Clinical Profile and Outcome of Renal Replacement Therapy in a Pediatric Intensive Care Unit of a Tertiary Care Hospital

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ABSTRACT

Objective: To assess the clinical profile and outcome of patients undergoing renal replacement therapy at a pediatric intensive care unit (ICU) of a tertiary care teaching hospital of Pakistan.

Study Design: Prospective longitudinal study.

Place and Duration of Study: Pediatric ICU, Pak Emiratse Military Hospital (PEMH) Rawalpindi, from Jan to Jun 2018.

Methodology: This study was conducted on 60 patients of acute kidney injury undergoing renal replacement therapy in the pediatric ICU of MH RWP during the study period. Outcomes were correlated with the recovery of patients.

Results: A total of 60 patients admitted in pediatric intensive care unit were put on renal replacement therapy in the study duration time. Male to female ratio was 2.1:1. Acute gastroenteritis was the commonest underlying medical disorder among the target population followed by sepsis. Mean age of patients put on renal replacement therapy was 4.13 ± 4.925 years. Most of the patients were put on renal replacement therapy due toelectrolyte imbalance. Out of 60 patients, 26 (43.3%) recovered, 09 (15%) were transformed into chronic kidney disease, 08 (13.3%) into end stage renal disease and 17 (28.3%) died. Female gender and use of peritoneal dialysis were the factors associated with non-recovery in our sample population.

Conclusion: Acute gastroenteritis and sepsis have been the common illnesses and conditions that can give rise to acute kidney injury and require the renal replacement therapy in a pediatric intensive care unit. Management of critically ill children involving the renal replacement therapy is an integral part of pediatric critical care medicine.

Keywords: Clinical profile, Renal replacement, Therapy.

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INTRODUCTION

Incidence of Childhood illnesses isincreasing all over the world despite all the efforts of prevention and early recognition.[1] Our country is facing a similar challenge and pediatric illness are on a rise posing a great burden on overall health care budget.[2] Critical care medicine specialized for pediatric patients is an emerging specialty with very limited scope in the low and middle income countries countries.[3]

Renal replacement therapy is an expensive and operator dependent technique.[4] It is the only life saving option among the patients suffering from acute kidney injury. Various studies in the past have demonstrated that around 20-40% of the patients require renal replacement therapy inside the pediatric intensive care unit.[5] This procedure has also been associated with many hazards like infections, fluid overload and even the death.[6,7]

A study done in Sudan concluded that sepsis was the commonest cause of renal replacement therapy in pediatric intensive care unit.[8] Another similar study conducted in US concluded that use of peritoneal dialysis is still a suitable option depending upon the clinical profile of the patient admitted in pediatric ICU, though its use is on a decline.[5] Data from a pediatric ICU of our neighboring country India revealed that sepsis, broncho-pneumonia and status epilepticus were common culprits of acute kidney injury in a pediatric ICU. A very large retrospective study which spanned over four years concluded that 73% patients had recovery after the treatment of acute kidney injury via renal replacement therapy in a pediatric ICU.[6,7]

Various factors have been correlated with the outcome among the children who underwent renal replacement therapy in the intensive care unit. Some of them include age, type of underlying illness, co-morbid illnesses, biomarkers, hemodynamic instability, RIFFLE class at time of presentation and more sessions of dialysis.[8,9]

Being from a developing nation with limited resources this topic is of utmost relevance in good pediatric clinical practice.[10] Very limited local data is available on this aspect and that too from a charity based renal hospital from another province, but no

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study has so far been conducted at a tertiary care military hospital receiving patients from all over Pakistan including the public sector tertiary care hospitals. This study was planned with the rationale to look for the clinical profile and outcome among the pediatrics patients admitted in the intensive care unit and put on renal replacement therapy in a tertiary care teaching military hospital of Pakistan.

METHODOLOGY

This prospective longitudinal study was conducted at the pediatric ICU of Pak Emirates Military Hospital Rawalpindi, from January to June 2018. Sample size was calculated by WHO sample size calculator. Non-probability consecutive sampling technique was used to gather the sample.[11]

Inclusion Criteria: All the patients between the age of 1 month to 12 years admitted in pediatric intensive care unit and underwent renal replacement therapy were included in the study.

Exclusion Criteria: Patients who were referred from other military, public sector and private hospitals who required renal replacement therapy were also included in the analysis in addition to the referrals from pediatric wards of own hospital. Exclusion criteria were the patients withless than one year of age or those with unclear medical diagnosis. Patients whoseparents did not give written informed consent were also excluded from the study.

After ethical approval from the Ethical Review Board Committee and written informed consent from the parents of potential participants, patients who underwent renal replacement therapy in pediatric intensive care unit of PEMH RWP fulfilling the above mentioned inclusion and exclusion criteria were included in the study. Pediatric intensive care unit is an eight bed facility with around 450 admissions per year and around 130 patients requiring the renal replacement therapy. The diagnosis of acute kidney injury was made by a consultant pediatrician on *p* RIFFLE criteria.[12,13] Estimated creatinine clearance (eCCl) was determined by calculating estimated glomerular filtration rate (eGFR) using Schwartz equation.[15] Indication for dialysis included: volume overload, severe metabolic acidosis, severe electrolyte imbalance not responding to medical regimen and advanced uremia. Though hemodialysis was preferred mode of treatment but consultant pediatrician chose between the hemodialysis and peritoneal dialysis depending upon the profile of patient. Outcomes included recovery, chronic renal disease, end stage renal disease and death. Relationship of factors like age, gender, severe anemia, volume overload and type of dialysis were correlated with the recovery of patients.

All statistical analysis was performed by using the Statistics Package for Social Sciences version 23.0 (SPSS-23.0). Frequency and percentages for gender, underlying medical condition, conditionand outcome was calculated.

RESULTS

A total of 69 patients were initially approached to get them included in the analysis. Six were less than one month old, one had no clear diagnosis of the underlying medical condition and parents of two did not give consent to include him in the study. Out of 60 patients included in the final analysis 41 were male and 19 were female. Mean age of patients put on renal replacement therapy was 4.13 (± 4.925). Male to female ratio was 2.1:1. Other characteristics of study population have been summarized in Table-I.

Table-I: Characteristics of study participants

Age (Years)	
Mean ± SD	4.13 (±4.925)
Range (min-max)	1month - 12 years
Gender	
Male	41 (68.3%)
Female	19 (31.7%)
Condition at which put on renal replacement therapy	
Electrolyte imbalance	19 (31.7%)
Metabolic acidosis	13 (21.7%)
Advanced uremia	15 (25%)
Fluid overload	11 (18.3%)
Others	02 (3.3%)

Acute gastroenteritis was the commonest underlying medical disorder among the target population followed by sepsis. Poisoningwas least reported (Table-II).

Table-II: Underlying medical illness among the patients put on renal replacement therapy at Pediatric Intensive Care Unit.

Medical Conditions	Frequency
Acute gastroenteritis	19 (31.7%)
Sepsis	15 (25%)
Shock	07 (11.7%)
Post infectious glomerulonephritis	07 (11.7%)
Obstructive urolithiasis	05 (8.3%)
Hemolytic uremic syndrome	03 (5%)
Drugs/poisoning	02 (3.3%)
others	02 (3.3%)

Most of the patients were put on renal replacement therapy due to electrolyte imbalance. Table-III showed that out of 60 patients, 26 (43.3%) recovered, 9 (15%) transformed into chronic kidney disease, 8 (13.3%) transformed into end stage renal disease and 17 (28.3%) died. Female gender and use of peritoneal dialysis as mode of renal replacement therapy were related to non recovery when binary logistic regression was applied.

Table-III: Outcome of patients put on renal replacement therapy.

Total	Recovery	Chronic Kidney Disease		End	Death
60	26 (43.3%)	09 (15%)		8 (13.3%)	17 (28.3%)

DISCUSSION

Organ support is the primary aim when a patient is admitted in the ICU. Pediatric critical care medicine is an emerging specialty in our country. Renal support after acute kidney injury is a common clinical scenario in a pediatric intensive care setting.[8,10] Therefore our study provides a basic data and highlights the importance of work required for critically ill children who need renal support for their survival.

Most of the patients in our study were male with male female ratio of 2.1:1. Similar results were reported in a similar study done in past in our country and our neighboring country India which showed clear male dominance among the study population.[10,13] Reason might be either female children have lesser chance of getting acute kidney injury in south Asia or chances of critically ill females with kidney injury reaching the tertiary care facility are less as compared to male babies. More research is required to look into this parameter.

Sepsis was the commonest cause which led to acute kidney injury and requirement of renal support in our study population. Similar results were reported in other studies done in the recent past.[8,10,14] Study of this parameter may help in both directions. May enable primary and secondary care physicians to treat the infections early and effectively and identify the risk factors associated with ICU admission and acute kidney injury related to infections. It may also enable the critical care physicians to assess the out come among patients with various causes leading to acute kidney injury in order to prioritize them for this specialized treatment.[15]

Female gender was related with poor outcome of renal replacement therapy in our study. Studies done in other countries did not confirm this association and concluded that gender had no relationship with outcome in critically ill patients after the renal replacement therapy.[16,17] Reason might be less number of female patients or cultural differences in the treatment at various parts of the world.

Peritoneal dialysis was related with increased mortality in our study. Results were variable in the studies done in the past. One large survey concluded that peritoneal dialysis has been linked with poor outcome among most of the patients of kidney injury.[18] While another survey revealed that results of peritoneal dialysis are comparable to the results of other modalities of renal replacement including the hemodialysis.[9] Therfore in a country like ours where cost is a major problem, decision should be made on each case considering the clinical profile.

High mortality rate has been a problem in ICUs all over the world.[16,17] This holds true for both adult and pediatric ICUs.[18,19] Outcome in our study was also not very different. More than half of our patients either died or advanced into chronic or end stage renal disease despite all the efforts made in the ICU including the suitable renal replacement therapy. Only 43.3 percent were recovered and they too were not followed up for long to look for the final outcome and mortality. Results were similar in the studies done in setups similar to us and were slightly better in the western countries.[8,20,21] More studies of similar pattern will help us in finding the factors determining the prognosis and associated with better outcome.

LIMITATIONS OF STUDY

The major limitation of our study is the lack of generalizability as patients from one ICU of a tertiary care hospital of Pakistan were studied instead of all hospitals of the country. Randomization was not done for the mode of renal replacement therapy. The sample size, and design of study pose methodological issues as well. Patients were not followed up for long term after the discharge so final outcome could not be determined. We suggest further studies on a broader based and a more representative sample size involving the hospitals of both public and private sector.

CONCLUSION

Acute gastroenteritis and sepsis have been the common illnesses and conditions that can give rise to acute kidney injury and require the renal replacement therapy in a pediatric ICU. Management of critically ill children involving the renal replacement therapy is an integral part of pediatric critical care medicine.Special attention should be paid to the

female patients and hemodialysis should be used as a preferred mode of renal replacement therapy whenever possible.

Conflict of Interest: None.

Authors' Contribution

MSJ: Data collection, literature search, manuscript writing, FB: supervising, analysis, correction, SA:data collection, manuscript writing.

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