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# The Effects of Peritoneal Dialysis Catheter Insertion Using Paramedian Versus Midline Approach on Children

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## ABSTRACT

**Objective:** There are several methods for dialysis in children with chronic renal failure. One of the methods is the insertion of a peritoneal dialysis (PD) catheter, which can be embedded with para-median and midline approaches. In this study, we aim to compare the complications and the success rate of these two approaches.

**Materials and Methods:** In this retrospective study, 41 patients under seven years who had undergone PD due to renal failure were included in this study. PD catheter was inserted via the paramedian approach in 15 and midline approach in 26 cases. Any early or late complications, as well as success rate, were compared between two approaches.

**Results:** Paramedian compared to midline approach had a significantly lower rate of catheter obstruction (20% vs. 53.8%,  $p=0.03$ ), leakage (13.3% vs. 46.2%,  $p=0.03$ ) and local infection (13.3% vs. 50%,  $p=0.02$ ) from early complications and lower rate of late fluid leakage (13.3% vs. 46.2%,  $p=0.03$ ) and tunnel or exit site infection (6.7% vs. 38.5%,  $p=0.02$ ) from late complications. The paramedian approach had a significantly higher rate of success (80% vs. 42.3%,  $p=0.02$ ).

**Conclusion:** Paramedian is a better approach for PD catheter insertion due to lower early and late complications, as well as a higher success rate.

**Keywords:** Peritoneal dialysis; catheter insertion; para-median, midline

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## INTRODUCTION

Peritoneal dialysis (PD) is a known therapeutic approach in patients with end-stage renal diseases (ESRD) (1). PD is a preferred modality for renal replacement therapy in children and considered as a bridge to transplantation (2). PD compared to hemodialysis has the advantages of a better quality of life, simplicity in use, no need for vascular access and an almost similar outcome in the first year of dialysis (1, 3).

PD-related complications, such as catheter obstruction, displacement, pericatheter leakage, peritonitis, and outlet infection, may lead to loss of the catheter and the need to change from PD to hemodialysis, which can be uncomfortable and expensive for the patient (4–6).

Two common approaches for PD catheter insertion are midline and paramedian. The later has gain popularity in recent years. Most previous studies comparing these two approaches were conducted in adult patients (6–10), and studies comparing the outcome in children are few in the literature (11). Therefore, the present study aims to compare these two approaches for PD catheter insertion in children under the age of seven years.

## MATERIALS and METHODS

In this retrospective study, 41 patients (age < 7 years) who were inserted PD catheter (median or paramedian approach) due to renal failure, in Pediatric Hospital, Tabriz, Iran, between September 2010 and September 2018, were included. Patients with a history of abdominal surgery, insertion of peritoneal dialysis catheter in another center, other co-diseases, such as endocrine disease and immune system deficiency, trauma, and skin diseases, were excluded from this study. The ethics committee of Tabriz University of Medical Sciences approved the study protocol (approval number: IR.TBZMED.REC.13970.1003, approval date: December 24, 2018).

All patients were a candidate for PD catheter insertion due to kidney failure and with the recommendation of pediatric nephrologist. In our center, midline approach was used as the choice for PD catheter insertion until 2014, and afterwards, the paramedian approach has become the method of choice. PD catheters were inserted by two experienced surgeons with proper postoperative care by the PD dialysis team. Patients' demographic data, such as age, sex, type of renal failure leading to the introduction of a peritoneal dialysis catheter, co-diseases and duration of hospitalization before and after the procedure, were extracted from their records.

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**Table 1.** The demographic, early and late complications in paramedian and midline approach

	Midline approach (n=15)		Paramedian approach (n=26)		p
	n	%	n	%	
Age (years)	4.86±2.26		5.11±1.72		0.69
Gender					
Male	8	53.3	12	46.2	0.65
Female	7	46.7	14	53.8	
Early complications					
Obstruction	3	20	14	53.8	0.03*
Catheter migration	1	6.7	7	26.9	0.12
Leakage	2	13.3	12	46.2	0.03*
Catheter bending	2	13.3	3	11.5	0.6
Outflow-inflow	1	6.7	2	7.7	0.7
Muscle bleeding during catheter insertion	3	20	2	7.7	0.24
Peritonitis	1	6.7	4	15.4	0.38
Local infection	2	13.3	13	50	0.02*
Late complications					
Omental plugging	1	6.7	1	3.8	0.6
Catheter migration	3	20	10	38.5	0.19
Low fluid drainage	1	6.7	6	23.1	0.18
Late fluid leakage	2	13.3	12	46.2	0.03*
Cuff exit	0	0	3	11.5	0.24
Hernia	1	6.7	3	11.5	0.53
Peritonitis	3	20	8	30.8	0.35
Tunnel or exit site infection	1	6.7	10	38.5	0.02*

\*p is two-sided significant

The incidence of early and long term complications was obtained. Early mechanical complications include clots, catheter movement, leakage, catheter bending, outflow-inflow and intra-abdominal hemorrhage and early medical complications include peritonitis and local infection. Long term mechanical complications include catheter holes covered by omentum, catheter site changes, inadequate fluid outflow, delayed fluid leakage, catheter cuff removal, catheter perforation, hernia, and medical complications include peritonitis and catheter exit site or tunnel infection.

### Statistical Analysis

All data were analyzed using SPSS software (version 23; SPSS Inc., Chicago, IL). The results were expressed as Mean±standard deviation or percentage. Kolmogorov-Smirnov test was used to assess the normal distribution of data. Chi-square test, Fisher's exact test, independent t-test or Mann-Whitney U test was used to compare data between groups. P-values of less than 0.05 were considered statistically significant.

## RESULTS

We evaluated 41 children undergoing PD dialysis due to renal failure. Causes of renal failure were congenital anomalies in 19,

nephrotic syndrome in 12, hereditary nephropathy in seven cases, MPGN in two cases, and RPGN in one case. Of 41 patients, in 15 cases (36.58%), PD was inserted with the paramedian approach and in 26 cases (63.42%) with the midline approach.

The demographic and early and late complications in both groups are demonstrated in Table 1. The groups were similar regarding the demographic findings. Among early complications, paramedian compared to midline approach had significantly lower rate of catheter obstruction, leakage and local infection. As for late complications, late fluid leakage and tunnel or exit site infections were significantly lower in paramedian than midline approach.

The catheter survival without mechanical and medical failure in the paramedian approach was significantly higher than the midline approach (80% vs. 42.3%, p=0.02).

## DISCUSSION

In this study, we evaluated the outcome of PD catheter insertion using paramedian or midline approach in children, and observed that the paramedian approach would have a lower rate of early and late complications. Studies in this regard in children are few and most conclusions are based on some studies performed on a

range of patients from children to adults. Similar to our findings, Kanokkantapong et al. (8) observed that paramedian compared to midline approach in adult patients have a lower rate of early complications. Other studies in this regard are rather old and performed in 15-25 years ago among adult patients of which all have indicated no differences in mechanical catheter failure or peritonitis (12–15).

Htay et al. (10), on their systematic review, concluded that midline compared to the paramedian approach has no or little difference for risk of peritonitis or tunnel/exit-site infection. In our study, there were significant differences regarding catheter leakage, early and late tunnel-exit-site infection and obstruction. PD-related infections are associated with higher rate of morbidity and mortality and are considered as the main cause for PD failure (16). Lower compliance for routine practice for PD catheter care is also considered as a cause for catheter-associated peritonitis in children (17). Studies have indicated that to prevent PD-related infections, it is necessary to administrate proper prophylactic antibiotics before catheter placement, proper patient training, exit-site care, and treatment for *S. aureus* nasal carriage (18).

Aside from the type and approach of catheter insertion, the reported rate of complication in children is different in studies. Stone et al. (19) reported that the most common complications were peritonitis, omental plugging, pericatheter drainage and exit site infection. Kim et al. (20) evaluating the noninfectious complications of PD catheter insertion in children in 26 years, reported the common catheter-related complications to be outflow failure, leakage and hernia. Lemoine et al. (21), in their study of mixed children and adult patients, reported early catheter obstruction in 22.7%. They observed that weight >10 kg and age >1 years is associated with a higher incidence of obstruction.

The age is considered as an important factor regarding the catheter-related complications. It is common in patients under two years old, with a higher rate of peritonitis and catheter loss (22). Rinaldi et al. (11) also reported worse catheter outcomes for infants under six months of age. There were only two patients under two years old that both had tunnel/exit-site infection and catheter migration.

In our study, paramedian compared to midline approach had a significantly higher rate of success. Kanokkantapong et al. (8) also reported higher rate of catheter survival and success in the paramedian approach.

### Limitations

This study had some limitations. First of all, the retrospective design of this study which limited the complete data available for interpretation. The second limitation was the difference in the period that each approach is performed, for what it seems that during years surgeons became more experienced and have better surgery outcomes. Another limitation was the small sample of the study group, which limits the better interpretation of the findings.

### CONCLUSION

In conclusion, paramedian is a better approach for PD catheter insertion due to lower early and late complications, as well as a higher success rate.

**Ethics Committee Approval:** The ethics committee of Tabriz University of Medical Sciences approved the study protocol (date: 25.02.2019, number: IR.TBZMED.REC.1397.1003).

**Informed Consent:** Written informed consent was obtained from patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept – MJ; Design – MJ; Supervision – DB; Resource – DB; Data Collection and/or Processing – AA; Analysis and/or Interpretation – SEM; Writing – SEM, SAS; Critical Reviews – SAS.

**Conflict of Interest:** The authors have no conflict of interest to declare.

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