

Support For Children with Chronic Renal Failure on Peritoneal Dialysis in an Adult Department: Experience of A Single Center

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Abstract

Introduction: Renal failure is a serious condition that may occur in very young children. It is a common problem in nephrology; however, early diagnosis is important, and prognosis depends on the underlying etiology and early supportive care. Currently, it is possible in Algeria to provide care for these children in our adult nephrology department, thanks to recent progress in the treatment of this condition, represented by currently available dialysis methods adapted for children.

Patients and Methods: This is a retrospective study conducted from January 2008 to March 2018 at Beni Messous University Hospital, Algiers. We reviewed the records of 50 children treated in our peritoneal dialysis unit. The following parameters were studied: age, sex, initial nephropathy, dialysis modality and duration, and patient outcomes.

Results: Fifty children were included, comprising 19 boys and 31 girls, with ages ranging from 14 days to 16 years. The distribution of initial nephropathy was as follows: malformative uropathy in 13 children (26%), hereditary nephropathy in 9 children (18%), primary nephropathy in 8 children (16%), vascular nephropathy in 7 children (14%), secondary nephropathy in 3 children (6%), and indeterminate in 10 children (20%). The mean duration on dialysis was 13 months (range: 20 days to 4 years). The dialysis modality was automated peritoneal dialysis (APD) in 20 children (40%) and continuous ambulatory peritoneal dialysis (CAPD) in 30 children (60%). The outcomes of our patients were as follows: recovery of renal function in 10 children (20%), kidney transplantation in 3 children (6%), transfer to hemodialysis in 5 children (10%), death in 16 children (32%), and 16 children (32%) currently on peritoneal dialysis.

Discussion and Conclusion: The management of children on dialysis in an adult department is a major challenge; however, the technical platform (hardware, nursing, etc.) was adapted to their care. This experience demonstrates that peritoneal dialysis can be successfully performed in children within an adult nephrology department when appropriate resources and trained personnel are available. The mortality rate in our cohort (32%) is higher than that reported in developed countries but consistent with data from developing countries where resources are limited.

Keywords: Pediatric peritoneal dialysis, chronic kidney disease, end-stage renal disease, children, automated peritoneal dialysis, continuous ambulatory peritoneal dialysis.

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1. Introduction

Chronic renal failure is an impairment of renal function that may occur in very young children[1] [1]. It is a common problem in pediatric nephrology; however, early diagnosis is important, and prognosis depends on the initial etiology and early supportive care [1, 2]. The incidence of end-stage renal disease in children is estimated at 5 to 15 cases per million of the age-related population, with significant geographic variation[2] .

The management of chronic kidney disease in children presents unique challenges compared to adults [2,3]. Children have distinct nutritional requirements, growth potential, and developmental needs that must be considered in their care. Additionally, the causes of chronic kidney disease in children differ from those in adults, with congenital anomalies of the kidney and urinary tract (CAKUT), hereditary nephropathies, and glomerulonephritis being more common [2].

Peritoneal dialysis is the preferred modality of renal replacement therapy for children with end-stage renal disease, particularly in younger children [3, 4]. It offers several advantages, including better preservation of residual renal function, hemodynamic stability, and the ability to be performed at home, allowing for more normal childhood activities [3, 4]. Additionally, peritoneal dialysis avoids the need for vascular access, which can be technically challenging in small children [3].

In Algeria, the management of children with chronic renal failure has historically been limited by a lack of pediatric dialysis facilities. Currently, it is possible to provide care for these children in adult nephrology departments, thanks to recent progress made in the treatment of this condition, represented by currently available dialysis methods adapted for children. This approach requires adaptation of the technical platform, including hardware, nursing, and medical expertise, to meet the specific needs of pediatric patients.

We report our experience with the management of children with chronic renal failure on peritoneal dialysis in an adult nephrology department over a 10-year period at Beni Messous University Hospital, Algiers. This study aims to describe the clinical characteristics, outcomes,

and challenges of managing pediatric peritoneal dialysis patients in this setting.

2. PATIENTS AND METHODS

2.1. Study Design and Setting

This was a retrospective, single-center study conducted in the Department of Nephrology, Dialysis and Transplantation, Beni Messous University Hospital, Algiers, Algeria. The study was conducted from January 2008 to March 2018. The study was approved by the institutional review board, and informed consent was obtained from the parents or legal guardians of all patients.

2.2. Study Population

We included all children (age < 18 years) with chronic renal failure who were managed on peritoneal dialysis in our department during the study period. A total of 51 children were initially identified. One child was excluded due to incomplete medical records, leaving 50 children for analysis. Medical records were reviewed, and data were extracted from the records of hospitalized patients in our department as well as from the pediatric wards of our hospital and nearby hospitals.

2.3. Data Collection

The following parameters were studied:

- Demographic data: age at initiation of dialysis, sex
- Clinical data: initial nephropathy
- Dialysis data: modality of peritoneal dialysis (automated peritoneal dialysis [APD] versus continuous ambulatory peritoneal dialysis [CAPD]), duration on dialysis
- Outcome data: recovery of renal function, kidney transplantation, transfer to hemodialysis, death, or continuation on peritoneal dialysis

2.4. Statistical Analysis

Data were analyzed using descriptive statistics. Continuous variables were expressed as means with standard deviations or medians with ranges. Categorical variables were expressed as frequencies and percentages. No comparative statistical tests were performed, as the study aimed to describe the cohort

rather than compare groups.

3. RESULTS

3.1. Patient Characteristics

A total of 50 children were included in the study. The demographic and clinical characteristics of the 98 patients are shown in Table 1.

Table 1. Demographic and Clinical Characteristics of Patients

Characteristic	Value
Total number of patients	50
Sex (Male/Female)	19 (38%) / 31 (62%)
Age range	14 days - 16 years
Median age (IQR)	6.5 years (2.0 - 11.0)

3.2. Initial Nephropathy

The distribution of initial nephropathy is shown in Table 2.

Table 2. Distribution of Initial Nephropathy

Etiology	Number of Patients	Percentage
Malformative uropathy	13	26%
Hereditary nephropathy	9	18%
Primary nephropathy	8	16%
Vascular nephropathy	7	14%
Secondary nephropathy	3	6%
Indeterminate	10	20%
Total	50	100%

Malformative uropathy was the most common etiology, accounting for 26% of cases, followed by 104 hereditary nephropathy (18%), primary nephropathy (16%), and vascular nephropathy (14%). This 105 distribution is consistent with the literature, which reports that The distribution of dialysis modalities is shown in Table 3.

congenital anomalies of the kidney and 106 urinary tract are the leading cause of chronic kidney disease in children [2][2].

3.3. Dialysis Modality and Duration

Table 3. Dialysis Modality

Modality	Number of Patients	Percentage
Continuous ambulatory peritoneal dialysis (CAPD)	30	60%
Automated peritoneal dialysis (APD)	20	40%
Total	50	100%

The majority of patients (60%) were on CAPD, while 40% were on APD. The mean duration on dialysis was 13 months, with a range from 20 days to 4 years. The choice of modality was influenced by patient age, family preference, and the availability of equipment.

3.4. Outcomes

The outcomes of the patients are shown in Table 4.

Table 4. Outcomes of Patients

Outcome	Number of Patients	Percentage
Currently on peritoneal dialysis	16	32%
Death	16	32%
Recovery of renal function	10	20%
Transfer to hemodialysis	5	10%
Kidney transplantation	3	6%
Total	50	100%

The outcomes were varied. Sixteen children (32%) are currently on peritoneal dialysis, and 16 children (32%) died during the follow-up period. Ten children (20%) recovered renal function, 5 children (10%) were transferred to hemodialysis, and 3 children (6%) underwent kidney transplantation.

4. DISCUSSION

4.1. Epidemiology of Pediatric Chronic Kidney Disease

Chronic kidney disease in children is a significant

health problem, with an estimated incidence of end-stage renal disease of 5 to 15 cases per million of the age-related population [2]. The causes of chronic kidney disease in children differ from those in adults. In our cohort, malformative uropathy was the most common etiology (26%), followed by hereditary nephropathy (18%), primary nephropathy (16%), and vascular nephropathy (14%). This distribution is consistent with the literature, which reports that congenital anomalies of the kidney and urinary tract are the leading cause of chronic kidney disease in

children, accounting for 40% to 50% of cases[2].

The high proportion of malformative uropathy in our cohort reflects the importance of early diagnosis and management of congenital anomalies of the kidney and urinary tract. Early intervention, including surgical correction of obstructive uropathy, can prevent or delay the progression to end-stage renal disease[2].

4.2. Peritoneal Dialysis as the Preferred Modality in Children

Peritoneal dialysis is the preferred modality of renal replacement therapy for children with end-stage renal disease, particularly in younger children [3, 4]. It offers several advantages[3, 4], including better preservation of residual renal function, hemodynamic stability, and the ability to be performed at home, allowing for more normal childhood activities[3, 4]. Additionally, peritoneal dialysis avoids the need for vascular access, which can be technically challenging in small children[3].

The International Pediatric Peritoneal Dialysis Network (IPPN) has established guidelines for the optimal care of children on peritoneal dialysis [3, 4]. These guidelines emphasize the importance of preserving residual renal function, preventing peritonitis, and ensuring adequate nutrition and growth [4].

In our cohort, the majority of patients (60%) were on CAPD, while 40% were on APD. This distribution reflects the availability of modalities and the specific needs of the patients. APD is often preferred in younger children or those with more complex medical needs, as it allows for automated cycling at night, freeing up the day for school and other activities [4].

4.3. Outcomes in Pediatric Peritoneal Dialysis

The outcomes in our cohort were varied. The mortality rate was 32%, which is higher than that reported in some studies from developed countries [2, 5]. However, it is consistent with the mortality rates reported in developing countries, where access to resources and expertise may be limited. In a European cohort of children with end-stage renal disease on dialysis, the mortality rate was lower, reflecting better access to care and transplantation [5].

The causes of death were not specified in our study, but common causes of death in pediatric dialysis patients include cardiovascular disease, infections, and

withdrawal from dialysis[2, 5]. In a study of European children on dialysis, infections and cardiovascular disease were the leading causes of death [5]. The high mortality rate in our cohort may be related to late referral, limited access to transplantation, and a higher burden of comorbidities.

A study from Nigeria reported a mortality rate of 30% in children on dialysis[6]. Similarly, a study from Tunisia reported that 25% of children on dialysis died during follow-up [7]. These findings highlight the challenges of providing pediatric dialysis in resource-limited settings and are consistent with our observations.

The recovery of renal function in 20% of patients is a positive outcome. Recovery of renal function in children on dialysis is more common than in adults, particularly in patients with acute kidney injury, vasculitis, or rapidly progressive glomerulonephritis[2]. In our cohort, recovery may have occurred in patients with acute tubular necrosis or other reversible causes of renal failure.

Kidney transplantation is the goal of renal replacement therapy in children, as it offers the best outcomes in terms of survival, growth, and quality of life [2, 8]. In a large Australian cohort, long-term survival of children with end-stage renal disease was significantly better after transplantation than on dialysis [8]. In our cohort, only 3 children (6%) underwent kidney transplantation. This low rate reflects the limited availability of transplantation in our setting, a common challenge in developing countries.

4.4. Challenges of Pediatric Dialysis in an Adult Department

The management of children on dialysis in an adult department is a major challenge. Several issues must be addressed to ensure optimal care.

First, the technical platform must be adapted to the needs of children. This includes the availability of pediatric-sized dialysis equipment, including catheters, cyclers, and supplies [3, 4]. In our department, we adapted the hardware and nursing to meet the specific needs of pediatric patients.

Second, the nursing staff must be trained in the care of children on dialysis. This includes knowledge of pediatric growth and development, nutritional requirements, and the psychosocial needs of children and their families.

Third, the medical team must have expertise in pediatric nephrology. This includes the ability to manage the unique complications of pediatric renal failure, including growth failure, metabolic bone disease, and developmental delay.

Fourth, there must be close collaboration with pediatric specialists, including pediatric nephrologists, pediatricians, and pediatric surgeons [2]. In our setting, we collaborated with the pediatric wards of our hospital and nearby hospitals to ensure comprehensive care.

Fifth, the psychological and social support for children and their families is crucial. Managing a child with chronic renal failure places significant emotional and financial strain on families, and appropriate support services should be made available.

4.5. Comparison with Other Studies

Our results are consistent with those reported in other studies from developing countries. In addition to the Nigerian and Tunisian studies mentioned above [6, 7], other reports from the region have shown similar challenges. The differences in outcomes between developed and developing countries reflect differences in access to care, including timely referral, availability of dialysis, and access to transplantation.

In contrast, studies from developed countries report lower mortality rates. The North American Pediatric Renal Trials and Collaborative Studies (NAPRTCS) reported a 5-year survival rate of 85% for children on dialysis [2]. The European Society for Pediatric Nephrology reported similar survival rates [5]. These findings underscore the need for continued efforts to improve pediatric dialysis care in resource-limited settings.

4.6. Clinical Implications and Recommendations Our experience has several clinical implications:

- **Pediatric dialysis in adult departments is feasible:** Peritoneal dialysis can be successfully performed in children within an adult nephrology department when appropriate resources and trained personnel are available. This is an important finding for countries where pediatric nephrology services are limited.
- **Multidisciplinary approach is essential:** Close collaboration with pediatric specialists is essential for comprehensive care. Children have unique medical, nutritional, and psychosocial needs that

require a multidisciplinary approach.

- **Transplantation should be prioritized:** Efforts should be made to increase the availability of kidney transplantation for children, as it offers the best outcomes. This includes improving the organ donation system and ensuring that children have timely access to transplantation.
 - **Mortality reduction strategies:** Strategies to reduce mortality, including infection control, nutritional support, and early referral for transplantation, should be prioritized. The high mortality rate in our cohort highlights the need for improved care.
 - **Training and education:** Ongoing training of medical and nursing staff in pediatric nephrology is essential to maintain and improve the quality of care.
- #### 4.7. Strengths and Limitations of the Study

Strengths:

- One of the few studies from North Africa on pediatric peritoneal dialysis
- Long study duration (10 years)
- Comprehensive data on etiology and outcomes
- Provides valuable insights for other developing countries facing similar challenges

Limitations:

- This was a retrospective, single-center study with a relatively small sample size (50 patients)
- We did not have detailed data on the causes of death, complications (including peritonitis rates), or quality of life
- The follow-up period was variable, so long-term outcomes could not be fully assessed
- We did not have a control group for comparison
- Data on growth parameters and nutritional status were not systematically collected

5. CONCLUSION

The management of children on dialysis in an adult department is a major challenge; however, the technical platform (hardware, nursing, etc.) was adapted to their care. This experience demonstrates that peritoneal dialysis can be successfully performed in children within

an adult nephrology department when appropriate resources and trained personnel are available. The outcomes in our cohort were varied, with a mortality rate of 32%, recovery of renal function in 20%, and kidney transplantation in 6%. Efforts should be made to improve outcomes through better infection control, nutritional support, and increased access to transplantation. Further studies are needed to better understand the factors influencing outcomes in this population and to develop strategies to improve care in resource-limited settings.

6. CONFLICT OF INTEREST

The authors declare no conflicts of interest.

7. ACKNOWLEDGMENTS

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