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Acute kidney injury: Experience from a state run tertiary care centre in Southern India

Umesh L.*, Shivaprasad S. M., Niranjan M. R., Leelavathi V., Sreedhara C. G. and Rajiv E. N.

Department of Nephrology, Institute of Nephro-Urology, Victoria Hospital Campus, Bangalore, Karnataka, India
Corresponding Email: inunephrology@gmail.com

ABSTRACT

AKI (Acute Kidney Injury) constitutes approximately 5-7% of hospital admissions and up to 30% of admissions to intensive care units. Large referrals to dialysis units suggest that the condition is more common in India. The study was conducted to identify the etiological factors, co-morbidities and mortality risk in AKI. We conducted prospective cross sectional analysis in 624 adult patients with AKI. The mean age was 48.96±18.3 years. AKI was predominantly encountered in ICU (Intensive Care Unit) patients. Diabetes, hypertension, COPD (Chronic Obstructive Pulmonary Disease), coronary artery disease were the most commonly prevalent co-morbidities. Out of the 624 patients, 460 were admitted with medical causes (73.7%), 124 with obstetrical causes (19.8%) and 40 (6.4%) with surgical causes. Sepsis was the most common medical cause for AKI accounting for 138(30%) of patients. Among pregnancy related AKI majority had puerperal sepsis 65 (52.41%) followed by pregnancy induced hypertension in 30(24.1%).There was increase incidence of acute gastroenteritis and parasitic infections during rainy seasons. Hemodialysis was required in 80% (n=499) of patients. The mean duration of hospital stay was 9.41±7.3 days. Multi-organ failure was seen in 106 (16.98%) patients. Among them 60 (63.6%) patients were expired. Our study highlights the AKI secondary to sepsis followed by pregnancy-related AKI was the most frequent etiological factors for AKI. Multi-organ failure, puerperal sepsis were accounted for the majority of mortality in AKI. AKI among these instances are largely preventable. The timely and aggressive management will certainly reduce the incidence of AKI.

Key words: Acute kidney injury, Sepsis, Multi organ failure, Pregnancy related AKI

INTRODUCTION

Acute kidney injury (AKI) is characterized by rapid (over hours to days) decline in glomerular filtration rate, retention of nitrogenous waste products and perturbation of the extracellular fluid volume, electrolytes and acid-base homeostasis. AKI constitutes approximately 5% of hospital admissions and up to 30% of admissions to intensive care units [1]. Detection of the incidence, etiological profile and outcome of AKI is important for commencement of preventive and therapeutic strategies, identifying patients early to avoid renal replacement therapy (RRT) as well as comparison of epidemiological studies for improved clinical decision making. Geographical, etiological, cultural and economic variations determine the dissimilarities among patterns of AKI in different regions of the world. Although reliable statistics on the prevalence of AKI are not available, statistics on referrals to dialysis units suggest that the condition is more common in India as compared to the West [2]. AKI can result from decreased renal perfusion without cellular injury, an ischemic, toxic or obstructive insult to the renal tubule, a tubulointerstitial process with inflammation and edema or primary reduction in the filtering capacity of the glomerulus [2]. The mortality rate among patients with AKI approaches 50% and has changed little over the past 15 years. A single-center study from eastern India has shown a reduction in the incidence of acute cortical necrosis from 6.7% in 1994 to 1.6% in 2005 [3]. In contrast, there is an increase in the incidence of surgical and sepsis-related AKI [4,5]. Hence we conducted a prospective study to look for pattern of AKI in south Indian population.

MATERIALS AND METHODS

All patients aged above 18 years with features of AKI as per AKIN (Acute Kidney Injury Network) criteria [6] which is defined as an increase in serum creatinine of 0.3 mg/dl or more within 48 hours of observation or 1.5 times baseline or greater, which is known or presumed to have occurred within 7 days, or a reduction in urine volume below 0.5 ml/kg/h for 6 hours. Both inpatients and out patients during the period of February 2012 to February 2016 were included in our study. Patients with pre-existing renal disease and those who received renal transplantation were excluded from the study. A total of 624 patients met the above requirements and were evaluated prospectively. Renal biopsy was performed if a patient was oliguric or dialysis dependent at the end of 3 weeks.

All 624 patients with clinical (uremic symptoms or oliguria or anuria of recent onset) and laboratory evidence of azotemia as per AKIN criteria were eligible. The informed consent was taken. Demographic information including age, sex, weight, height, duration of ICU and hospital stay were obtained. Clinical data collected included primary diagnosis, past medical history, presence of co‑morbidities, surgical status, physical examination findings, lab investigations, treatment history, hospital course and need for renal replacement therapy (RRT). Baseline and peak levels of serum creatinine, urine output were documented. Data regarding laboratory investigations were collected to confirm the etiology of AKI, which included complete urine analysis, metabolic panel, lipid profile, blood culture, hematologic profile, coagulation profile. Radiological tests, serological tests and renal biopsy findings when available were obtained. Statistical calculations were done using Chi‑square test as and when required. $P < 0.05$ was considered to be significant. The calculations were carried out using SPSS (statistical package for the social sciences) 16.0 statistical software.

RESULTS

The total of 624 patients were studied. The mean age of these patients was 48.96±18.3 (range 18 to 85) years. The number of males was 385(61.85%) and 238 were females (38.14%). Among the etiological factors 460 were admitted with medical causes (73.7%), 124 (19.8%) patients with obstetrical causes and 40 (6.4%) patients with surgical causes. (Shown in Bar Diagram 1)

Among medical causes of AKI, the sepsis related AKI 138 (30%), obstetric AKI 124 (19.8%), acute gastroenteritis 71(15.5%), drugs and toxin induced AKI 50(11.03%) patients. Among drugs NSAIDS, aminoglycosides and herbal medicines were contributed. Parasitic infections was seen in 34 (7.6%) which includes malaria, leptospirosis, dengue fever and miscellaneous causes of AKI was seen in 61 (13.37%) patients which includes cardiac, hepatic causes and malignancy related AKI (Table 1).

The mean duration of hospital stay was 9.41±7.3 days with a range from 1 to 34 days. Out of 624 patients 181 (29.0%) had co-morbid illnesses. The diabetes in 65 (10.42%), hypertension in 46 (7.5%), COPD in 40 (6.4%), and coronary artery disease in 30 (4.8%). (Table 2)

Among surgical related AKI majority had renal stone disease causing obstruction which was seen in 20 (50%) patients followed by post operative AKI and cellulitis seen in twenty five percent patients each was observed.

Among pregnancy related AKI the puerperal sepsis in 65 (52.41%), pregnancy induced hypertension in 30 (24.1%). Twelve (9.67%) patients had post partum hemorrhage, 7 (5.64%) ante partum hemorrhage, post partumhemolytic uremic syndrome seen in 3 patients (2.41%) and miscellaneous causes were seen 7 (5.6%).

There was increase incidence of acute gastroenteritis during summer months and whereas sepsis and parasitic infections were very high during rainy seasons.

Among 624 patients seventy one patients underwent renal biopsy. Acute tubular necrosis (ATN) in 30 (38.96%), acute interstitial necrosis (AIN) in 15 (19.48%), ATN and AIN in 8 (10.52%), acute cortical necrosis in 12 (15.78%), and hemolytic uremic syndrome in 12 (15.78%) patients.(Table 3)

Eighty percent patients needed hemodialysis. On an average each patient treated with HD received 2.5±1.5 (range 1-14) sessions of HD. Eighty percent of the patients achieved near normal function at the time of discharge. Multi-organ failure was seen in 106 (16.98%) patients. Among them 60 (63.6%) patients were expired. Vasopressor support was needed for 134 patients to maintain hemodynamic stability. Among them 29 (40%) died within 48 hours of admission. Whereas only 5(3.73%) patients who were not supported with vasopressors had mortality ($p < 0.05$).

DISCUSSION

The cause of AKI was multifactorial. The present study revealed that our patient age group was a decade younger than in the west however comparable with most of Indian studies. Medical causes contributed to AKI in 73.7%, surgical causes in 6.4% and obstetric causes in 19.8% of patients. A study from south India by jayakumar et al showed 87.6% AKI in medical patients, 8.9% and 3.4% AKI in surgical and obstetrical patients respectively [4]. Obstetrical causes were very high in our study mostly due to late referral of patients with pregnancy related complications which was similar to study conducted by Kumar et al. [7].The low percentage of AKI in surgical patients in our study could be attributed to non availability of surgical specialities in our institute and also non performance of open heart and pancreatic surgery. Most common medical cause of AKI is sepsis constituting 30%, A study from North India showed 33.6% AKI due to sepsis [8]. A strong seasonal variation in the incidence of AKI was noted in acute gastroenteritis and parasitic infections group which in combination seen in 22.2% of the patients, a spike during and immediately after the rainy seasons (June to September) was observed. Hypothesis being heavy precipitation leads to soil erosion, leaching of minerals and organic compounds, and water logging, conditions favorable to survival of organisms causing or transmitting infectious diseases such as leptospirosis, dengue, and malaria [9,10,11].

In the present study drugs and toxins were responsible for the development of AKI in 50(11.03%) patients NSAIDS and herbal medicine were culprit agents. In India a study by Thatte et al reporteda 20% incidence of drug induced AKI with a larger proportion (40%) being secondary to aminoglycoside usage. [12]

Obstructive uropathy constitutes a major cause of surgical AKI in certain tropical areas. In the present study renal stone disease causing obstruction was seen in 20 (50%) of the surgical patients followed by post operative AKI and cellulitis. Improvements in obstetrical care have led to a decline in the incidence of obstetric AKI from 22% of all AKI in 1960s to 8% in 1990s.[13] However scenario remains unchanged in developing countries. Present study among pregnancy related AKI majority had puerperal sepsis (45.4%) followed by pregnancy induced hypertension in (23.2%). Mean duration of hospital stay was 9.4 days. Hemodialysis was required in 80% of the patients but 80% among them recovered completely with normal renal function at discharge. An overall mortality rate was 9.61%.The mortality was high in patients with multiorgan failure as in other studies.[13,14,15]. Mortality was high in patients having AKI due to medical causes as compared to patients with AKI resulting from surgical and obstetrical causes. Possible explanation for the lower mortality in surgical and obstetrical patients is that they did not have significant multiorgan failure patients which was common among patients with medical AKI. There was no statistical significant difference in mortality in terms of age and gender in our study population. Presence of hypotension was associated with significant mortality. Hypotension has been observed to be an adverse prognosticator in AKI.[12] Mortality was high in patients who required vasopressor support and amongst those who required dialysis therapy. Vasopressor support as well as dialysis support are considered a prognostic factor for outcome in AKI patients.[16] Severe metabolic acidosis and hyperkalemia were associated with adverse outcome.[17‑18]. In the present study population also patients presented with septic shock needing vasopressors had high mortality rate which was consisting with above studies.

Bar Diagram 1 showing causes of AKI

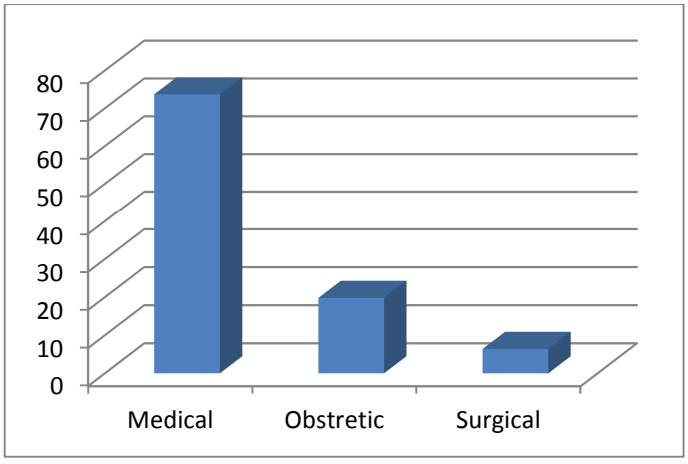

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Table 1 showing etiology of AKI

Etiology	Number of patients (N %)
Septicemia	138 (30%)
Acute gastroenteritis	71 (15.5%)
Drugs and Toxins	50 (11.03%)
Parasitic infections	34 (7.6)
Obstretic causes	124 (19.8%)
Surgical causes	40 (6.4%)
Miscellaneous	61 (13.37%)

Table 2 showing co-morbid conditions

Co-morbid Conditions	Number of patients (N%)
Diabetes Mellitus	65 (10.42%)
Hypertension	46 (7.5%)
COPD	40 (6.4%)
Coronary artery disease	30 (4.8%)

Table 3 showing renal biopsy findings

Histopathology	Number of patients (N%)
Acute tubular necrosis (ATN)	30 (38.96%)
Acute interstitial nephritis (AIN)	15 (19.48%)
ATN + AIN	8 (10.52%)
Acute cortical necrosis	12 (15.78%)
Hemolytic uremic syndrome	12 (15.78%)

CONCLUSION

Sepsis related AKI followed by pregnancy-related AKI was the most frequent etiological factors for AKI. Multi-organ failure, puerperal sepsis, hypotension at the time of presentation were accounted for the majority of mortality in AKI. AKI among these instances are largely preventable. The timely and aggressive management will certainly reduce the incidence of AKI.

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