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Therapeutic Efficacy of Peritoneal Dialysis in Pediatric Acute Kidney Injury Patients in a Referral Hospital

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Abstract:
Background: *Acute Kidney Injury(AKI) in children is associated with significant morbidity and mortality. Peritoneal dialysis (PD) is the preferred and convenient treatment modality for acute kidney injury (AKI) in children and hemodynamically unstable patients.*
Aim :*To study the incidence and clinico-etiological profile of paediatric acute kidney injury patients and the outcome following peritoneal dialysis.*
Study Design*: Retrospective observational study done from November 2007 to August 2016.*
Materials &Methods *:All children aged 1day to 18 years of age with clinical symptoms or abnormal laboratory parameters suggesting acute kidney injury were included in the study. Renal failure classified by pRIFLE. The outcome of acute kidney injury following acute Peritoneal Dialysis was studied in 160 children.Data was analyzed by descriptive statistics.Chi square test is used as test of significance.*
Results : *The incidence of AKI in children requiring dialysis is 4.6% (160/3478). Among them children<1yr age – 37 (23.1%), 1 – 12yrs age – 71 (44.3%), 13 - 18yrs age – 52 (32.5%). Male female ratio was 1.71 (101/59). Infections were the most common etiology in 48.7% (78) with highest being malaria. Glomerular diseases were seen in 11.2% (18) and were more common in 1-12 years age group. Treatment of these patients with peritoneal dialysis was highly effective with complete recovereyof AKI in 120 (75%), partial recoverery in 31(19.3%), Death in 9 (5.6%).*
Conclusions:*Infections are most common cause of paediatric AKI with malaria being most common cause among them in our study. Initiation of renal replacement therapy in the form of acute peritoneal dialysis in children with AKI is associated with good outcome and improved survival.*
Keywords*:Acute Kidney Injury ;pRIFLE ; outcomes; peritoneal dialysis*

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I. Introduction

Acute kidney injury is a life threatening condition associated with significant morbidity and mortality in both children and adults[(1)]. It has both short term(greater hospital stays, death) and long term consequences(residual renal abnormalities,progressionto chronic kidney disease)[(2,3,4)].

In recent years, the use of continuous renal replacement therapy (CRRT) has been increasingly preferred over peritoneal dialysis for the pediatric population in most centers in the developed countries.[(5)]

In developing countries, Peritoneal Dialysis(PD) is frequently the only dialysis modalityavailable, and it is well accepted because it can be initiated easily, without any need for highly trained personnel or expensive equipment[(6)].

PD is used in greater number of children with AKI because of those inherent advantages[(7)], which are particularly relevant in patients with risks for bleeding or hemodynamic instability and posing a technical challenge with respect to vascular access (for example, neonates and young infants)[(8)].

Some earlier reports from developing countries showed variable results[(9,10)]. In the present study, we report our experience with acute PD and analyze outcomes in children with acute kidney injury age.

II. Methods

This is a retrospective observational study done over a period from November 2007 to August 2016 in Andhra Medical College, Visakhapatnam, Andhra Pradesh, India.The protocol of the study was approved by the institutional ethics committee.The objectives of the study are to determine the incidence, clinico-etiological profile of pediatric AKI patients and outcome following peritoneal dialysis.

INCLUSION CRITERIA :1)Children aged 1 day to 18 y2) Patients presented with clinical features and abnormal laboratory parameters suggestive of acute kidney injury and requiring renal replacement therapy were included.

EXCLUSION CRITERIA :1) All patients above 18 years of age were excluded2)Documented history of chronic kidney disease in past or atadmission were excluded.

Relevant clinical history was obtained followed by a clinical examination was done in all these patients. Investigations ordered were blood urea, Serum creatnine, Complete bloodpicture,Complete urine examination,Serum electrolytes, Liver function tests, lipid profile, 24hr urine protein or spot P/C ratio was done.Those patients in whom glomerular diseases were suspected, collagen profile, serum complement levels were done. Blood and urine culture sensitivity tests were sent when infection was suspected. Malariawas diagnosed by either peripheral smear or Quantitative buffy coat test. Viral screening for HIV,HbsAg, Anti HCV weredoneinall children.Imaging tests done include chest x ray PA view ,electrocardiography,echocardiography,Ultrasound and obtaining special tests like CT scan when necessary. All patients were categorised based on eGFR criteria as described in RIFLE staging described for paediatric acute kidney injury by the Acute dialysis quality initiative program.

Indications for renal replacement therapy :

1) Features of uremia like pericardial rub, uremic encephalopathy, recurrent vomiting.
2) Intractable volume overload or hypertension.
3) Intractable metabolic acidosis.
4) Severe hyperkalemia refractory to medical management.

Peritoneal dialysis was performed by placing a commercially available disposable pediatric-size semi-rigid PD catheter. Under strict aseptic conditions, the catheter was placed percutaneously with the help of a trocar under local anesthesia and connected to the PD set with bags containing PD fluid. The fill volume was 25 – 30 mL/kg in younger children and 30 – 40 mL/kg in older children. A deep subcutaneous purse-string suture was usually applied around the PD catheter at the site of entry into the peritoneal cavity to minimize the risk of fluid leakage. Total duration of each cycle was about 45 – 60 minutes (20 cycles daily). Dialysis was resumed based on clinical assessment and laboratory parameters.

III. Statistical Analysis

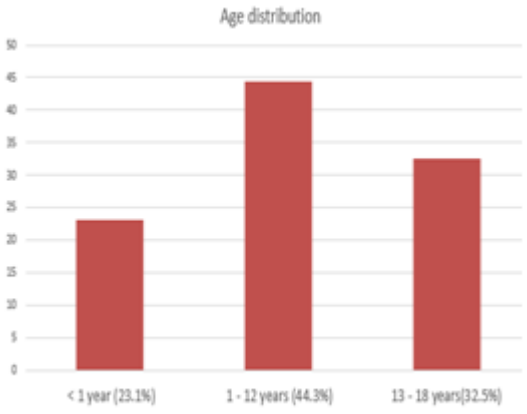
Data was analyzed by descriptive statistics. Collected data is entered in MS EXCEL 2007 and analyzed in percentages.

IV. Results

Out of total 3478 AKI patients requiring renal replacement therapy, 160 were in paediatric age group with an estimated incidence of 4.6%. Out of the 160 patients,children<1yr age were 37 (23.1%), 1 – 12yrs age group were 71 (44.3%),13 - 18yrs age were 52 (32.5%).Out of the 160, 101(63%) were male children and 59(37%) were female children. Male female ratio was 1.71 (101/59).Almostin all age groups there was a preponderance of male children. The gender distribution in various age groups is shown in Table 1.

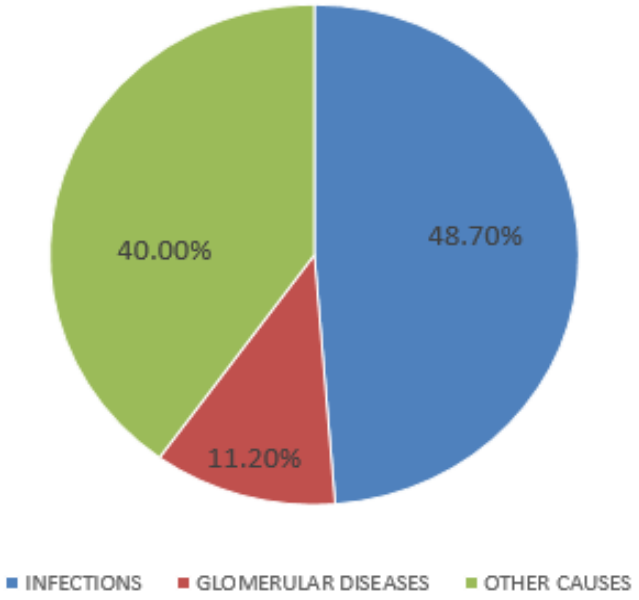
TABLE 1: AGE AND GENDER DISTRIBUTION IN VARIOUS AGE GROUPS

	n = 160 (%)	< 1 YEAR (n = 37)	1 – 12 YEARS (n = 71)	13 – 18 YEARS (n = 52)
MALES	101 (63%)	7 (77.7%)	42(59.1%)	30(57.6%)
FEMALES	59 (37%)	2 (22.2%)	29(40.8%)	22(42.3%)



V. Etiology

Among the total 160 children, Infections predominantly contributing to acute kidney injury in 48.7%(78/160) ofchildren.Glomerular diseases which caused acute kidney injury in 11.2% of children (18/160).Other comorbidities contributing to other causes of AKI.



Various infections causing acute kidney injury in the observed study are as follows are described in

Table 2.
INFECTIONS CAUSING ACUTE KIDNEY INJURY

ETIOLOGY	OVERALL (n = 160)	< 1 YEAR (n = 37)	1 – 12 YEARS (n = 71)	13 – 18 YEARS (n = 52)
INFECTIONS	78 (48.75%)	15 (40.5%)	36 (50.7%)	27 (51.9%)
MALARIA	37 (47.4.3%)	1 (6.6%)	20 (55.5%)	16 (59.2%)
BACTERIAL SEPSIS	27 (34.6%)	6 (40%)	12 (33.3%)	9 (33.3%)
POST GE	11 (14.1%)	6 (40%)	4 (11.1%)	1 (3.7%)
PNEUMONIA	2 (2.5%)	2 (13.3%)	0	0
DISSEMINATED TB	0	0	0	1 (3.7%)

The incidence of glomerular diseases causing acute kidney injury in the total children contributed to 11.2% (18) , and more in 1-12year age group. Distribution of glomerular causes leading to acute kidney injury are as shown in Table 3.

TABLE 3 :GLOMERULAR DISEASES CAUSING ACUTE KIDNEY INJURY

ETIOLOGY	OVERALL (n = 160)	<1 YEAR (n = 37)	1 – 12 YEARS (n = 71)	13 – 18 YEARS (n = 52)
GLOMERULAR DISEASES	18 (11.2%)	1 (2.7%)	11 (15.4%)	6 (11.5%)
NEPHROTIC SYNDROME	9 (50%)	0	4 (36.3%)	5 (83.3%)
PIGN	6 (33.3%)	0	6 (54.4%)	0
HUS	3 (16.6%)	0	1 (100%)	1 (16.6%)

Other causes: Besides, infections and glomerulonephritis various other comorbidities lead to acute kidney injury in specific age groups like liver failure, diabetic ketoacidosis, poisoning, snake bite, sickle cell anemia.The relative frequency with which these diseases occurred are shown in Table 4.

TABLE 4 : OTHER CAUSES OF ACUTE KIDNEY INJURY

	OVERALL (n = 160)	<1 YEAR (n = 37)	1 – 12 YEARS (n = 71)	13 – 18 YEARS (n = 52)
SNAKE BITE	1 (0.6%)	0	0	1 (1.9%)
LIVER FAILURE	2 (1.2%)	0	2 (2.8%)	0
DKA	1 (0.6%)	0	1 (1.4%)	0
POISONING	3 (1.8%)	1 (2.7%)	2 (2.8%)	0
SICKLE CELL ANEMIA	2 (1.2%)	0	1 (1.4%)	1 (1.9%)
MISCELLANEOUS CAUSES	55 (34.3%)	20 (54%)	18 (25.3%)	17 (32.6%)

Clinical profile of the patients:

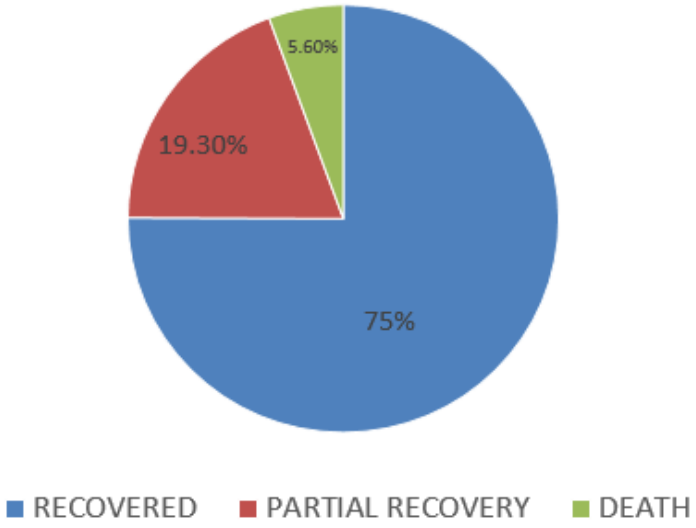
The most common clinical features wereedema(67.2%) followed by oliguria(66.3%), fever(45.9%), shortness of breath(36.1%), and hematuria(24.6%).Central nervous system manifestations were seen in about 32(20%).Hypertension was seen in about 37(23.1%) patients and more common in adolescents16(10%). Hypotension seen in about 32(20%) patients and is more common in neonates 3(50%) and infants 5(33.3%).
Laboratory profile: Anemia was seen in 17(10.6%) patients, elevated total WBC count in 41(25.6%) patients, thrombocytopenia(<1,00,000 platelet count) in 26(16.2%) patients, hypoalbuminemia in 60(37.5%) patients, hyponatremia in 58(36.2%) patients, hypernatremia in 14(8.75%) patients, hypokalemia 18(11.2%) patients, hyperkalemia in 29(18.1%) and abnormal liver enzymes in 36(22.5%) patients. Sixteen (10%) patients had blood cuture positivity.

DIALYSIS :

All paediatric patients included in the study received peritoneal dialysis. About 20 cycles were given with each cycle lasts about 45 – 60 min. Dialysis was resumed if oliguria or anuria and azotemia persisted.

OUTCOME:

Out of 160 patients -120 patients recovered (75%), 31 patients partially recovered (19.3%), 9 died (5.6%). Mortality among children of <1 year age - 2.7%,1 – 12 years age – 9.8% ,13-18 years – 1.9%.



Causes of mortality in these patients – sepsis -5/9(55.5%), malaria -2/9(22.2%),nephrotic syndrome-1/9(11.1%), post GE – 1/9(11.1%)

VI. Discussion

This study highlights the outcomes of paediatric AKI patients receiving renal replacement therapy in the form of peritoneal dialysis. In this study, incidence of AKI in paediatric age group requiring dialysis is about 4.6%.The incidence of acute kidney injury in various studies reported ranges between 10-58%[11,12,17].Increasing age was associated with increasing incidence of acute kidney injury as described by Scott et al[13] in a study done in California.In present study there was a preponderance of male children. Male predominance is seen in acute kidney injury in adults[14] but only a few studies have descried similar observation in children.[15,16]

Etiological profile of acute kidney injury is variable in developed and developing countries. In this study, infections were the predominant aetiology causing acute kidney injury in about 48.75% of patients. Among infections,malaria contributed highest with 47.4% of infections followed by sepsis in 34.6% of patients. The incidence of glomerular diseases causing acute kidney injury in the total children contributed to 11.2% (18) and more in 1-12year age group. Post infectious glomerulonephritis is more common in 1-12year age group contributing to 54.5% of the cases.Similar etiological profile was noted in study done in South India by Krishnamurthy et al[17] who also noted infections as most common etiology followed by PIGN in 1-12year age group.

As the modality available in our setting for children, PD is started as soon as possible after hospitalization in the patients requiring dialysis. We use commercially available PD solutions and disposable catheters under aseptic conditions with standardized monitoring of vital functions and biochemical parameters. With respect to the efficacy of PD in our study, blood urea and serum creatinine values decreased significantly throughout the period of dialysis.

The overall mortality in our study was 5.6%, less than mortality rates reported in various studies range from 16-43% [17] .The mortality rate in children with AKI is highly variable and considered to depend largely on the nature of the underlying disease process rather than on renal failure itself. The mortality was high among children aged 1-12 years with most common cause being sepsis with multi organ dysfunction.

A study done by Ademola[20] et al in south west Nigeria for peritoneal dialysis in childhood AKI patients showed a survival rate of 70%.Another study done by Om P.Mishra[6] et al in Varanasi regarding peritoneal dialysis in children with AKI showed survival rate of 64%.A pilot study[19]done byJacob George et al in medical college, Thiruvananthapuramcomparing continuous venovenoushemodiafiltration and peritoneal dialysis suggests that continuous PD may be as effective modality as CVVHDF for the treatment of AKI in critically ill patients. It may also be cost effective, and it deserves further study.

VII. Conclusion

1) Incidence of AKI in paediatric age group requiring renal replacement therapy is 4.6%
2) Infections are most common cause of childhood AKI with malaria being most common cause among them in our study.
3) Initiation of renal replacement therapy in the form of acute peritoneal dialysis in children with acute kidney injury is associated with good outcome and improved survival.

References

[1] Cerdá J, Bagga A, Kher V, Chakravarthi RM. The contrasting characteristics of acute kidney injury in developed and developing countries. Nat ClinPractNephrol. 2008;4:138–53.
[2] Askenazi DJ, Feig DI, Graham NM, Hui-Stickle S, Goldstein SL:3-5 year longitudinal follow-up of pediatric patients after acute renal failure. Kidney Int 69: 184–189, 2006
[3] Mammen C, Al Abbas A, Skippen P, Nadel H, Levine D, Collet JP,Matsell DG: Long-term risk of CKD in children surviving episodes of acute kidney injury in the intensive care unit: A prospective cohort study. Am J Kidney Dis 59: 523–530, 2012
[4] Sinha R, Nandi M, Tullus K, Marks SD, Taraphder A: Ten-year follow-up of children after acute renal failure from a developing country. Nephrol Dial Transplant 24: 829–833, 2009.
[5] KDIGO clinical practice guideline for acute kidney injury: modality of renal replacement therapy for patients with AKI. *Kidney IntSuppl*2012; 2:107–10.
[6] Om P. Mishra,Aditya K. Gupta,1 Vishal Pooniya,1 RajnitiPrasad :PERITONEAL DIALYSIS IN CHILDREN WITH ACUTE KIDNEY INJURY: ISPD 2012
[7] Maxwell MH, Rockney RE, Kleeman CR, Twiss MR. Peritoneal dialysis. 1. Technique and applications. *JAm Med Assoc*1959; 170:917–24.
[8] Passadakis PS, Oreopoulos DG. Peritoneal dialysis in patients with acute renal failure. *AdvPerit Dial* 2007; 23:7–16.
[9] Kandoth PW, Agarwal GJ, Dharnidharka VR. Acute renal failure in children requiring dialysis therapy. *Indian Pediatr*1994; 31:305–9.
[10] Acharya UTN, Singla PN, Singh RG, Usha, Mishra OP. Outcome of dialysed patients with acute renal failure. *Indian Pediatr*1996; 33:387–90.
[11] Duzova A, Bakkaloglu A, Kalyoncu M, et al; Turkish Society for Pediatric Nephrology Acute Kidney Injury Study Group. Etiology and outcome of acute kidney injury in children. PediatrNephrol. 2010;25:1453–61.
[12] Zappitelli M, Moffett BS, Hyder A, Goldstein SL. Acute kidney injury in non-critically ill children treated with aminoglycoside antibiotics in a tertiary healthcare centre: A retrospective cohort study. Nephrol Dial Transplant 2011;26:144-50.
[13] Xue JL, Daniels F, Star RA, Kimmel PL, Eggers PW, Molitoris BA, Himmelfarb J, Collins AJ: Incidence and mortality of acute renal failure in Medicare beneficiaries, 1992 to 2001. J AmSocNephrol 17: 1135–1142, 2006
[14] J. G. Jetton and D. J. Askenazi. Update on acute kidney injury in the neonate. *Current Opinion in Pediatrics* 2012;24:191–96.
[15] Esezobor CI, Ladapo TA, Osinaike B, Lesi FEA (2012) Paediatric Acute Kidney Injury in a Tertiary Hospital in Nigeria: Prevalence, Causes and Mortality Rate. PLoS ONE 7(12): e51229. doi:10.1371/journal.pone.0051229.
[16] Sutherland SM, Ji J, Sheikhi FH, Widen E, Tian L, Alexander SR, Ling XB. AKI in hospitalized children: epidemiology and clinical associations in a national cohort. Clin J Am SocNephrol. 2013 Oct;8(10):1661-9.
[17] SriramKrishnamurthy,NiveditaMondal, Parameswaran Narayanan, NiranjanBiswal, SadagopanSrinivasan,RajendiranSoundravally. Incidence andetiology of acute kidney injury in southern India. Indian J Pediatr 2012 online publication.
[18] Agraharkar M, Patlovany M. Recovery of renal function indialysis patients. BMC Nephrol. 2003;4:9.
Jacob George, SandeepVarma, Sajeev Kumar, Jose Thomas, SreepaGopi, and RamdasPisharody:COMPARING CVVHDF AND PERITONEAL DIALYSIS IN CRITICALLY ILL PATIENTS WITH ACUTE KIDNEY INJURY: A PILOT STUDY: 2011 :28 Feb : International Society for Peritoneal Dialysis
[19] Adebowale Dele Ademola, AdanzeOnyenonachiAsinobi, OluwatoyinOlufunmilayo: Peritoneal dialysis in childhood AKI :2012 : International society for peritoneal dialysis.

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