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Original Article

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Clinical Profile, Biochemical Parameters, and Outcome of Acute Kidney Injury in Elderly Patients in a Tertiary Care Centre

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Abstract

Objective: To study the etiology, risk factors, clinical profile, complications, and outcomes of acute kidney injury (AKI) in elderly patients. ***Design:*** A prospective observational study. ***Subjects/Patients:*** Elderly patients (>60 years) admitted with AKI in medical wards and ICUs of a tertiary care hospital. Patients with chronic kidney disease were excluded. ***Methods:*** 101 patients with AKI (as per KDIGO criteria) were included. Data on demographics, clinical presentation, biochemical parameters, and outcomes were collected and analyzed using statistical tools. Patients were followed until discharge or death. ***Results:*** The mean age was 75.77±6.87 years, with a male-to-female ratio of 1.40:1. Hypertension (52.47%) and diabetes (51.49%) were common risk factors. Sepsis (29.70%) was the leading cause of AKI, followed by obstructive uropathy (21.78%). Pre-renal AKI was the most common type (45.54%). Mortality was 27.72%, with a higher risk in patients with multi-organ involvement, oliguria, hyperkalemia, and severe metabolic acidosis. ***Conclusion:*** AKI in the elderly is associated with significant morbidity and mortality, with sepsis being a major cause. Early recognition, prevention, and aggressive management of risk factors and infections are crucial to improving outcomes.

Keywords: ***Hemodialysis, Renal Insufficiency, Multiple Organ Failure, Contrast Media, Hyperkalemia.***

Introduction

Acute kidney injury(AKI) is a common disorder, estimated to occur in 4% to 7% of hospitalized patients and as many as 30 to 60% of patients with critical illness. The elderly population is more prone to acute kidney injury than the younger population and has a poorer prognosis despite advances in treatment. In developing countries the cost of renal replacement is very high, making it prohibitive for a large proportion of the population. In such scenarios the only realistic way to tackle the problem of its impact on morbidity and mortality is prevention. Prevention is the key to avoiding the heavy burden of mortality and morbidity associated with AKI. More precise data on the true incidence and clinical consequences of AKI will help highlight the significance of the disease within the community. It will also promote greater awareness among governments, the public, general practitioners, family physicians,

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and other healthcare professionals, ultimately supporting efforts to prevent the condition. This study was aimed to study the etiology, risk factors, clinical profile, complications and outcome with respect to the AKI in elderly patients. This study aimed to study the etiology, risk factors, clinical profile and complications of AKI in elderly patients as well as the outcome concerning renal function tests.

Materials and Methods

This was an observational and prospective study that included elderly patients of age >60 years admitted in medical wards and the intensive care unit of our institution with documented AKI (defined as per KDIGO criteria). After obtaining institutional ethics committee permission and written informed consent of patients who fulfilled inclusion criteria, the necessary information was obtained. Any known cases of chronic kidney disorder and non-consenting patients were excluded from the study. The study group was recruited for a period of one year.

The sample size calculated was 101 cases (taking 5% precision and 95% confidence interval). Individual patients were asked for detailed history, and detailed physical examination, including general and systemic examination, was carried out. The routine investigation report mandatory for all acute kidney injury patients was entered in the pro forma. Patients were followed up on the day of admission, on the 3rd day of admission, and at the time of discharge or death. Data on clinical profile, biochemical parameters, and outcome of acute kidney injury were used for statistical analysis. Blood reports such as Hb, total leucocyte count, platelet count, Malaria/leptospirosis/dengue, Fasting blood sugar/Post-prandial blood sugar, Arterial blood gas, Blood urea nitrogen, creatinine, Liver function tests, Prothrombin time/International normalized ratio, and serum electrolytes were analyzed. Urine reports included urine routine and urine culture sensitivity. All the responses were tabulated and graphically represented as and wherever necessary. All data was entered into Excel sheets, and statistical tools like mean, mode, median, chi-square test, and Fisher's exact test were applied as and when required.

Results

101 patients were included in the study over 18 months. The collected data was analyzed. The prevalence of acute kidney injury in hospitalized patients is around 3-7%. The sample size calculated was 101 (taking 5 %precision and 95% confidence interval). In our study population, 32.68% (33) patients were in the age group of 61 to 70 years, 51.48 % (52) were in the 71 to 80 year age group, and 15.84% (16) patients were above 80 years. Mean age was 75.77 + 6.87 years. Males and females formed 58.42% (59) and 41.58% (42) of the study population respectively. Hypertension (52.47%, 33 patients) was the most common risk factor associated with AKI followed by diabetes mellitus (51.49%, 52 patients). Drugs contributed as a risk factor for AKI in 40 (39.60%) patients. Obstructive uropathy (including renal vascular disease and benign prostatic hyperplasia) was found in 22 (21.78%) patients. Dehydration was seen in 29 (28.71%) patients. Cardiac failure was seen in 10 (9.90%) of patients. In our study, ACE inhibitors (35%, 14 patients) were the most common drug contributed as a risk factor for AKI followed by Angiotensin Receptor blockers (27.50%, 11 patients). NSAIDS contributed to AKI in 5 (12.50%) patients. Diuretics, contrast, and mannitol contributed to AKI in 6(15%), 2(5%), 2(5%) patients respectively.

Kidney was the only organ involved in 16 patients (15.84%). 43 patients (42.58%) had two organs involved while 31 patients (30.69%) had three organs involved. >= 4 organs were involved in 11 patients (10.89%).68.31% of the patients were managed conservatively whereas 31.68% happened to require hemodialysis. In our study, out of 32 patients who were dialyzed, 14 (43.75%) recovered completely, 4 (12.50%) were sent home on maintenance hemodialysis and 14 (43.75%) died.

In our study, 73 (72.27%) patients were discharged and 28 (27.72%) patients died. Out of 59 males, 43 (72.88%) were discharged and 16 (27.12%) died. Out of 42 females, 30 (71.42%) were discharged and 12 (28.57%) died. Out of 52 patients with Diabetes Mellitus, 32 were discharged and 20 died. Out of 49 patients who did not have diabetes mellitus, 41 were discharged and 8 died. Out of 29 patients with altered sensorium, 13 were discharged and 16 died. Out of 72 patients with normal sensorium, 60 patients were discharged and 12 died. Out of 53 patients with Hypertension, 38 were discharged and 15 died. Out of 48 non-hypertensive patients, 35 were discharged and 13 died. Out of 11 patients with 0 predisposing factors, 8 were discharged and 3 died. Out of 26 patients with 1 predisposing factor, 22 were discharged and 4 died. Out of 41 patients with predisposing factors, 28 were discharged and 13 died. Out of 23 patients with 3 or more predisposing factors, 15 were discharged and 8 died. Out of 49 Febrile patients, 31 were discharged and 18 died. Out of 52 Afebrile patients, 42 were discharged and 10 died.

Out of 16 patients with one organ involved, 15 were discharged and 1 died. Out of 43 patients with two organs involved, 36 were discharged and 7 died. Out of 31 patients with three organs involved, 20 were discharged and 11 died. Out of 11 patients with four organs involved, 2 were discharged and 9 died. Out of 41 patients with TLC < 20,000 31 were discharged and 07 died. Out of 60 patients with >= 20,000 TLC 39 were discharged and 21 died. Out of 9 patients with Serum creatinine <= 3 mg/dl, 8 were discharged and 1 died. Out of 92 patients with serum creatinine >3 mg/dl, 65 were discharged and 27 died. Out of 16 patients with serum potassium >5mEq/L 7 were discharged and 9 died. Out of 85 patients with Serum potassium <=5mEq/L, 68 were discharged and 1 died. Of 18 patients with severe metabolic acidosis, 7 were discharged and 11 died. Out of 83 patients without severe metabolic acidosis, 66 were discharged and 17 died.

In our study population, the prerenal (45.54%) type of AKI was most common followed by renal type (32.67%). Post-renal type of AKI was found in 21.78% of patients. Renal and prerenal type of AKI was differentiated on the basis of Blood urea nitrogen/creatinine ratio on admission which was <20 & >20 respectively. In 46 patients with pre-renal AKI, 33 were discharged and 13 died. Of 33 patients with renal AKI, 22 were discharged and 11 died. In 22 patients with post-renal AKI, 18 were discharged and 4 died. Of 51 patients with non-oliguric AKI, 43 were discharged and 8 died. Of 50 patients with oliguric AKI, 30 were discharged and 20 died. Of 4 patients with Stage 1 AKI, 3 were discharged and 1 died. Of 10 patients with Stage 2 AKI, 8 were discharged and 2 died. Of 87 patients with Stage 3 AKI, 62 were discharged and 25 died. In our study, Non-oliguria type of AKI (50.50%) and oliguria type (49.50%) have almost equal incidence.

Table 1: Stages of AKI according to KDIGO criteria

AKI Stage	Serum Creatinine (SCr)	Urine Output
1	1.5–1.9 times baseline OR ≥ 0.3 mg/dL increase	< 0.5 mL/kg/h for 6–12 hours
2	2.0–2.9 times baseline	< 0.5 mL/kg/h for ≥ 12 hours

3	3.0 times baseline OR Increase in SCr to ≥ 4.0 mg/dL OR Initiation of RRT OR Decrease in eGFR to < 35 mL/min/1.73 m² in patients < 18 years	< 0.3 mL/kg/h for ≥ 24 hours OR Anuria for ≥ 12 hours

Table 2: Frequency and mean/percentage of characteristics of patients of acute renal failure

Characteristic	Frequency	Variable mean +/- SD or percentage
Age	-	75.77 ± 6.88
Males (%)	59	58.42%
Hypertension (%)	53	52.47%
Diabetes Mellitus (%)	52	51.49%
Dehydration (%)	29	28.71%
Obstructive Uropathy (%)	22	21.78%
Cardiac failure (%)	10	9.90%
Chronic liver disease (%)	6	5.94%
Drugs (%)	40	39.60%

Table 3: Frequency and percentage of various drugs taken by patients with acute kidney injury

Drugs	Frequency	Percentage
ACE inhibitor	14	35%
ARBs	11	27.50%
NSAIDS	5	13%
Diuretics	6	15%
Contrast	2	5%
Mannitol	2	5%

Table 4: Frequency and percentage of various symptoms experienced by patients with acute kidney injury

Symptoms	Frequency	Percentage
Vomiting	58	57.20%
Fever	49	48.51%
Oliguria	45	44.55%
Breathlessness	34	33.66%
Altered sensorium	29	28.71%
Diarrhoea	20	19.80%
Abdominal pain	19	18.81%
Pedal edema	15	14.85%
Anuria	15	14.85%
Convulsion	7	6.93%

Table 5: Frequency and percentage of various etiological factors in patients with acute kidney injury

Etiology	Frequency	Percentage Prevalence
Sepsis	30	29.70%
Obstructive Uropathy	22	21.78%
Acute Gastroenteritis	2	19.80%
Tropical Infections	17	16.83%
Cardiorenal	10	9.90%
Hepatic-Renal	6	5.94%
Drugs & Toxins	4	3.96%
Others	7	6.93%

Table 6: Frequency and percentage of various complications in patients with acute kidney injury

Complications	Frequency	Percentage
Hypocalcemia	41	40.59%
Metabolic Acidosis	27	26.73%
Hyperkalemia	5	4.85%
Volume Overload	13	12.87%
Uremic Encephalopathy	12	11.88%
Hyperphosphatemia	11	10.89%

Table 7: Frequency and percentage of various indications of hemodialysis in patients with acute kidney injury

Indication of hemodialysis	Frequency	Percentage
Severe metabolic acidosis	32	43.75%
Oliguria and metabolic acidosis	8	25%
Anuria	14	21.88%
Hyperkalemia	3	9.37%

Table 8: Frequency and percentage of the stages of acute kidney injury

Stage of AKI	Frequency	Percentage Prevalence
Stage-1: Risk (creatinine =1.5 to 1.9)	4	3.96%
Stage-2: Injury (creatinine=2 to 2.9)	10	9.90%
Stage-3: Failure (creatinine>=3)	87	86.13%

Table 9: Percentage of patients discharged or died in various stages of Acute Kidney Injury

Stage of AKI (KDIGO Criteria)	Discharge	Death	Total
STAGE 1 (Serum Creatinine 1.5 to 1.9)	3 (75%)	1 (25%)	4
Stage 2 (Serum Creatinine 2 to 2.9)	8 (80%)	2 (20%)	10
Stage 3 (Serum Creatinine 3 or >3)	62 (71.26%)	25 (28.74%)	87
Total	73	28	101

Table 10: P-value of various factors identified to be associated with acute kidney injury

Factor	p value	Statistical Difference
Gender	0.872	No
Diabetes Mellitus	0.013	Yes
Sensorium	<0.000092	Yes
Hypertension	0.891	No
Fever	3.85	Yes
number of organs involved	< 0.00003	Yes
Total leukocyte count*	0.048	No
Serum Creatinine**	0.438	No
Serum Potassium***	0.00234	Yes
Severe Metabolic acidosis	0.00048	Yes
type of AKI	0.466	No
Urine Output	0.00634	Yes
Stage of AKI	0.358	No

*(*more than 20,000, ** more than 3 mg /dl, ***more than 5mEq/L)*

Discussion

In this study, we analyzed clinical profile, biochemical parameters, outcome and the factors determining poor patient outcome among elderly patients (>60 years) with AKI. In a study conducted in China, by Chia- Ter Chao *et al.* [1] 21.30% were in the age group of 61 to 70 years, 29.30% were in the age group of 71 to 80 years and most of the patients (49.50%) were above the 80 years age group. The mean age in this study was 76.2 + 9.54. In India, a study conducted by S Mahajan *et al.* [2] in elderly patients, the maximum number of patients were in the 61 to 70 years age group i.e. 82.2%, and only 2.9% of patients were above 80 years. The mean age of this study was 66.4 +7.5 years. In our study maximum number of patients were in the age group of 71 to 80 years i.e. 51.49%, minimum number of patients were above 80 years i.e. 15.84%. Mean age group in our study (75.77 + 6.87) years is comparable to the study by Chia-Ter Chao *et al.* [1]. We have not found a relationship between advanced age and poor prognosis in ARF, which has also been the experience of other authors. In our study, males have a higher incidence of AKI as compared to females which is comparable to the study conducted by Chia-Ter Chao *et al.* [1] which had 56% males and 77.44 % females respectively. While the study conducted by S Mahajan *et al.* [2] consisted of 70.50% & 29.50% males and females respectively. There was a slight male preponderance in the age group of 61 to 70 years, and 71 to 80 years with male to female ratio of 2.3:1 and 1.26:1 respectively, but in the age group above 80 years, slight female preponderance was found with male to female ratio 1:1.28. Study conducted by S Mahajan *et al.* [2] male: female ratio was 2.4:1 compared to our study which is 1.40: 1 respectively. The observation of male preponderance in our study could be partially attributed to the bias of society in developing countries to provide expensive tertiary care treatment preferably to male members.

In the present study, hypertension (52.47%) was the most common risk factor associated with AKI followed by Diabetes Mellitus (51.49%). Similar results were found comparing our study to a study conducted by Eswarappa *et al.* [3] in which hypertension was seen in 70% and diabetes was associated with 31% of patients. When we compared our study with the study conducted by Chia-Ter Chao *et al.* [1], we found that hypertension was seen in 55% of patients and Diabetes in 46%. In the study by S. Mahajan *et al.* [2] (n=454), volume depletion was the most common precipitating factor (33%). In our study volume depletion was seen in 50.49% of patients. Use of diuretics, gastrointestinal losses, and poor fluid intake were major causes of volume depletion. Diabetes mellitus was present in 15.2% of patients compared to our study in which diabetes mellitus was seen in 51.49%. This difference in predisposing factor may be because our study was conducted in the general medical ward as compared to by S. Mahajan *et al.* [2] which was conducted in the nephrology ward of AIIMS. In the study by S. Mahajan *et al.* [2] drugs predisposing to AKI were seen in 52 patients (11.5%). Aminoglycosides were the offending agents in 21 patients (40.4%), followed by non-steroidal anti-inflammatory drugs (NSAIDs) in 10 patients (19.1%) and angiotensin-converting enzyme (ACE) inhibitors in 6 patients (11.9%). In our study drugs contributed as a risk factor for AKI in 39.60% of elderly patients. ACE inhibitors 14(35%) were the most common drug that contributed as a risk factor for AKI followed by ARBs (27.50%). This difference in both studies is that most of the patients in our study were hypertensive and were on ACE inhibitors and ARBs. However a study conducted by Sharon Anderson *et al.* [4] NSAIDs are the most common drugs predisposing to AKI followed by Diuretics and ACE inhibitors. The increased half-life, decreased BMI, and physiologic changes making the aged population more reliant on prostaglandin-induced afferent arteriolar vasodilation cause them to have a higher baseline risk of

AKI from NSAIDs. The contrast agent used in 2 patients was iodinated contrast agent iohexol and iodixanol respectively. Both patients were hypertensive. In a study by S. Mahajan *et al.* [2] 22 patients (4.7%) developed ARF following a contrast study. In a study by S. Mahajan *et al.* [2] Congestive heart failure and cardiac arrhythmias accounted for 21.36 % of patients with ARF compared to our study cardiac failure and cardiac causes accounted for 9.90% of AKI in the elderly. Obstructive uropathy (including renal vascular disease and benign prostatic hyperplasia) was found in 18.81% of patients. In the study by S. Mahajan *et al.* [2] obstructive uropathy was seen in only 6.39% of patients.

In our study, Vomiting was the most common symptom (57.42%) followed by Fever (48.51%) and oliguria (44.55%). Altered sensorium was present in 29(28.71%) patients of the study population. This is comparable to a study conducted by Maulita Kapadia *et al.* [5], in which vomiting was the most common symptom seen in 81% followed by oliguria (63%), and the study conducted by Eswarappa M *et al.* [3], in which oliguria was the most common symptom seen in 67% followed by fever in 52% of patients. However, both of these studies i.e. Maulita Kapadia *et al.* [5] and Eswarappa M *et al.* [3] were carried out in both younger and older populations.

Studies are looking into the spectrum of AKI among elderly patients in our country but these are scarce. The higher risk of sepsis in the elderly as a result of decreased effectiveness of the immune system predisposes the elderly to the development of AKI. In our study, sepsis (29.70%) was the most common cause of AKI followed by obstructive uropathy (21.78%). Urinary tract infection and pneumonia were also common infections leading to Acute renal failure (ARF) in the study. Endotoxins directly sensitize the renal tubular cells to the effect of ischemia even in the absence of hemodynamic changes. Age-related changes in the kidney make this phenomenon much more marked in the elderly. This is comparable to a study conducted by Maulita *et al.* [5] in which sepsis (48%) was the most common cause of AKI followed by acute gastroenteritis (11%). Similar results were found in the study conducted by Eswarappa M *et al.* [3] and Kumar *et al.* [6]. Arora *et al.* [7] evaluated 41 elderly ARF patients with a mean age of 67.1 years at their center and found that prostate-related surgical problems were the leading cause of ARF in their center. Prakash *et al.* [8] evaluated 56 elderly patients with ARF and found that volume depletion followed by obstruction was the leading cause of Acute renal failure. Acute gastroenteritis 20(19.80%) was the 3rd most common cause of AKI in our study. Most of these patients had severe dehydration. Hypotension was seen in some of the patients. Acute gastroenteritis, a rare entity in developed nations, still poses a challenge in developing countries like India due to poor hygienic conditions, overcrowding, and late referral to tertiary hospitals. Due to drugs & toxins, only 4 patients were found of which 2 were given contrast agents and 2 were given injection mannitol which caused nephrotoxicity. In this group, we have included only those drugs and toxins for which no other cause has been found for AKI. Bridoux *et al.* [9] have reported a high incidence of ARF caused by ACE inhibitors in older patients without renal artery stenosis in our study, Malaria (58.82%) was the most common tropical infection to cause AKI followed by Leptospirosis (29.41%). Dengue was found in 11.76% of patients. This is comparable to study conducted by Rakesh Bhadade *et al.* [10], in which malaria was the most common cause of AKI seen in 52% of patients followed by undifferentiated fever (24%) (where the cause of fever couldn't be found despite standard battery of tests) and in the decreasing order, leptospirosis (11%), acute gastroenteritis (8%), dengue (4%) and hepatitis E (1%). When we studied the pattern of renal involvement according to KDIGO criteria, we found that 4(3.96%) were in Stage 1 i.e., at risk of AKI, maximum number i.e., 86.13 % (87) belonged to Stage 3 which is renal failure and 9.90% (10) were in Stage 2 i.e., renal injury. The mean creatinine value was 4.82+ 3.12 mg/dl. These results are comparable to the study conducted by Rakesh Bhadade *et al.* [10] in which 8.54% patients were in stage 1, followed by 20.64% of patients that were in stage 2, and a maximum number of patients were in stage 3 i.e. 71.20%. However, this study was conducted for AKI patients admitted in ICU patients.

In our study population, the pre-renal (45.54%) type of AKI was the most common, followed by the renal type (32.67%). Post-renal type of AKI was found in 21.78% of patients. A similar finding was observed in the study conducted by Balushi *et al.* [11], where the most common cause of AKI was found to be pre-renal (50.9%), followed by renal (44.5%). In a study conducted by Kumar *et al.*., the most common type was renal AKI (69.60%), followed by pre-renal (20.60%). Pre-renal failure is characterized by a particularly good prognosis in our study, probably due to its reversibility with volume expansion, whereas post-ischemic and post-operative Acute Tubular Necrosis showed lower survival rates in both age categories. A particularly good prognosis was seen in post-renal obstruction; however, this was not statistically significant. In our study, the non-oliguric type of AKI (50.50%) and oliguric type (49.50%) had almost equal incidence. Mortality was higher in the oliguric type of AKI, which is statistically significant, a finding similar to that observed in the study conducted by S. Mahajan *et al.* [2]. In our study, hypocalcemia (40.59%) was the most common complication, followed by metabolic acidosis (26.73%). Uremic encephalopathy was seen in 11.88% of patients, and hyperkalemia in 14.85%. Of 101 patients, 84.16% had involvement of other systems, such as hematological, hepatic, central nervous, cardiovascular, and respiratory systems, while only 15.84% (16 patients) had pure renal involvement. The majority, 42.58% (43 patients), had two systems involved alongside the renal system. In our study, 69 (68.31%) patients were managed conservatively, while 32 (31.68%) required hemodialysis, which is comparable to the study conducted by S. Mahajan *et al.* [2], where 33.50% required hemodialysis. Similar findings were reported by M. Eswarappa *et al.* [5] (n=125) and S. Garudkar *et al.* [12]. Of the 32 patients who were dialyzed, 14 (43.75%) had severe azotemia as the indication for hemodialysis, 8 (25%) had oliguria with metabolic acidosis, 7 (21.88%) had anuria, and 3 (9.37%) had hyperkalemia. In the study by S. Mahajan *et al.* [2], advanced azotemia, hyperkalemia, and volume overload were the most common indications for renal replacement therapy in 64.5%, 16.2%, and 14.6% of patients, respectively. In our study, of the 32 patients who were dialyzed, 14 (43.75%) recovered completely, 4 (12.50%) were sent home on maintenance hemodialysis, and 14 (43.75%) died. In our study, 73 (72.27%) patients survived, and 28 (27.72%) died. Our study's mortality results are comparable to those observed in studies by Balushi *et al.* [11] (33.30%), M. Eswarappa *et al.* [3] (37.60%), and S. Mahajan *et al.* [2] (41.20%). Mortality in the elderly with AKI varies considerably across studies, making direct comparisons challenging due to differences in patient populations, clinical factors, and outcome measures. In our study, there was no significant difference in mortality according to gender distribution, which is comparable to findings by S. Mahajan *et al.* [2] and M. Eswarappa *et al.* [3]. We also found that the presence of underlying illnesses, particularly diabetes mellitus, ischemic heart disease, multi-organ involvement, and sepsis, were significantly associated with poorer outcomes. The onset of ARF in the setting of cardiac failure and sepsis was associated with poor outcomes, while patients with obstructive uropathy and drug/contrast-induced ARF had significantly better outcomes. We observed higher mortality in

patients with altered sensorium compared to those with normal sensorium. Mortality did not correlate with the presence of hypertension, the number of predisposing factors, peak serum creatinine levels, or a WBC count >20,000 per microlitre. However, mortality correlated well with the presence of diabetes mellitus, multi-organ involvement, hyperkalemia, severe metabolic acidosis, and oliguria. The need for renal replacement therapy was associated with high mortality. Mortality was higher in stage 3 (failure) of KDIGO classification compared to stages 1 and 2, although this difference was not statistically significant. Druml *et al.* [13] in their retrospective analysis of 242 elderly ARF patients admitted to a medical ICU found that sepsis, the need for renal replacement therapy, ventilatory dependence, and serum creatinine >6 mg/dl predicted poor outcomes. Sesso *et al.* [14] followed 325 elderly ARF patients and found that underlying malignancy, surgery, oliguria, need for dialysis, sepsis, and organ failure were associated with poor outcomes. Thus, the factors predicting adverse outcomes in the elderly ARF population are similar across various studies.

The limitations of our study include the relatively small sample size of 101, which, although calculated, may not be fully representative of the population. Conducting the study in a tertiary care hospital may have led to an overestimation of associated comorbidities and mortality compared to primary or community-based care settings. Additionally, the lack of long-term follow-up means that patient outcomes after hospital discharge remain unknown. Lastly, KDIGO staging could not reliably predict outcomes in our study, as the majority of patients had multisystem failure, highlighting the need for further studies to validate this classification of AKI.

Conclusion

Male preponderance was seen in our study with a male-to-female ratio of 1.40:1. Males were more prevalent in all age groups except for those above 80 years, where a slight female preponderance was noted. Hypertension, diabetes mellitus, and cardiac failure were significant predisposing factors for AKI in elderly patients. Vomiting, fever, and oliguria were the most common presenting symptoms, followed by anuria and atypical presentations such as convulsions and altered sensorium. Sepsis was the most common cause of AKI, followed by obstructive uropathy. In cases of sepsis, the most common sources of infection were urosepsis and pneumonia in elderly patients. These findings highlight the importance of early detection and aggressive management of sepsis and its associated complications to reduce mortality in elderly patients with AKI. Acute gastroenteritis and tropical acute febrile illness (AFI) remain significant challenges in our country, with malaria being the most common tropical infection causing AKI. The most common type of AKI in our study was pre-renal, followed by renal and post-renal AKI. Most patients presented with stage 3 (failure) according to KDIGO criteria, but KDIGO staging could not predict outcomes due to the majority of patients having multi-system failure. Common complications of AKI include hypocalcemia, metabolic acidosis, hyperkalemia, volume overload, and uremic encephalopathy. The mortality rate during the study period was observed to be 27.72%.

Declarations

Human subjects

Consent for treatment and open access publication was obtained or waived by all participants in this study. Seth GSMC and KEM Hospital, Mumbai issued approval EC/82/2015. The IEC-II hereby approves the proposal entitled Protocol version no. 1.2 "Clinical profile, biochemical parameters and outcome of Acute Kidney Injury in elderly patients".

Animal subjects

All authors have confirmed that this study did not involve animal subjects or tissue.

Conflicts of interest

None

Finding Statement

All authors have declared that no financial support was received from any organization for the submitted work.

Financial relationships

All authors have declared that they have no financial relationships at present or within the previous three years 9 of 10 with any organizations that might have an interest in the submitted work.

Other relationships

All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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