vasoactive hormones, leading to the increase of blood pressure. ACE inhibitor is the therapy of choice for this condition and is administered in patient with blood pressure above the 95th percentile based on age, height, and gender. In addition to this therapy, fluid and salt restriction is implemented with the aim of reducing blood pressure.[22] Bone mineral disorders commonly manifest in individuals with CKD due to the imbalance of calcium and phosphorus within the bloodstream. This disruption exerts consequential effects on the skeletal, vasculature, and cardiac system, arising from the progressive decline in renal function.[21] Similarly, other research also stated that this condition is the subsequent outcome of CKD, resulting from the accumulation of phosphate in the patient's body due to hindered excretion and decreased levels of calcitriol owing to the diminished renal mass in CKD patients.[23]

The indicators of CAPD regiments such as the duration, cycle, dwell time, fill volume, and the types of dialysis solution were noted in this study. Majority of the patients underwent CAPD procedures in the duration of 6 hours, with the total cycle of 4 times a day, a dwell time of 6 hours, a filling volume of 1000 ml, and using the CAPD solution of Dianeal® 1.5%. The regiment is in accordance with the guideline suggested by Indonesian Society of Nephrology (PERNEFRI) and Indonesian Ministry of Health, which suggested a total cycle of 3-4 times a day or more based on the body weight.[20, 24]

Based on our analysis, all indicators of CAPD regiments were not significantly correlated with the nutritional status of the patients with CKD. Despite the absence of previous studies that directly assessed the correlation between the duration of CAPD and the nutritional status of children with CKD, a similar result was reported by Adriyan et. al. which investigated the correlation between the use of Tenchkoff catheter (one of the tools in the CAPD procedure) with the nutritional status of pediatric patients with CKD. The study suggested that the use of Tenchkoff catheter were not significantly associated with the level of nutritional status in children with

CKD. Furthermore, the study also reported similar nutritional status on the population study, with the majority of the participants had normal nutritional status with short stature.[25] This may suggest that the duration of CAPD had no direct influence towards the nutritional status in pediatric patients with CKD. However, the study noted that the use of Tenchkoff catheter for more than 150 days may increase the risk of infection.[25] The occurrence of infection or other complications had been observed to affect the nutritional status of patients who underwent peritoneal dialysis. Furthermore, protein deficiency which caused malnutrition is associated with the risk of infection in patients who undertake CAPD.[26] Thus, despite having no direct influence towards the nutritional status, the duration of CAPD may trigger malnutrition through the occurrence of infection, particularly if the use of CAPD exceed 150 days.

This study also revealed that there was no correlation between the cycle of CAPD with the nutritional status of the patients. This is in contrast with the previous research which suggested that the increase of CAPD cycle was associated with the albumin loss, an indicator for malnutrition.[27] However, the regiment used in this study is in accordance with the guideline.[20] Furthermore, there is still no clear mechanism on how CAPD cycle affecting the nutritional status of patients with CKD. Thus, further study is still needed to determine the mechanism underlying the association between CAPD cycle and nutritional status of children with CKD.

Dwell time is known as the amount of duration a dialysis solution remain inside the abdominal cavity during the CAPD process. The dwell time in dialysis regimens is determined by the peritoneal membrane permeability of the patient, assessed through the Peritoneal Equilibration Test (PET) and categorized into 2 groups; high and low transporter status. In adult patients, high transporter status is linked with poorer prognosis. Meanwhile, in pediatric patients, high transporter status is associated with the higher level of C-Reactive Protein (CRP) and lower level of albumin serum which occur concurrently with the decrease of longitudinal growth.[28] In contrast, our study reported that the amount of dwell time was not significantly correlate with the nutritional status of the children with CKD. However, as our study did not differentiate between patients with high and low transporter status, further analysis is required to see the association between the transporter status with the nutritional status of children with CKD.

The relation between fill volume and the types of dialysis solution of CAPD were also examined in this study. The result exhibited that there was no correlation between the amount of fill volume as well as the type of solution used in CAPD procedures with the nutritional status of children with CKD.

Based on the findings of this study, it can be concluded that the regimens administered to the patients was effective, and did not compromise the nutritional status of the patients with CKD.

## Conclusion

In conclusion, children with CKD who underwent CAPD primarily had normal nutritional status with very short stature. Furthermore, majority of the participants experienced anemia as the complication of CKD. Majority of the patients in this study underwent CAPD procedures in the duration of 6 hours, with the median total cycle of 4 times a day, the median dwell time of 6 hours, the mean filling volume of 926.70 ml/m2 BSA, and using the CAPD solution of Dianeal® 1.5%. There was no correlation between the parameters of CAPD regiments with the nutritional status of CKD patients who underwent CAPD. This indicates that current CAPD regiment did not impact the nutritional status of CAPD children.

## Conflict of Interest

None declared

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## References

1. IDAI. Mengenal penyakit ginjal kronik pada anak: IDAI; 2016 [cited 2022 9 Jun]. Available from: https://www.idai.or.id/artikel/seputar- kesehatan-anak/mengenal-penyakit-ginjal-kronik-pada-anak.
2. Becherucci F, Roperto RM, Materassi M, Romagnani P. Chronic kidney disease in children. Clinical Kidney Journal. 2016;9(4):583–91. https://doi.org/10.1093/ckj/sfw047
3. Hidayati, EL. Gangguan ginjal pada anak: KEMENKES; 2018 [cited 2022 9 Jun]. Available from: http://p2ptm.kemkes.go.id/uploads/VHcrbkVobjRzUDN3UCs4eUJ0dVBndz09/2018/11/Paparan_dr_Eka_Laksmi_IDAI_Media_Briefing_Kenali_Gangguan_Ginjal_Pada_Anak_13_November_2018.pdf
4. Greenbaum LA, Warady BA, Furth SL. Current advances in chronic kidney disease in children: growth, cardiovascular, and neurocognitive risk factors. Semin Nephrol. 2009;29(4):425-34. https://doi.org/10.1016/j.semnephrol.2009.03.017
5. Silverstein DM. Growth and Nutrition in Pediatric Chronic Kidney Disease. Front Pediatr. 2018;6:205. https://doi.org/10.3389/fped.2018.00205
6. Vadakedath S, Kandi V. Dialysis: A Review of the Mechanisms Underlying Complications in the Management of Chronic Renal Failure. Cureus. 2017;9(8):e1603. https://doi.org/10.7759/cureus.1603
7. National Institute of Diabetes and Digestive and Kidney Disease. Eating & nutrition for peritoneal dialysis: NIDDK; 2018 [cited 2022 9 Jun]. Available from: https://www.niddk.nih.gov/health-information/kidney-disease/kidney-failure/peritoneal-dialysis/eating-nutrition.
8. Paglialonga F, Edefonti A. Nutrition assessment and management in children on peritoneal dialysis. Pediatr Nephrol. 2009;24(4):721-30. https://doi.org/10.1007/s00467-007-0719-4
9. Dewi RTK, Putranto W, Susanto A, Suseno A, Purwanto B, Mangesti RD, et al. Hubungan Kualitas Hidup dan Status Nutrisi pada Pasien Penyakit Ginjal

Kronik dengan Tipe Dialisis. Jurnal Penyakit Dalam Indonesia. 2020;7(1). https://doi.org/10.7454/jpdi.v7i1.381
10. Kiebalo T, Holotka J, Habura I, Pawlaczyk K. Nutritional Status in Peritoneal Dialysis: Nutritional Guidelines, Adequacy and the Management of Malnutrition. Nutrients. 2020;12(6). https://doi.org/10.3390/nu12061715
11. Satirapoj B, Limwannata P, Kleebchaiyaphum C, Prapakorn J, Yatinan U, Chotsriluecha S, et al. Nutritional status among peritoneal dialysis patients after oral supplement with ONCE dialyze formula. Int J Nephrol Renovasc Dis. 2017;10:145-51. https://doi.org/10.2147/IJNRD.S138047
12. World Health Organization. Analisis lengkap kajian negara Indonesia. 2010.
13. Yulianti M, Suhardjono S, Kresnawan T, Harimurti K. Faktor-faktor yang Berkorelasi dengan Status Nutrisi pada Pasien Continuous Ambulatory Peritoneal Dialysis (CAPD). Jurnal Penyakit Dalam Indonesia. 2017;2(1). https://doi.org/10.7454/jpdi.v2i1.59
14. Ekim M, Ikinciogullari A, Ulukol B, Bakkaloglu SA, Ozkaya N, Kendirli T, et al. Evaluation of Nutritional Status and Factors Related to Malnutrition in Children on CAPD. Peritoneal Dialysis International: Journal of the International Society for Peritoneal Dialysis. 2003;23(6):557-62. https://doi.org/10.1177/089686080302300607
15. Nelms CL, Shaw V, Greenbaum LA, Anderson C, Desloovere A, Haffner D, et al. Assessment of nutritional status in children with kidney diseases-clinical practice recommendations from the Pediatric Renal Nutrition Taskforce. Pediatr Nephrol. 2021;36(4):995-1010. https://doi.org/10.1007/s00467-020-04852-5
16. Ponton-Vazquez C, Vasquez-Garibay EM, Hurtado-Lopez EF, de la Torre Serrano A, Garcia GP, Romero-Velarde E. Dietary Intake, Nutritional Status, and Body Composition in Children With End-Stage Kidney Disease on Hemodialysis or Peritoneal Dialysis. J Ren Nutr. 2017;27(3):207-15. https://doi.org/10.1053/j.jrn.2016.12.007
17. Iorember FM. Malnutrition in Chronic Kidney Disease. Front Pediatr. 2018;6:161. https://doi.org/10.3389/fped.2018.00161
18. Yuniarti W. Anemia in Chronic Kidney Disease Patients. Journal Health & Science : Gorontalo Journal Health and Science Community. 2021;5(2):341-7. https://doi.org/10.35971/gojhes.v5i2.11632
19. Patrick FM, Umboh ORH, Rotty LWA. Hubungan Kadar Hemoglobin dengan Laju Filtrasi Glomerulus pada Pasien Penyakit Ginjal Kronik Stadium 3 dan 4 Di RSUP Prof. Dr. R. D. Kandou Manado Periode Januari 2017 - Desember 2018. e-CliniC. 2019;8(1). https://doi.org/10.35790/ecl.v8i1.27190
20. Roesli RMA, Bawazier LA, Lubis HR, Prodjosudjadi W, Pranawa, Suhardjono. Konsensus dialisis. 1 ed. Jakarta: PERNEFRI; 2003.
21. Komunitas Pasien Cuci Darah Indonesia. Mengapa penting bagi pasien CAPD untuk minum obat yang diresepkan? : KPCDI; 2021 [cited 2022 13 Nov]. Available from: https://kpcdi.org/2020/04/01/mengapa-penting-bagi-pasien-capd-untuk-minum-obat-yang-diresepkan/.
22. Ervina L, Bahrun D, Lestari HI. Tatalaksana penyakit ginjal kronik pada anak. Majalah Kedokteran Sriwijaya. 2015;47(2):144-9. https://doi.org/https://doi.org/10.36706/mks.v47i2.2758
23. Suwitra K. Gangguan mineral dan tulang pada penyakit ginjal kronik patogenesis, diagnosis, dan modalitas terapi: Universitas Udayana; 2015.
24. Direktorat Jenderal Bina Pelayanan Medik. Pedoman pelayanan hemodialisis di sarana pelayanan kesehatan. Jakarta: Departemen Kesehatan RI; 2008.
25. Ardiyan T, Fitriana EI, Dastamuar S, Maritska Z. Hubungan antara Lama Terpasang Kateter Tenchkoff, Status Gizi, Jenis Pembedahan, dan Komplikasi pada Anak dengan Continous Ambulatory Peritoneal Dialysis. Sari Pediatri. 2022;24(1). https://doi.org/10.14238/sp24.1.2022.36-43
26. Al Mokali K, Al Sannaa Z, Al Mutairi F, Ahmed AE. Factors influencing occurrence of peritonitis in Saudi children on peritoneal dialysis. BMC Pediatr. 2020;20(1):42. https://doi.org/10.1186/s12887-020-1936-2
27. Honda M, Kamiyama Y, Kawamura K, Kawahara K, Shishido S, Nakai H, et al. Growth, development and nutritional status in Japanese children under 2 years on continuous ambulatory peritoneal dialysis. Pediatr Nephrol. 1995;9(5):543-8. https://doi.org/10.1007/BF00860924
28. Schmitt CP, Zaloszyc A, Schaefer B, Fischbach M. Peritoneal dialysis tailored to pediatric needs. Int J Nephrol. 2011;2011. https://doi.org/10.4061/2011/940267