



## Spectrum of Acute Kidney Injury Under 14 Years of Age a Tertiary Care Experience

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### ABSTRACT

**BACKGROUND:** Acute Kidney Injury (AKI) is a freelance risk issue for morbidity and mortality in children. We have tried to focus it to forestall the same. **OBJECTIVES:** To establish the spectrum and risk factors associated with AKI and to assess the outcome. **METHODS:** A cross-sectional study was done under 14 children satisfying the pRIFLE criteria were registered for the study and neonates, children not satisfying the criteria or having chronic kidney disease or acute on CKD were excluded. **RESULTS:** Oliguria was the most common presenting complaint. Four major causes of AKI were malaria, sepsis, snake bite & acute gastroenteritis. Mortality was 13% & there is significant association of outcome with serum urea/ creatinine and potassium level. **CONCLUSIONS:** Most of the conditions leading to AKI in our area are eminently treatable or preventable. However clinical awareness, early detection and treatment can improve the outcome of these patients.

### KEYWORDS

Acute Kidney Injury(AKI), Chronic Kidney Disease(CKD), pRIFLE criteria, Oliguria

### BACKGROUND

Acute kidney injury (AKI), at just once called acute renal failure (ARF), is usually printed as an associate abrupt decline in excretory organ function, clinically manifesting as a reversible poignant increase in nitrogen waste products measured by blood urea nitrogen and serum creatinine levels (more than double the traditional level for the age of the patient) over the course of hours to weeks (Gallego et al.,1993).The ADQI (The Acute Dialysis Quality Initiative) cluster planned an accord hierarchical definition referred to as RIFLE criteria (Ronco, Kellum & Mehta, 2001). A modification of this criteria was afterwards planned by the Acute Kidney Injury Network that coined the term AKI (Mehta et al.,2007; Levin et al.,2007; Molitoris et al.,2007) Previously, no customary definition of AKI was there, that hindered comparison among studies (Gallego et al.,1993) This scale presently the foremost wide accepted also used for early detection and classification of the AKI severity (Bellomo, Ronco, Kellum, Mehta & Palevsky, 2004). The definition relies upon two criteria: shrivelled rate of glomerular filtration by calculating serum creatinine clearance (Schwartz et al., 2009) and/or the duration of oliguria or anuria (Goldstein, Giroir & Randolph, 2005). After applying this on adults, its validation was conducted on youngsters and modified as the pediatric scale or pRIFLE (Akcan-Arikan et al., 2007); this scale was accustomed outline AKI during this study.

The incidence of AKI has been increasing and likewise, the mortality rate also varies widely in different reports. The incidence of ARF has been reported to be 5% (Brady, Brenner & Lieberthal,1996), 13 % (Gallego et al., 1993) of general hospital admission to 28% (Biesenbach et al., 1992). Correspondingly the mortality rate also varies widely in different reports from 34.6% (Arora et al., 1994), 65%(Singh et al.,1993) to 89%(Rahman & Hussain,1993) ARF in the child population

was almost a fifth of the adult incidence. In a study of 1298 patients with renal disease in Islamabad found a prevalence of 13.1% with ARF (Iqbal, Rehman & Khan, 1994). Similarly, another study found a prevalence of ARF as 19.4% (Arora et al., 1994). The rates of mortality remain unchanged until nowadays even with fashionable ways of treatment like dialysis. This is often owing to the modification in characteristics of patient population like declining range of transfusion-related causes and an increase in range of nephrotoxic causes, the dynamic pattern of surgery and therefore, the progress in resurgance and intensive medical aid, which ends in longer survival and development of AKI.

It has been projected as a significant downside in the pediatric age group in terms of prevalence, morbidity pattern, diagnostic difficulties, treatment modalities, prognosis, and its outcome in individual cases. It continues to be a common condition in developing countries like India as a result of acute gastroenteritis (AGE), acute glomerulonephritis (AGN), infections and sepsis in hot and humid conditions whereas trauma, surgery, drugs and toxins square measure the key causes in western countries (Ronco, Kellum & Mehta, 2001). Scientific knowledge of the same is grossly inadequate in Indian context.

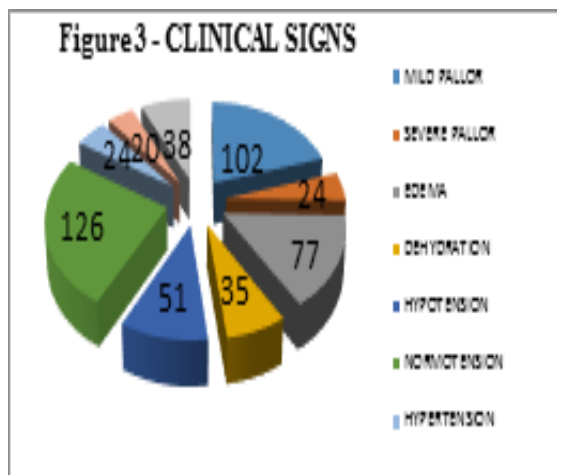
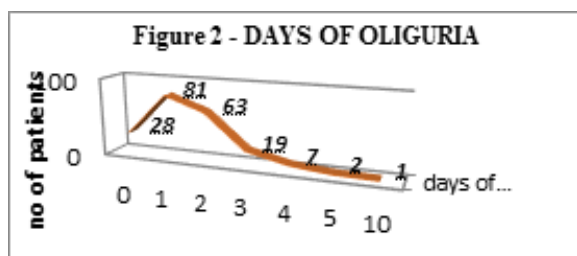
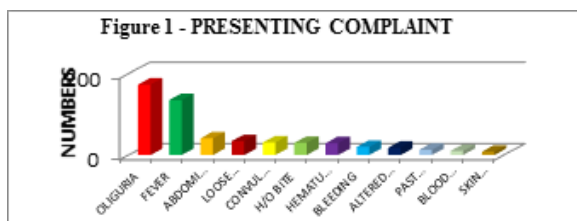
In view of the magnitude of this downside and therefore, the dynamic state of affairs regarding the age composition, etiological pattern, clinical manifestations and advantage of early detection and acceptable management, this specific study was undertaken to research the varied aspects of AKI in youngsters in our setup.

### METHODS

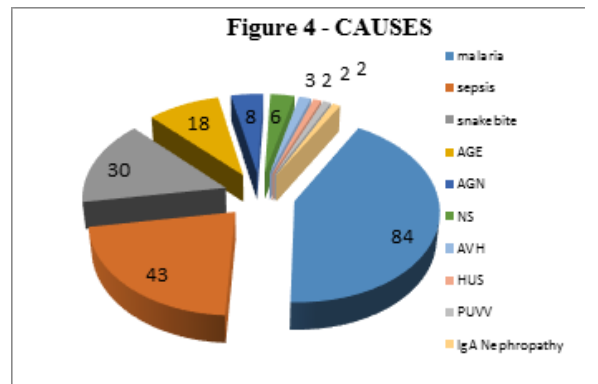
This is a sort of hospital-based prospective observational analytical cross-sectional study worn out the Department of

Pediatrics, VIMSAR, Burla from September 2014 to August 2015. All children more than one month of age and less than 14 years of age admitted to our indoor unit with clinical evidence of developing AKI (oliguria / anuria) were screened for evidence of AKI (Restrepo de Rovetto et al., 2012) by laboratory parameters (serum creatinine  $\geq 1.5$  mg/dl for children  $>1$  year of age and  $\geq 1$ mg/dl for children 1month – 1year of age) (James, Debra & Karl, 2002). Those who manifested evidence of AKI during the hospital stay were also included. Children less than one month of age, not satisfying the AKI criteria and laboratory parameters, having chronic kidney disease (CKD) and acute on CKD were excluded from our study. 201 cases were selected by simple consecutive sampling enrolled for the study after proper consent given by the care giver and ethical committee approval. A detailed history of illness, clinical examination, investigations, treatment and responses to therapy of each case was noted in the pre designed case pro forma and all the relevant data were noted on the excel sheet in a tabular form. Necessary statistical procedures were applied using SPSS v 20, Microsoft office student 2016 and Epi Info 7 software to observe the percentage of outcome variable in different demographic and clinical subgroups. Those cases which had a predisposition for development of pre-renal type of AKI were given the fluid challenge in the form of normal saline 20ml/kg over 30 minutes followed by a diuretic challenge (frusemide 2mg/kg) after correction of dehydration, hypotension or shock if associated. Those who had urination were grouped under pre-renal type and those who didn't were treated as intrinsic type of AKI.

**RESULTS**



Out of 201 patients 43.3% of cases were under 5 yrs. of age. Male: Female ratio was 1.4:1. Oliguria/anuria is the most common (86%)presenting complaint followed by fever (67%)



(Figure 1). Maximum no of cases (40%) presented with 1-day oliguria/anuria, 31% cases were hospitalised after 2 days' illness and 5% after 72 hrs (Figure 2). Anaemia was present in significant population (63 %). Edema was found in 38% & dehydration in 17 %. Hypotension was associated with 25 % of cases (Figure 3). Acidotic breathing as a feature of uraemia was detected in 19 % cases. Four major causes of AKI in this study in order are malaria (41.8%), Sepsis (21.4%), Snake Bite (14.9%) & acute gastroenteritis (9%) contributing to 87% of the total study population (Figure 4). Maximum (54%) cases had deranged serum urea level within 100 mg/dl. Only 13% of subjects had very high serum urea level ( $>200$ mg/dl). 57% of cases were having serum creatinine level between 1.5 – 3.0 mg/dl and 22% having  $> 6.0$  mg/dl. Majority of cases were found to be isotremic, only 15% cases were found to be hyperkalemic .75% cases were found to have intrinsic type of renal failure and 24 % cases had pre renal type of AKI. Intrinsic type of AKI was common in infancy & above 5 years of age group. Pre renal type increased in frequency in 1-5 yrs. age group. Maximum cases (66%) improved with fluid & electrolyte management. Need for dialysis was 34% in our study. Mortality in our series was 13 % and maximum occurred in  $>1-5$  yrs. age group. Intrinsic type of AKI was more associated with poorer outcome. Among aetiologies of AKI cases due to sepsis & Malaria was associated with higher mortality. There is no significant association of outcome in relation to duration of oliguria (Pearson chi-square = 2.204,  $p = 0.3322$ ) and types of AKI (Pearson chi-square = 0.339,  $p = 0.8441$ ) but there is significant association of outcome in relation to serum urea (Pearson chi-square = 27.599,  $p = 0.0001$ ) / creatinine (Pearson chi-square = 23.259,  $p = 0.0001$ ) and potassium level (Pearson chi-square = 22.985,  $p = 0.0001$ ). Independent sample student t test was conducted between death and recovery groups in various haematological parameters (Table 1) and found significant differences in serum urea (mg/dl) / Serum creatinine (mg/dl) / Serum sodium (mg/dl) / Serum potassium (mg/dl) between two groups.

**DISCUSSIONS**

Out of total no. of 2458 admissions to department of pediatrics in stated age group during the study period, 201 cases fulfilling inclusion criteria were included in the present study. So, prevalence of AKI in hospitalised patients in the present study accounted for 8.17%. But others have reported an estimate between 13% to 19% (Iqbal, Rehman & Khan, 1994; Arora et al., 1994), which is much higher than present study. This difference may be due to inclusion of newborn cases and higher number of study cases in their series. 43.3% cases occurred in the under 5 age group in our study, approximately same was observed by previous studies (Arora et al., 1994;Srivastava, Bagga, & Moudgil,1990;Acharya, Singla, Singh, Usha & Mishra,1996).In the present study male children outnumbered females (M: F=1.4:1) coincides with the previous researcher (Arora et al., 1994;Srivastava, Bagga, & Moudgil,1990;Acharya, Singla, Singh, Usha & Mishra,1996). Oliguria / anuria was present in approx. 86% of cases amongst

the study group which is varied widely than previous studies (100% in Acharya, Singla, Singh, Usha & Mishra, 1996 & approximately 50% in Arora et al., 1994). This difference is due to detection of biochemical derangements in snake bite cases mostly during their hospital stay and in this study these cases contributing to significant number (14.9%) among study population. Loose stool (AGE) was found in 16.9% cases similar with previous research (Srivastava, Bagga, & Moudgil, 1990) but very less than that of another study (58.5% in Srivastava, Bagga, & Moudgil, 1990), difference being the regional and cultural practices, increasing level of awareness among the people regarding oral rehydration. We observed presence of skin infection as a marker of AGN (4%), altered sensorium (9%), haematuria (14.4%), convulsion (15.4%), abdominal distension (20%), bleeding manifestation and bloody stool (5%) cases amongst the study population. Oligo/anuria of more than 72 hrs. was found in only 5% cases as against 78% in previous study (Acharya, Singla, Singh, Usha & Mishra, 1996). As this study was undertaken in a tertiary hospital, early referral of cases accounted for this gap. Pallor was found in 80.7% cases, peripheral edema in 38.3% cases, & dehydration in 17.4% cases which is almost similar to previous research (Acharya, Singla, Singh, Usha & Mishra, 1996). But hypotension was much more in our study which may be due to delayed referral from peripheral hospitals. The infectious etiology includes Malaria, Sepsis, Snake bite & AGE which accounted for 87% cases in the present study which coincides with previous studies (Gokalp, Oguz, & Gultekin, 1991; Srivastava, Bagga, & Moudgil, 1990). The patients who died had significantly higher ( $p < 0.001$ ) levels of blood urea, serum creatinine and potassium in comparison to those who recovered, same as that of past research (Acharya, Singla, Singh, Usha & Mishra, 1996). Intrinsic renal failure accounts for the majority of case distribution (74.6%), followed by pre-renal type (24.4%). Post renal contributed only 1%, more or less similar to previous research (Gallego et al., 1993). 34% patients in our study need dialytic support against 67.3% in other study (Arora et al., 1994) which may be due to good conservative management at our centre. Mortality rate in our study was 13% against 30% -60% by others (Arora et al., 1994; Singh et al., 1993; Rahman & Hussain, 1993). These variations in our study may be due to small sample size or as ours is a tertiary care hospital some cases may fail to come because of financial constraints.

## CONCLUSIONS

The etiology and clinical features of AKI in children is diverse and varies not only in different parts of the world but also among different regions of same country. The biochemical parameters for early detection are not well developed and laboratory facilities for diagnosis are grossly inadequate in most institutions. The treatment modalities developed by foreign authors are not fully applicable in our setup which leaves us with conservative and often peritoneal dialysis as a method of treatment. The increasing facets of contemporary medical amenities are though capable of getting prompt reversal of insane kidney function, in distinction to western or developed countries wherever the reason behind AKI is either congenital malformations, trauma or toxins, most of the borne in upon conditions (falciparum malaria, snake bite & haemolytic uremic syndrome) in our country are eminently treatable or preventable; but clinical awareness, early detection and treatment can produce substantial distinction among outcome of these patients. The present study was an effort to focus the various domains of AKI in children presenting to the hospital which included well characterized, diverse study population and depicted the etiological trends in this part of state and some parts of Eastern India. As it is a cross-sectional study we could not find incidence rate and so a cohort or RCT study is awaited for better future implications.

## CONFLICT OF INTEREST:

None declared

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## REFERENCES

- Gallego, N., Gallego, A., Pascual, J., Liano, F., Estepa, R., Ortuno, J. (1993). Prognosis of patients with acute renal failure without cardiopathy. *Nephron*, 64(3),399-404. doi:10.1136/adc.84.3.258
- Ronco, C., Kellum, J.A., Mehta, R., (2001). Acute dialysis quality initiative (ADQI). *Nephrol Dial Transplant*, 16(8),1555. doi: 10.1093/ndt/16.8.1555.
- Bellomo, R., Ronco, C., Kellum, J.A., Mehta, R.L., Palevsky, P. (2004). Acute renal failure definition, outcome measures, animal models, fluid therapy and information technology needs: the second international consensus conference of the acute dialysis quality initiative (ADQI) group. *Crit Care Med*, 8,204-12. doi: 10.1186/cc2872
- Schwartz, G.J., Munoz, A., Schneider, M.F., Mak, R.H., Kaskel, F., Warady, B.A., & Furth, S.L. (2009). New equations to estimate GFR in children with CKD. *J Am Soc Nephrol*, 20(3), 629-37. doi: 10.1681/ASN.2008030287
- Goldstein, B., Giroir, B., Randolph, A. (2005). International pediatric sepsis consensus conference: definitions for sepsis and organ dysfunction in pediatrics. *Pediatr Crit Care Med*, 6 (1),2-8. doi: 10.1097/01.PCC.0000161585.48182.69
- Mehta, R.L., Kellum, J.A., Shah, S.V., Molitoris, B.A., Ronco, C., Warnock, D.G., & Levin, A. (2007). Acute Kidney Injury Network: report of an initiative to improve
- outcomes in acute kidney injury. *Crit Care*, 11(2), R31. doi: 10.1186/cc5713
- Levin, A., Warnock, D.G., Mehta, R.L., Kellum, J.A., Shah, S.V., Molitoris, B.A., & Ronco, C. (2007). Improving outcomes from acute kidney injury: report of an initiative. *Am J Kidney Dis*, 50(1),1. doi: 10.1053/j.ajkd.2007.04.015.
- Molitoris, B.A., Levin, A., Warnock, D. G., Ronco, C., Mehta, R.L., Kellum, J.A., & Shah, S.V. (2007). Improving outcomes from acute kidney injury. *J Am Soc Nephrol*. 18(7). doi: 10.2215/CJN.02620409
- Akcan-Arikan, A., Zappitelli, M., Loftis, L.L., Washburn, K.K., Jefferson, L.S., Goldstein, S. (2007). Modified RIFLE criteria in critically ill children with acute kidney injury. *Kidney Int*, 71,1028-35. doi: 10.1038/sj.ki.5002231
- Brady, H.R., Brenner, B., Lieberthal, W. (1996). *The kidney*. Philadelphia, Pennsylvania: WB Saunders.
- Biesenbach, G., Zazgornik, J., Kaiser, W., Grafinger, P., Stuby, U., Necek, S. (1992). Improvement in prognosis of patients with acute renal failure over a period of 15 years: an analysis of 710 cases in a dialysis center. *Am J Nephrol* 1992 ;12(5):319-25. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/1489000>
- Arora, P., Kher, V., Gupta, A., Kohli, B.S., Gulati, S., Rai, P.K., & Sharma, R.K. (1994).
- Pattern of acute renal failure at a referral hospital. *Indian pediatrics*, 31, 1047. Retrieved from <http://www.indianpediatrics.net/>
- Singh, R.G., Agarwal, D.K., Usha, Jha, A., Dubey, B., and Bhargava, V. (1993). What decides High mortality in Pediatric acute renal failure? *Kobe Journal of Medical Sciences*, 39. Retrieved from <http://www.med.kobe-u.ac.jp/journal/contents.html>
- Rahman, M., Hussain, M. (1993). The bimodal mortality pattern of acute renal failure in children. *Ren-fail*, 15(1),55-9. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/8441837>
- Iqbal, J., Rehman, M.A., Khan, M.A. (1994). Pattern of renal diseases in children. *J Pak Med Assoc*, 44,118-20. Retrieved from <http://www.jpma.org.pk/>
- James, C. M. Chan., Debra, M. Williams., Karl, S. Roth. (2002). Kidney Failure in Infants and Children. *Pediatrics in Review*, 23(2),47-49. Retrieved from <http://www.pedsinreview.aappublications.org/content/23/2/47>
- Restrepo de Rovetto, C., Mora, J.A., Alexandre, C.S., Marmolejo, A.F., Paz, J.F., de Castano, I. (2012). Acute kidney injury applying pRIFLE scale in Children of Hospital Universitario del Valle in Cali, Colombia: clinical features, management and evolution. *Colombia Medica*, 43(3),201. Retrieved from <http://www.bioline.org.br/pdf/rc12033>
- Srivastava, R. N., Bagga, A., Moudgil, A. (1990). Acute renal failure in north Indian children. *Indian J Med Res*, 92,404-8. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/2079354>
- Acharya, U.T.N., Singla, P.N., Singh, R.J., Usha, Mishra, O.P. (1996). Outcome of dialyzed patients with ARF. *Ind.Pediatrics*, 33(5),387-390. Retrieved from <http://www.indianpediatrics.net/may1996/387.pdf>
- Gokalp, A.S., Oguz, A., Gultekin, A. (1991). ARF related to infectious disease in infancy
- and childhood. *Annals of Tropical Pediatrics*, 11,119-121. Retrieved from <http://www.akademikpersoneel.kocaeli.edu.tr/gokalpas/index.php?y...bilgi..>