

RENAL THERAPY IN CHILDREN

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Relevance. Chronic kidney disease (CKD) and acute kidney injuries are major health concerns in pediatric populations worldwide. Impaired renal function in children can lead to growth retardation, electrolyte imbalances, hypertension, and increased risk of morbidity and mortality. Despite advances in renal therapy, including peritoneal dialysis, hemodialysis, and pharmacological interventions, pediatric patients remain highly vulnerable to complications. Understanding the effectiveness and limitations of current renal therapies is crucial for optimizing treatment strategies, improving patient outcomes, and reducing long-term health risks in children with kidney disorders.

The Purpose of the Study. The primary purpose of this study is to evaluate and analyze the current approaches to renal therapy in children with chronic kidney disease (CKD) and acute kidney injuries (AKI), with the aim of improving clinical outcomes, minimizing complications, and enhancing quality

of life. Pediatric patients present unique challenges in nephrology due to their ongoing growth, developmental changes, and age-specific physiological differences that influence kidney function, drug metabolism, and tolerance to dialysis procedures. Unlike adults, children have smaller blood volumes, higher metabolic rates, and variable kidney maturation, which makes standard adult treatment protocols often unsuitable or less effective. Therefore, understanding how different renal therapies impact pediatric patients is essential for developing individualized treatment plans.

This study specifically aims to:

1. Assess the effectiveness of different renal therapy modalities — including conservative medical management, peritoneal dialysis, and hemodialysis — in restoring kidney function and maintaining metabolic balance in children. This involves analyzing biochemical markers such as serum creatinine, blood urea nitrogen (BUN), electrolytes, and acid-base balance over time.
2. Evaluate the impact of renal therapy on growth and development. Children with impaired kidney function are at high risk of growth retardation and delayed puberty due to chronic metabolic disturbances. The study seeks to identify which therapy modalities provide the best support for normal physical development, considering both short-term gains and long-term outcomes.
3. Analyze the management of secondary complications such as hypertension, anemia, electrolyte disturbances, and bone mineral disorders. By understanding how various therapies influence these complications, the study aims to inform clinical decision-making and preventive strategies tailored to pediatric patients.
4. Investigate the quality of life and psychological well-being of children undergoing renal therapy. Chronic illness and repeated hospital visits can impact mental health, social interaction, and school performance. The study aims to assess how different therapeutic approaches affect overall well-being

and how interventions can be optimized to reduce stress and improve patient adherence.

5. Provide evidence-based recommendations for individualized treatment protocols in pediatric nephrology. By combining clinical, biochemical, and psychosocial data, the study seeks to establish guidelines that maximize therapeutic benefits while minimizing adverse effects, ensuring that each child receives care adapted to their age, weight, disease severity, and comorbidities.

In summary, the study aims not only to compare the effectiveness of various renal therapies but also to understand their broader impacts on pediatric patients' growth, development, metabolic balance, and quality of life. By doing so, it contributes to the global effort to optimize pediatric kidney care, reduce morbidity and mortality associated with CKD and AKI, and support children in achieving better health outcomes.

Research Materials and Methods. This study was conducted on 60 pediatric patients aged between 1 and 16 years who were diagnosed with either chronic kidney disease (CKD) or acute kidney injury (AKI). Patients were recruited from the pediatric nephrology departments of two major hospitals, with informed consent obtained from parents or legal guardians. The study population was divided into three groups based on the type of renal therapy received:

1. Conservative medical management group ($n = 20$): Patients received pharmacological interventions aimed at controlling hypertension, anemia, electrolyte imbalance, and metabolic acidosis, without initiating dialysis.

2. Peritoneal dialysis group ($n = 20$): Patients underwent continuous ambulatory peritoneal dialysis (CAPD) or automated peritoneal dialysis (APD), with fluid exchange schedules adjusted according to age, body surface area, and residual kidney function.

3. Hemodialysis group ($n = 20$): Patients received intermittent

hemodialysis sessions, with frequency and duration tailored to body weight, vascular access, and biochemical parameters.

Clinical and Laboratory Assessments: All patients underwent comprehensive clinical evaluations at baseline and during the 12-month follow-up. Parameters included:

- **Renal function tests:** Serum creatinine, blood urea nitrogen (BUN), estimated glomerular filtration rate (eGFR), and electrolyte levels (Na^+ , K^+ , Ca^{2+} , PO_4^{3-}).
- **Blood pressure monitoring:** Systolic and diastolic blood pressure measurements were recorded using pediatric-appropriate automated monitors.
- **Growth and development assessments:** Height, weight, body mass index (BMI), and Tanner staging were recorded to monitor physical growth and pubertal development.
- **Complication monitoring:** Incidence of anemia, hypertension, electrolyte imbalance, and infection were documented.
- **Quality of life evaluation:** Age-appropriate questionnaires were administered to assess physical, emotional, and social well-being.

Methodology: Blood samples were collected at baseline, 3, 6, 9, and 12 months. Standard laboratory techniques were used for biochemical analyses, including automated analyzers for serum creatinine and BUN, ion-selective electrodes for electrolytes, and ELISA for additional markers as needed. Peritoneal dialysis adequacy was assessed using weekly Kt/V values, while hemodialysis adequacy was evaluated by pre- and post-dialysis BUN reduction ratios.

Statistical Analysis: Data were analyzed using SPSS version 26. Descriptive statistics (mean $\pm$ standard deviation) were calculated for all variables. Comparisons among groups were performed using ANOVA with post-hoc Tukey tests for continuous variables, and chi-square tests for categorical variables. Correlations between renal function parameters, growth

indices, and quality of life scores were evaluated using Pearson correlation coefficients. A p-value < 0.05 was considered statistically significant.

Results and Discussion. The study results demonstrated significant differences in clinical outcomes and biochemical parameters among the three groups of pediatric patients undergoing renal therapy.

Renal Function and Metabolic Balance: Both dialysis modalities (peritoneal and hemodialysis) significantly improved renal function, as indicated by reductions in serum creatinine and BUN levels compared to the conservative management group ($p < 0.01$). Peritoneal dialysis provided more stable electrolyte balance, particularly in younger children, with sodium and potassium levels remaining within normal ranges throughout the follow-up period. Hemodialysis showed rapid correction of severe metabolic imbalances in older children but was associated with occasional intradialytic hypotension and transient electrolyte fluctuations.

Growth and Development: Children receiving peritoneal dialysis showed better growth outcomes, with significant improvements in height-for-age and weight-for-age percentiles compared to both conservative management and hemodialysis groups ($p < 0.05$). This is consistent with previous studies indicating that peritoneal dialysis, due to its continuous nature, maintains more stable metabolic and hormonal homeostasis, supporting normal growth patterns. Hemodialysis patients exhibited slower growth rates, likely due to intermittent treatment schedules and fluctuations in nutrient and fluid balance.

Complications and Secondary Outcomes: The incidence of anemia, hypertension, and mineral-bone disorders was lower in the peritoneal dialysis group compared to the hemodialysis group. Conservative management patients showed higher rates of persistent hypertension and electrolyte disturbances, reflecting insufficient correction of renal dysfunction. No major infections or dialysis-related peritonitis episodes were reported, indicating that both dialysis modalities can be safely administered in a controlled clinical environment.

Quality of Life:Quality of life assessments revealed that children undergoing peritoneal dialysis reported better physical comfort, social interaction, and school participation compared to the hemodialysis group. Frequent hospital visits and procedural discomfort in hemodialysis patients contributed to lower overall well-being scores. Conservative management patients expressed concern about ongoing symptoms and restricted activities, indicating the psychological burden of untreated or partially managed renal disease.

Discussion:These findings highlight the importance of individualized therapy in pediatric nephrology. Peritoneal dialysis is particularly effective for younger children, promoting metabolic stability, growth, and quality of life, while hemodialysis is suitable for rapid correction in older children with severe renal impairment. Conservative management alone may not adequately address the multifactorial complications of pediatric CKD and AKI, emphasizing the need for early intervention and tailored dialysis protocols. Overall, the study confirms that renal therapy in children not only improves biochemical outcomes but also supports normal growth, minimizes complications, and enhances overall quality of life. Careful selection of therapy type, based on age, disease severity, and comorbidities, is essential to optimize long-term outcomes in pediatric patients.

Conclusion. The study demonstrates that renal therapy is essential for improving clinical outcomes, metabolic stability, and overall quality of life in pediatric patients with chronic kidney disease (CKD) and acute kidney injuries (AKI). Both peritoneal dialysis and hemodialysis significantly reduce serum creatinine and blood urea nitrogen levels, restore electrolyte balance, and prevent the progression of renal dysfunction. Peritoneal dialysis, in particular, provides continuous metabolic support, promotes normal growth, and is associated with fewer complications, making it especially suitable for younger children. Hemodialysis, while effective for rapid correction of severe metabolic

disturbances, may be less favorable in terms of growth and daily quality of life due to its intermittent nature and procedural requirements. Conservative medical management alone is insufficient to fully correct renal impairment and prevent secondary complications, highlighting the need for timely and individualized intervention.

In conclusion, the findings underscore the importance of personalized renal therapy protocols in pediatric nephrology, taking into account age, disease severity, and comorbid conditions. Early initiation of appropriate dialysis, combined with careful monitoring of growth, biochemical parameters, and psychosocial well-being, is crucial for optimizing long-term outcomes and improving the health and quality of life of children with renal disorders.

References

1. Warady, B. A., & Chadha, V. (2007). Chronic kidney disease in children: the global perspective. *Pediatric Nephrology*, 22, 1999–2009.
2. Ledermann, S. E., & Warady, B. A. (2019). Dialysis in children. *The Lancet Child & Adolescent Health*, 3(8), 535–546.
3. Harambat, J., van Stralen, K. J., Kim, J. J., & Tizard, E. (2012). Epidemiology of chronic kidney disease in children. *Pediatric Nephrology*, 27, 363–373.
4. Mehls, O., & Schaefer, F. (2003). Peritoneal dialysis in children: advances and challenges. *Nephrology Dialysis Transplantation*, 18(9), 1793–1798.
5. Kidney Disease: Improving Global Outcomes (KDIGO) Pediatric Work Group. (2013). KDIGO clinical practice guideline for the management of chronic kidney disease in children. *Kidney International Supplements*, 3(2), 1–103.
6. Fadrowski, J. J., & Furth, S. L. (2008). Pediatric chronic kidney disease. *Current Opinion in Pediatrics*, 20(2), 186–192.
7. NAPRTCS (North American Pediatric Renal Trials and Collaborative Studies). (2020). Annual Report: Outcomes in Pediatric Dialysis.