ISSN No:-2456-2165

Profile of Acute Kidney Injury in Children Requiring Intensive Care: A Tertiary Care Hospital Experience

Dr. Megha Jhunjhunwala, Dr. Pragathi Kamath, Dr. Bela Verma
Department of Pediatrics, Grant Government Medical College
Mumbai, Maharashtra, 400008. India

Abstract:-

- ***Background:***

Acute kidney injury (AKI) is a serious condition in children admitted in Pediatric Intensive Care Units causing morbidity and mortality. Etiology of AKI is multi-factorial and clinical manifestations and severity are variable and are directly related to outcome.

- ***Objective:***

The aim of the study was to determine most important factors affecting prognosis and eventual outcome of the patients of acute Kidney injury in the tertiary care setting.

- ***Materials and Methods:***

This prospective observational study was conducted in the Pediatric Intensive Care Unit (PICU) of a tertiary level, government hospital in the city of Mumbai. We studied all PICU admissions over a 12 month period between November 2017 to October 2018. Children between 1month and 12 yrs admitted in PICU were considered for the study.

- ***Results:***

446 children admitted in PICU were included in the study. 8.1% developed Acute Kidney injury out of them, Female to male ratio was 1.25:1, 52.8% of patients had AKI during hospital stay. Median age for AKI was 18 months with mean PICU stay of 11.4±9 days. Mortality of the AKI group was 62%, much higher than the rest (25%). Sepsis (66.7%) was the major cause. 50% of patients received Nephrotoxic drugs during the stay. Majority (44%) of patients had Stage 1 AKI. None of the electrolyte or biochemical abnormalities were significantly associated with mortality.

- ***Conclusion:***

AKI is a significant contributor of mortality in patients in PICU. Its etiology is multi factoral and clinical manifestations and severity varies. Early diagnosis and treatment coupled with judicious use of potentially nephrotoxic drugs can help managing this condition.

Keywords:- *Acute Kidney Injury, Children, Pediatric Intensive Care Unit.*

I. INTRODUCTION

Though there is no universally accepted definition of Acute kidney injury (AKI), but broadly it is a constellation of reduced renal function that leads to reduction in glomerular filtration which causes deranged electrolyte, acid-base and fluid homeostasis(1). Though there is no uniformity in the data across various studies, but overall, it's estimated to affect around 5-12% of hospitalized children (2). AKI complicating patients in Pediatric Intensive Care units have unsurprisingly poor prognosis with death rates estimated to be around 9% to as high as 67%, (3). In fact, it is an independent predictor of high mortality and morbidity (3). Long term studies and registries have tried to assess the risk of Chronic Kidney Disease (CKD) after AKI. A Canadian study, showed up to 46.8% risk in children aged 1-3 years after an episode of AKI(5). Among Pediatric Intensive Care Unit (PICU) admissions, 6% are candidates of Renal Replacement Therapy (RRT), but this comes at a cost in of raised mortality by 50-80%. This is especially more pronounced in presence of Septicemia with or without septic shock and multi organ failure. (6). This is also invariably translates into more financial burden to the family, increased cost of health care and extended stay in the health care facility. As most of the available data on clinical course of patients with AKI is from West, Indian data on the topic is scarce. Therefore, in the present study we aim at analyzing most important factors affecting prognosis and eventual outcome of the patients of AKI in a tertiary care hospital in Western India.

II. MATERIALS AND METHODS

We analyzed our data in retrospect from November 2017 to October 2018 which comprised Total 446 children admitted in PICU were included. Patients were classified as AKI cases if AKI was diagnosed based on Pediatric Risk, Injury, Failure, Loss, End Stage Renal Disease (pRIFLE) criteria either at admission or subsequently during the hospital stay. We stratified patients according to the highest pRIFLE stage. We excluded the patients who were previously diagnosed as renal disease. We included patients with AKI at admission or during their PICU stay. Factors including age, gender, underlying etiology, hypertension (HTN), use of nephrotoxic drugs, hypernatremia (hyperNa), hyponatremia (hypoNa), hyperkalemia (hyperK), mechanical ventilation (MV), septicemia and outcome were studied.

ISSN No:-2456-2165

III. RESULTS

446 children admitted in our Pediatric Critical Care Unit were enrolled in the study. Primary emphasis was diagnosis of Acute Kidney Injury in the patients either at presentation or during the course of the hospitalization. 36 patients out of 446 (8.1%) developed Acute Kidney injury. Female to male ratio was 1.25:1, 16 patients were infants (<12 months of age). 17 patients (47.2%) had AKI at the time of admission, rest 52.8% % (i.e. 19 patients) had AKI during hospital stay. Median age for AKI was 18 months.

Mean creatinine level was 1.3±1.2 mg/dl. Patients had a mean PICU stay at 11.4±9.107 days. 22 patients succumbed. That makes mortality 62% in this subgroup, whereas in other patients admitted to PICU who didn't have AKI had a mortality of 25% (102 out of 410). 66.7% (i.e. 24 patients) had Sepsis, 50% (18 patients) had a history of Nephrotoxic drug use either during their stay in PICU or before. 12 patients (33%) had Pneumonia and Failure to thrive was seen in 6 cases (16.7%), Intracranial bleed was diagnosed in 2 (5.6%), Nephrotic syndrome in 2 (5.6%), Heart disease in 6 (16.7%), Meningitis in 4(11.1%), Dengue in 3 (3%), and Hemolytic Uremic Syndrome was seen in 2 (5.6%).16 patients (44%) had Stage 1 AKI, while only 7 had Stage 3 AKI. 3 patients (8%) had Stage 3 AKI. 8 patients (22%) had Hypernatremia whereas 3 (8.3%) had Hyperkalemia was present in 5 (13.88%) patients. 10 patients (27%) were hypertensive. Univariate Analysis was done, which showed that none of the above mentioned risk factors were significantly associated with the mortality.

	Death	HR(95%CI)	p
AKI stage 1 (n=26)	16	1.85 (2.333-14.81)	0.56
Stage 2 (n=2)	1	2.72 (0.15-47.77)	0.49
Stage 3 (n=7)	5	1.9 (0.19-18.43)	0.58
Hypo Na (n=10)	6	0.5 (0.18-1.38)	0.181
Hyper Na (n=8)	5	0.69 (1.25-1.94)	0.49
Hyper K (n=5)	3	0.885 (0.25-3.05)	0.846
Hypertension (n=10)	7	2.06 (0.77-5.53)	0.148

Table 1:- Univariate analysis of factors contributing to mortality

IV. DISCUSSION

In our study, 8.1% patients out of total 446 patients studied developed AKI, given the fact that there are many definitions of Acute Kidney Injury, making it difficult to gauge incidence and prevalence. AWARE Study (Assessment of Worldwide Acute Kidney Injury, Renal Angina and Epidemiology in Critically Ill Children, which was a multi-center study included patients from as young as 3 months till age 25 found the incidence of AKI to be 26.9% of which Stage 2 and 3 AKI were 11.6%(7). AWAKEN Study (Assessment of Worldwide Acute Kidney injury Epidemiology in Neonates), which included neonates found the incidence to be 27%. Incidence in our study is considerably lower, possibly due to early identification and management.

In our study, Sepsis was the major cause in 66.7% whereas 50% had history of Nephrotoxic drug intake. Many risk factors or etiological factors are recognized for the AKI in various studies including hypovolemia(8), hypotension(9), sepsis(8), preexisting renal(9) diseases, coagulopathy(8), and heart disease(8). Our results are comparable to Indian study, which showed association of AKI with infection (55.4%), acute gastroenteritis (16.9%), cardiac disease (14.8%), and hemolytic uremic syndrome (3.6%)(10).

In our study, the mortality was 61% with maximum patients with having Stage I AKI, in a study by S. Krishnamurthy et al(10) mortality was found to be 46.3% whereas a 22 year analysis of patients of AKI in Thailand showed the mortality to be 41.5% with Sepsis being the most common etiological factor(8). Another study in India showed mortality to be 46% (11). Our study showed comparatively higher mortality possibly secondary to late referral to our center and multiple comorbidities.

However present study has some limitations that are worth a mention. First and foremost being a Single Centre Experience and that too for a relatively short span of time i.e. 1 year. Predictors of Mortality were not evaluated and survivors were not followed up for the long term.

V. CONCLUSION

AKI in PICU has a higher mortality. Steps to prevent AKI, early detection and treatment are needed. Mortality is higher, longer the stay in PICU. Prior comorbidities like heart disease are associated with worse prognosis. Stage of AKI had no statistically significant correlation with the prognosis, indicating importance of the comorbidities. Identification of AKI with the earliest detection, appropriate management and avoidance of potentially nephrotoxic drugs hold the key to the better outcomes. However, a study with a bigger cohort is needed to validate the results.

REFERENCES

[1]. McCaffrey J, Dhakal AK, Milford DV, Webb NJA, Lennon R. Recent developments in the detection and management of acute kidney injury. Arch Dis Child. 2017 Jan;102(1):91–6.
[2]. Mehta P, Sinha A, Sami A, Hari P, Kalaivani M, Gulati A, et al. Incidence of acute kidney injury in hospitalized children. Indian Pediatr. 2012 Jul;49(7):537–42.
[3]. Plötz FB, Bouma AB, van Wijk JAE, Kneyber MCJ, Bökenkamp A. Pediatric acute kidney injury in the ICU: an independent evaluation of pRIFLE criteria. Intensive Care Med. 2008 Sep;34(9):1713–7.
[4]. Alkandari O, Eddington KA, Hyder A, Gauvin F, Ducruet T, Gottesman R, et al. Acute kidney injury is an independent risk factor for pediatric intensive care unit mortality, longer length of stay and prolonged mechanical ventilation in critically ill children: a two-center retrospective cohort study. Crit Care Lond Engl. 2011 Jun 10;15(3):R146.
[5]. Mammen C, Abbas AA, Skippen P, Nadel H, Levine D, Collet JP, et al. 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. 2012 Apr 1;59(4):523–30.
[6]. Zappitelli M. Epidemiology and diagnosis of acute kidney injury. Semin Nephrol. 2008 Sep;28(5):436–46.
[7]. Basu RK, Kaddourah A, Terrell T, Mottes T, Arnold P, Jacobs J, et al. Assessment of Worldwide Acute Kidney Injury, Renal Angina and Epidemiology in Critically Ill Children (AWARE): study protocol for a prospective observational study. BMC Nephrol [Internet]. 2015 Feb 26 [cited 2019 Apr 2];16. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4355130/
[8]. Vachvanichsanong P, Dissaneewate P, Lim A, McNeil E. Childhood acute renal failure: 22-year experience in a university hospital in southern Thailand. Pediatrics. 2006 Sep;118(3):e786-791.
[9]. Bailey D, Phan V, Litalien C, Ducruet T, Mérouani A, Lacroix J, et al. Risk factors of acute renal failure in critically ill children: A prospective descriptive epidemiological study. Pediatr Crit Care Med J Soc Crit Care Med World Fed Pediatr Intensive Crit Care Soc. 2007 Jan;8(1):29–35.
[10]. Krishnamurthy S, Narayanan P, Prabha S, Mondal N, Mahadevan S, Biswal N, et al. Clinical profile of acute kidney injury in a pediatric intensive care unit from Southern India: A prospective observational study. Indian J Crit Care Med Peer-Rev Off Publ Indian Soc Crit Care Med. 2013 Jul;17(4):207–13.
[11]. Gupta S, Sengar GS, Meti PK, Lahoti A, Beniwal M, Kumawat M. Acute kidney injury in Pediatric Intensive Care Unit: Incidence, risk factors, and outcome. Indian J Crit Care Med Peer-Rev Off Publ Indian Soc Crit Care Med. 2016 Sep;20(9):526-9.