

Incidence and Epidemiology of Acute Kidney Injury in Tertiary Care Centre in Gwalior Chambal Region

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ABSTRACT

Background: Acute kidney injury (AKI) is a commonly encountered syndrome associated with various aetiologies and pathophysiological processes leading to decreased kidney function. This study was designed to assess the incidence and epidemiology of AKI of patients in a tertiary care centre in the Intensive Care Unit (ICU) of Gwalior, Madhya Pradesh, India.

Methods: This was a prospective study of AKI patients, admitted in the Intensive Care Unit (ICU) of the Department of Medicine from September 2017 to February 2018. In total 100 AKI patients, which included 54 males and 46 females, male (44.20±8.54) and females (47.56±10.20) were collected and then subjected to the classification and arrangements data on the basis of general characteristics of patients; nature of disease and etiology of AKI amongst patients reported. Statistical data were collected using a self-administered questionnaire.

Results: Total of 100 AKI patients with the mean age of male (44.20±8.54) and female (47.56±10.2) found. Cases of AKI causes were characteristics of AKI patients most prominent of co-mortality diabetic (18%) then hypertension (12%). Etiology of cases among the pneumonia was (13%), pyelonephritis/ urosepsis (11%), acute gastrointestinal tract pathology (8%), meningitis (5%), bacterial gastroenteritis (5%), soft tissue injury (4%), and septic arthritis (3%) found. Female was risked to AKI majorly due to acute gastrointestinal tract pathology (8%). Hair dye (4%) was the first major poisonous cause of occurrence of AKI, followed by Organophosphorous (1%), celphos (3%), Datura (1%), and rat killer (1%).

Conclusion: AKI was an increasing concern and potentially catastrophic complication in hospitalized patients and frequently observed in our study due to sepsis post-trauma and heart failure as well as it carries a poor prognosis.

Key-words: Acute kidney injury, AKI, Acute kidney failure, Chronic disease, Cardiac failure, Hemorrhage

INTRODUCTION

Acute kidney injury (AKI) is a syndrome (or more accurately a group of syndromes) [1] defined by an abrupt decrease in glomerular filtration. AKI is a common condition in all countries of the world, regardless of economic status.

The syndrome is associated with considerable morbidity, mortality and high costs. As an episode of AKI can lead to the development of chronic kidney disease (CKD) or end-stage renal disease (ESRD), and the incidence of AKI is increasing, the impact of AKI on long-term health and cost is far greater than formerly acknowledged [2,3].

Annual prevalence of patients with AKI in need of one of the replacement methods has been reported to be about 200 to 300 cases in 1 million populations [4,5]. The causes of AKI are different based on various geographical regions and there is a significant difference in its prevalence between developing and developed countries [6]. Most affected population was 60–79 year old men and common co-morbidities in this group of patients

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include surgery, diabetes, pneumonia, cardiac failure, stroke, and history of CKD [7].

Definitions and diagnosis of AKI- Loss of kidney function is classically defined by increases in serum creatinine level; however, in community settings and circumstances in which a patient's volume status is closely monitored for example, in ICU-oliguria or anuria might be the only recognizable sign of AKI [8]. Accordingly, in the Improving Global Outcomes (KDIGO) guideline, AKI stages are classified into three stages on the basis of either the increase in serum creatinine level or the duration and extent of oliguria [9-11].

Epidemiology and risk factors of AKI patients- The widespread adoption of standardized criteria to define the presence of AKI have facilitated comparisons of the epidemiology and outcomes of AKI across hospital settings [12]. However, this standardization should not imply that AKI is a single entity. Rather, AKI is a syndrome that encompasses a multitude of clinical scenarios, underlying etiologies, co-morbidities, drug exposures and severities of renal dysfunction. AKI also involves several different patho-physiological processes; in experimental models, gene expression in the kidney in response to intrinsic renal tubular injury differs from that seen in homeostatic responses to volume contraction, even when each mechanism results in similar changes in serum creatinine concentration [13]. These factors are important to consider when evaluating studies describing the epidemiology of AKI in hospitalized patients (or indeed, in any group of patients), especially given that most epidemiologic studies use serum creatinine criteria alone to define AKI and generally do not report the etiology of AKI or the characteristics of the hospitals studied [14]. Therefore, the present study was done with the aim of evaluating the incidence and epidemiology of AKI in patients presenting to emergency department as a sample of ICU.

MATERIALS AND METHODS

A prospective study was done from September 2017 to February 2018 in a 1200 bed strength tertiary care centre (G. R. Medical College) located in Gwalior, Madhya Pradesh, India. The study protocol was approved by the Institute Ethics Committee. Total numbers of 100 AKI patients (i.e. 54 male and 46 female) were collected for this study. Obtained data

were then subjected to the classification and arrangements on the basis of general characteristics of patients; nature of the disease, etiology of the septicemic cause of AKI amongst patients, nephrotoxins, and poisonous causes of AKI amongst population reported.

Inclusion criteria

- Presence of uremic symptoms or oliguria or anuria of recent onset,
- **AKI as defined using the kidney disease-** KDIGO criteria based on serum creatinine (increase in serum creatinine by ≥ 0.3 mg/dL within 48 h or increase in serum creatinine to ≥ 1.5 times baseline), which is known or presumed to have occurred within the prior 7 days. Staging of AKI was serum creatinine 1.5 to 1.9 times base-line or ≥ 0.3 mg/dL increase (stage 1); 2.0 to 2.9 times baseline (stage 2) and 3.0 time baseline or increase in serum creatinine to ≥ 4.0 mg/dL or initiation of renal replacement therapy (stage 3). It was presumed that the patient had normal renal function, if the serum creatinine was 1.5 mg/dL.

Exclusion criteria

- Pre-existing kidney disease (serum creatinine >1.5 mg/dL or ultrasonography of the abdomen suggestive of bilateral small kidneys/loss of corticomedullary differentiation (CMD)/obstructive nephropathy/other renal pathology)
- Patients with AKI in CKD.

Statistical Analysis- The results were presented in mean \pm SD and percentage. Chi-square test was used to compare the categorical variables between cases and controls. Unpaired t-test was used to compare the study parameters between cases and controls. The Pearson correlation coefficient was calculated among the study parameters. The p-value i.e. <0.05 was considered as significant. All the analysis was carried out by using SPSS (IBM) 21.0 version (Chicago, Inc., USA).

RESULTS

A total of 1795 patients were admitted in ICU of the Department of Medicine at G. R. Medical College, Gwalior during the study period, screened for inclusion into the study. In which, a total of 100 patients were suffered from AKI and the incidence rate of AKI in the present study was 5.57% (Table 1).

Table 1: Incidence rate of AKI in present study cohort

| | Number | Percentage (%) |
|--------------------------------|--------|----------------|
| Total Admission at study place | 1795 | 100 |
| Incidence rate of AKI | 100 | 5.57 |

Majority of the patients had AKI stage II (74%) followed by AKI stage I (13%) and AKI stage III (13%) shown in Table 2.

Table 2: Distribution of acute kidney injury classification

| AKI classification | Frequency | Percentage (%) |
|--------------------|-----------|----------------|
| Stage I | 13 | 13 |
| Stage II | 74 | 74 |
| Stage III | 13 | 13 |

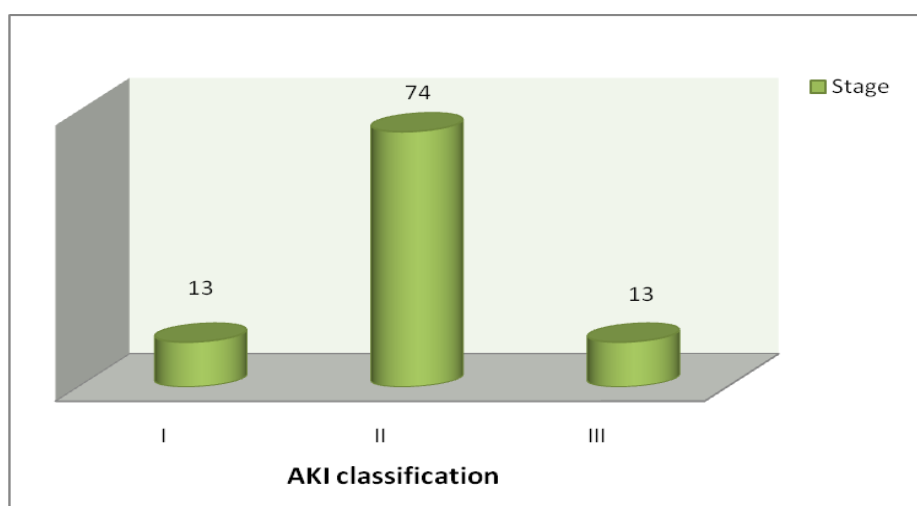


Fig. 1: Distribution according to AKI classification

General characteristics of AKI patients- In the total studied population male were in majority. The average age of AKI patients was found 45.74 ± 9.45 years whereas,

male was found 3 years younger with average age of 44.20 ± 8.54 and female with average age of 47.56 ± 10.20 (Fig. 3).

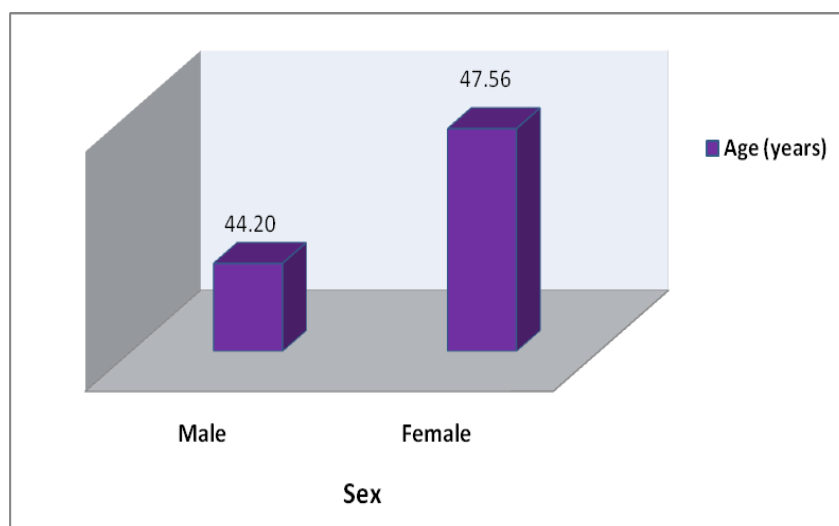


Fig. 2: Comparing mean of age between Gender

Total 20% of patients were subjected to internal medicine ward whereas, 80% were found to be admitted into ICU. The majority of patients were in ICU ward, which indicated that patients were being treated for some chronic diseases. Total 8% patients were suffering from hypertension as co-morbidity of which 14.81% were male and 8.69% were female. Diabetes mellitus was found to one of the major chronic disease in 18% of

total population, in which 16.66% were male and 19.56% were female. Blood pressure recordings indicated that of the total population 24% were suffering from hypotension, 14% were normal and 8% had hypertension. It was observed that occurrence of The 8% of the population was suffering from HIV, 6% with cancer, 4% with hepatitis B and hepatitis C, 4% with heart failure and 2% with CKD (Table 3).

Table 3: General characteristics of AKI patients

| Variables | Total (%) N=100 | Male (%) N=54 | Female (%) N=46 |
|--------------------------------|--------------------|------------------|--------------------|
| Age (years) | 45.74±9.45 | 44.20±8.54 | 47.56±10.20 |
| Unit of hospitalization | | | |
| Internal medicine | 20(20) | 12(22.22) | 8(17.39) |
| ICU | 80(80) | 42(77.77) | 38(82.60) |
| Co-morbidity | | | |
| Hypertension | 12(12) | 8 (14.81) | 4(8.69) |
| Diabetes mellitus | 18(18) | 9(16.66) | 9(19.56) |
| Blood pressure (mmHg) | | | |
| Hypotension | 24(24) | 18(33.33) | 6(13.04) |
| Normal | 14(14) | 9(16.66) | 5(10.86) |
| Hypertension | 8(8) | 6(11.11) | 2(4.34) |
| HIV | 8(8) | 5(9.25) | 3(6.52) |
| Cancer | 6(6) | 4(7.47) | 2(4.34) |
| Hepatitis B/C | 4(4) | 3(5.55) | 1(2.17) |
| Heart failure | 4(4) | 3(5.55) | 1(2.17) |
| Known CKD | 2(2) | 1(1.85) | 1(2.17) |

Etiology of AKI amongst patients- Among the studied population the septicemic cause of occurrence of AKI was different amongst different patients. Sepsis post trauma was one of the biggest causes of AKI in the study population followed by the pneumonia (13%), pyelonephritis/ urosepsis (11%), meningitis (5%), soft tissue (4%), bacterial gastroenteritis (5%) and septic arthritis (3%). Female was risked to AKI majorly due to acute gastrointestinal tract pathology (8%) (Table 4).

Nephrotoxins causes of AKI amongst patients- The hair dye (4%) was the first major poisonous cause of occurrence of AKI, followed by Organophosphorous (1%), celphos (3%), Datura (1%) and rat killer (1%) in this study population. It was also found that the males were at higher risk of poisoning than that of female almost in all the enlisted poisoning cases (Table 4).

Table 4: Nature and etiology of AKI amongst patients

| Variables Etiologies (Septicemia) | Total (%) N=100 | Male (%) N=54 | Female (%) N=46 |
|--|--------------------|------------------|--------------------|
| Pneumonia | 13(13) | 8(14.81) | 5(10.86) |
| Acute gastrointestinal tract pathology | 8(8) | 3(5.55) | 5(10.86) |
| Meningitis | 5(5) | 2(3.70) | 3(6.52) |
| Pyelonephritis/Urosepsis | 11(11) | 7(15.21) | 4(8.69) |
| Sepsis post trauma | 12(12) | 10(18.51) | 2(4.34) |
| Septic arthritis | 3(3) | 1(1.85) | 2(4.34) |
| Soft tissue injury | 4(4) | 3(5.55) | 1(2.17) |
| Bacterial gastroenteritis | 5(5) | 4(7.40) | 1(2.17) |
| Post-operative cases | 7(7) | 4(7.40) | 3(6.52) |
| Sepsis abortion | 6(6) | 0(0.00) | 6(13.04) |
| Post parter hemorrhage | 5(5) | 0(0.00) | 5(10.86) |
| Congestive cardiac failure | 4(4) | 2(3.70) | 2(4.34) |
| Acute pancreatitis | 4(4) | 3(5.55) | 1(2.17) |
| Nephrotoxins | | | |
| Hair dye | 4(4) | 1(1.85) | 3(6.52) |
| Organophosphorous | 1(1) | 1(1.85) | 0(0.00) |
| Rat killer | 1(1) | 0(0.00) | 1(2.17) |
| Celphos | 3(3) | 2(3.70) | 1(2.17) |
| Datura | 1(1) | 1(1.85) | 0(0.00) |
| Others | 3(3) | 9(16.66) | 4(8.69) |

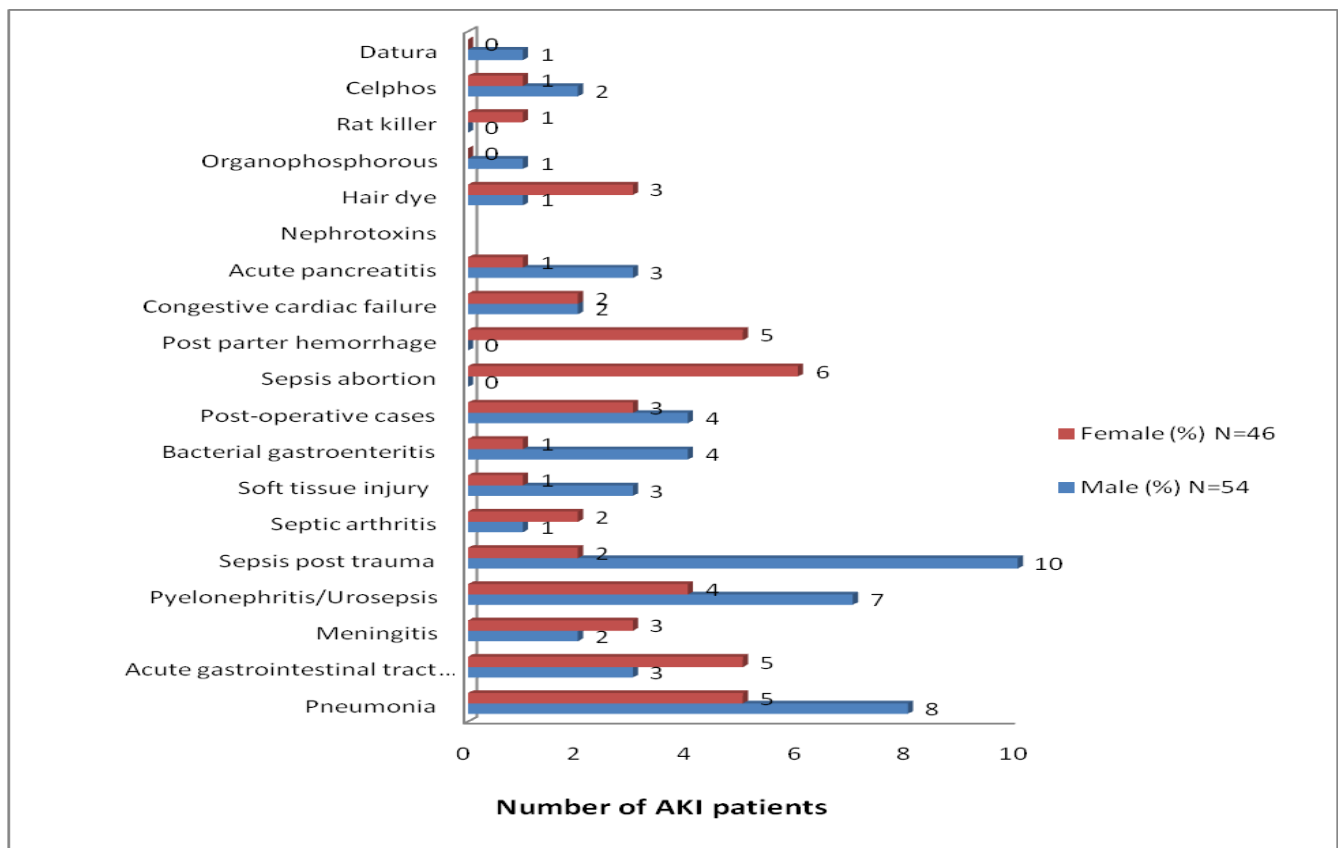


Fig. 3 Nature and Etiology of AKI amongst patients

DISCUSSION

In the present study, the average age of the population was 45.74±9.45 years, which were younger than the studies reported [15-17]. It is also reported that the AKI mostly occurs at old age or a disease of senility [15]. In our study AKI suffered male were also found three years younger than the average age of female, which clearly indicates male is at higher risk at early age than females. This may be due to rapidly changing life style and consumption of fast food in busy lifestyle. It was reported that consumption of fast food and increased dietary intake of foods with high oxalate content such as cocoa will lead to CKD [18]. Such chronic disease many a times leads to development of AKI [18]. The majority of studied population was admitted in internal medicine ward with chronic history of disease and prolonged intensive treatment. Hypotension was found to be the main co-morbidity in present study, which found in majority in sample population suffering AKI. Hypotension lowers the rate of flow of blood throughout the body which, leads to reduce in the rate of filtration of toxic component in the kidney. Non-filtered toxic component remains in the body majorly in accumulating in the kidney prone to AKI. It is also reported that patients with CKD, congestive heart failure, hypertension, renovascular disease and diabetes were more likely to develop AKI [15,19]. In our study 4% population was found to be suffering from heart failure and 2% with CKD [16,19]. In study population diabetes mellitus was found to one of the major chronic disease affecting 18% of total population of which 16.66% were male and 19.56% were female. Hypotension as well as hypertension was also observed in the AKI patients. In male population occurrence of AKI with normal blood pressure was higher 16.66%, as compared to females 10.86%, which again indicative of food habits and stress [16,18]. Along with it the patient were suffering from the infectious causes like affecting total 8% HIV was higher in 9.25% male as compared to females 6.52%, total 6% cancer was higher 7.47% as compared to females 4.32%, 4% as well as total hepatitis B and hepatitis C was higher 5.55% as compared to females 2.17%. Heart failure 4% total and known CKD 2% of higher as 5.55% of male compared than 1% of female.

It was reported that sepsis is one of the major cause of AKI and septicemic causes to occurrence of AKI was different amongst different patients. With respect to the

observations made in the present study most literature report a similar total Incidence of hospitalization in ICU ward ranging from 55.60% to 84% [20-25]. Certain reports, have however documented a highest Incidence of hospitalization in Internal medicine ward the range 37.1% [26]. Similarly ICU admitted patients, sepsis was one of the major causes in our finding of with 77.77% of male and 82.60% of female were at risk, whereas, in Internal medicine ward cases, our finding was 22.22% of male and 17.39% of female [27]. The majority of studied population was admitted in ICU with chronic history of disease and prolonged intensive treatment.

Other septicemia causes though do not directly relate to the AKI indirectly contributing the aggravation of condition. Those includes infections like pneumonia, pylonephritis/ urosepsis, acute gastro-intestinal tract pathology, meningitis, soft tissue, bacterial gastroenteritis, septic arthritis and other unidentified cause. In our study it is also found that the female with infectious causes are greater risk relating poor health and hygiene of females. Infectious causes like pneumonia, for male was 14.81% and 10.86% for female, gastrointestinal tract pathology (10.86%) and meningitis (6.52%) were the main disease associated with the occurrence of AKI in females. In all the toxic origin of occurrence of AKI male population was suffered greatly than the females, which clearly indicate the toxigenic occurrences of AKI related to job profile [21]. Male population was found at higher risk in all the toxic incidences. All other toxicities of hair dye, methanol, organophosphate, paraquat, celphos, and rat killer are either industrial origin or the risk jobs preferably performed by the male candidates at home and socially; hence male was clearly at major risk.

CONCLUSIONS

The incidence of AKI is high in ICU admitted patients and the development of AKI is associated with poor outcome and reduced survival. AKI significantly increases the period of hospital stay, and this is likely to increase to the healthcare burden and morbidity. The epidemiology of present study concluded, the risk of AKI was high among critically ill patients with co-morbidities. Most of the risk factors of AKI can be prevented with early diagnosis and interventions such as health education on oral rehydration, quality prenatal and emergency obstetric care, appropriate management of infections

and taking proper precautions, when prescribing nephrotoxic medications.

Future study may be also benefitted by better identifying modifiable risk factors to prevent the development of AKI from the outset and timely and aggressive management will certainly reduce the incidence of AKI. Treatment of AKI is largely supportive and further research is urgently needed to improve AKI diagnosis and patient's outcomes.

CONTRIBUTION OF AUTHORS

Research concept- Prof. Sushma Trikha, Prof. Archana Kansal, Dr. Neelima Singh

Research design- Dr. Krishan Kumar

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Data collection- Dr. Krishan Kumar

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Article editing- Dr. Krishan Kumar

Final approval- Prof. Sushma Trikha

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