

ORIGINAL ARTICLE

Clinical Acute Kidney Injury (AKI) in the Elderly: A Cross Sectional Study at a Tertiary Care Hospital in Western India

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ABSTRACT

BACKGROUND AND OBJECTIVES: Acute kidney injury (AKI) is a dramatic and potentially lethal syndrome often seen by nephrologists. Elderly patients are more prone to develop acute kidney injury, due to a greater incidence of systemic illnesses. A total of 100 patients with acute kidney injury (AKI) were studied. **METHODS:** AKI was clinically diagnosed when serum creatinine concentration increased to more than 265 µmol/l acutely, with or without oliguria. Oliguria was defined as a urine output of less than 500 ml/24 h. All the patients were subjected to investigations which included hematological profile, blood urea nitrogen, serum creatinine and serum electrolyte estimation, urine examination with urinary indices and ultrasonography of the kidneys. **RESULTS:** Drugs and sepsis were the predominant causes of medical AKI in the geriatric patients. Of all the causes of geriatric AKI, which included both medical and surgical, nephrotoxic drugs either alone or in combination with other predisposing factors were the cause in a majority of cases. Recovery from AKI, as evidenced by normalization of serum creatinine, was delayed in the elderly as compared to the younger patients (32.0 versus 11.4 days, $P < 0.001$). Mortality was found to be higher in the elderly as compared to the younger patients. **CONCLUSION:** Nephrotoxic drugs (aminoglycoside antibiotics and non-steroidal anti-inflammatory), sepsis and prostate-related causes were the important factors for AKI in the elderly. It is therefore suggested that nephrotoxic drugs should be used with great deal of caution in elderly patients. Geriatric AKI takes a longer time to recover.

Keywords: Acute Kidney Injury, Nephrotoxic Drugs, Prostate, Sepsis

INTRODUCTION

Acute kidney injury (AKI) is a dramatic and potentially lethal syndrome often seen by nephrologists. Elderly patients are more prone to develop acute kidney injury, due to a greater incidence of systemic illnesses. Amongst the systemic illnesses, hypertension, cardiac insufficiency, arteriosclerosis, diabetes mellitus, multiple myeloma, benign hyperplasia of prostate, and urinary tract infection all predispose to development of acute kidney injury in certain situations.

The likelihood of developing AKI is even greater if additional risks such as fluid deprivation or investigations with contrast media are required in patients with these systemic diseases.¹ There are a few studies available regarding geriatric AKI. There are conflicting reports regarding the course and prognosis of AKI in the geriatric age group.²⁻⁴ Though a different course of AKI is expected in this age group, a clear picture has not emerged. We have analyzed the etiology, course, and prognosis of AKI in the elderly patients and compared it with AKI in younger patients seen during the same time period.

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MATERIALS AND METHODS

All patients of AKI admitted or referred to our tertiary care referral hospital during the period January 2017 to December 2017 were included in the study. Patients less than 12 years of age with past history of renal disease and those of acute on chronic renal failure were excluded. The study

group thus comprised 100 patients, who had been divided into two groups: group A, geriatric patients (n = 30), i.e. age more than 60 years, and Group B, younger patients (n = 70) with age ranging between 13 and 60 years. AKI was clinically diagnosed when serum creatinine concentration increased to more than 265 $\mu\text{mol/l}$ acutely, with or without oliguria. Oliguria was defined as a urine output of less than 500 ml/24 h. All the patients were subjected to investigations which included hematological profile, blood urea nitrogen, serum creatinine and serum electrolyte estimation, urine examination with urinary indices and ultrasonography of the kidneys. The management of the patients included correction of fluid and electrolyte imbalance, treatment of infection episodes with appropriate antibiotics, and dialytic support in the form of hemodialysis whenever needed. No specific therapy in the form of dopamine or calcium-channel blockers were given in any patients. Sepsis was considered to be present when there was positive blood culture in the clinical setting of fever. Hypotension was defined as systolic blood pressure less than 80 mmHg. Both geriatric and young AKI patients were compared for the underlying etiology, the severity as evidenced by the peak serum creatinine concentration and the need for dialytic support, duration of AKI, i.e. time taken for the serum creatinine to return to normal, complications, and outcome. Baseline renal function was not available in all patients but return of renal function to normal after recovery was considered to substantiate the diagnosis of acute kidney injury. Statistical analysis was by unpaired Student's *t* test and chi-square test. The values are given as mean \pm SD. A *P*-value less than 0.05 was considered as significant.

RESULT AND DISCUSSION

The mean age of geriatric patients and younger patients was 67.1 ± 7.5 years and 32.3 ± 12.4 years respectively (Table 1). Amongst the 30 geriatric patients, 16 developed AKI due to surgical causes

while in there remaining 14 patients, AKI was due to medical reasons. Amongst the medical causes of geriatric AKI, drugs and sepsis were the predominant causative factors present in 12 of 14 cases (85.7%) while in younger patients' gastroenteritis was the leading cause (Table 2). Various complications that predisposed to postoperative AKI in the geriatric patients were nephrotoxic drugs, sepsis and hypotension either alone or in different combinations. Sepsis and the use of nephrotoxic drugs was responsible for AKI in six patients, in three a combination of drugs and hypotension was responsible, while in two cases hypotension and sepsis individually led to AKI. In one patient all the three, i.e. sepsis, drugs, and hypotension, contributed to development of AKI. Only four of 30 patients were on calcium channel blockers, given for treatment of hypertension prior to development of AKI. Of all the causes of geriatric AKI, including both medical and surgical causes, nephrotoxic drugs either alone or in combination with other predisposing factors were the cause in as many as 22 patients. The combination of amino glycosides and non-steroidal anti-inflammatory drugs contributed to AKI in 8 patients (26.67%), while non-steroidal anti-inflammatory drugs alone, amino glycosides alone and radio contrast agent in two cases each were the causes of AKI. The comparison of the duration and the severity of AKI, complications and mortality in two groups of patients is depicted in Table 1. The number of geriatric patients requiring hemodialysis was less than the younger AKI patients (50.00% versus 91.42%). Mean duration of dialytic support was significantly longer in geriatric patients (34.0 h with 95% confidence intervals as 31.3—36.7 h), as compared to the younger patients (22.0 h with 95% confidence limits as 19.84-24.16 h). Also, the time taken for normalization of serum creatinine was significantly longer in geriatric patients (32 days, with 95% confidence limits as 28.6-35.4 days), as compared to younger patients (11.4 days

Table 1: Comparison of clinical characteristics of two groups

Clinical characteristics	Geriatric (n=30)	Younger (n=70)	p Value
Age (years)	67.1 ± 7.5	32.3 ± 10.3	0.0345
Sex (M: F)	7:1	3:1	0.0289
Oliguric renal failure	20 (66.67%)	63 (90.0%)	0.0091
Peak serum creatinine (µmol/lit)	607.2 ± 369.6	862.4 ± 484	0.0085
Patients requiring dialytic support	15 (50%)	64 (91.42%)	0.0012
Duration of dialysis (hours)	34.0 ± 8.4	22 ± 10.8	0.0056
Time taken for normalization of serum creatinine (days)	32 ± 10.6	11.4 ± 9	0.0569
Mortality	4 (13.33%)	3 (04.28%)	N/A

Table 2: Comparison of medical causes of AKI

Cause	Geriatric (n=30)	Younger (n=70)
Drugs	02 (06.67%)	N/A
Drugs + Sepsis	08 (26.67%)	01 (01.42%)
Contrast agent	02 (06.67%)	01 (01.42%)
Gastroenteritis	02 (06.67%)	27 (38.57%)
Acute postinfectious glomerulonephritis	N/A	08 (11.42%)
Lupus nephritis	N/A	02 (02.85%)
Sepsis	N/A	05 (07.14%)

with 95% confidence limits as 9.6-13.2 days). This was despite low mean peak serum creatinine in the elderly (607.2 µmol/l with 95% confidence limits as 492.9-721.4 µmol/l) than in the younger AKI patients (862.4 µmol/l 95% confidence limits as 765.6-959.2 µmol/l). Renal biopsies were undertaken in 32 patients in the younger group. None of the patients in the elderly group had renal biopsy, as renal function returned to normal in all the surviving patients. The biopsy showed acute tubular necrosis in 20, acute Glomerulonephritis in eight, diffuse proliferative lupus nephritis in two, lymphoma in one, acute cortical necrosis in one of 20 acute tubular necrosis patients, two were associated with *Plasmodium falciparum* infection, two with paroxysmal nocturnal hemoglobinuria, one was due to acute pancreatitis and 15 to gastroenteritis. The mortality in geriatric patients was greater as compared to younger patients (13.33% versus 04.28%). Mortality in geriatric patients was attributed to septicemic shock and myocardial infarction in two cases each, while in younger group, one patient died of acute

pancreatitis with AKI, one patient of septicemia with AKI, and one of systemic lupus erythematosus with renal and cerebral involvement. The term old age (geriatric) generally refers to people aged 65 or more.¹ The elderly is more prone to develop prerenal AKI due to dehydration because of diminished fluid intake and impairment of the ageing kidney to conserve sodium and water. The resultant pre-renal azotemia, if not taken care of, progresses to established AKI.⁶ Dehydration accounts for 23%⁷ to 50%⁴ of reversible or irreversible AKI in the elderly. In the present series dehydration alone was the cause in only 5% of cases. This, however, may not reflect the true incidence of AKI due to volume depletion, as the majority of our patients were referred from primary and secondary health care centers where fluid depletion had already been taken care of reduced intravascular volume due to significant gastrointestinal fluid and electrolyte losses in patients with bacillary dysentery, cholera, and viral gastroenteritis has been reported as a leading cause of AKI in the tropics⁸. This has been our experience

also in the younger patients. Poor socioeconomic conditions, lack of a clean pipe-borne water supply, ignorance about personal hygiene, overcrowding, and inadequate medical facilities are some of the myriad factors implicated for the wide prevalence of diarrheal diseases in third world countries⁹. Surgical cause has been attributed to 10.5-38% of total geriatric AKI^{1,10}. Prostatic enlargement has been shown to be an important cause of AKI. Urinary tract obstruction due to prostatism may present in elderly males in a clinically occult manner owing to decreased bladder sensation masking the symptoms¹¹. Prostate-related causes, i.e. benign hypertrophy of prostate, carcinoma of prostate, and prostate surgery were the commonest surgical causes of AKI in this study. More often than not the factor responsible for AKI in a particular individual are a varying combination of dehydration, hypotension, infection and nephrotoxic drugs¹. The results of this study also show that sepsis, drugs and hypotension indifferent combinations are the predisposing factors in postoperative AKI. There is a decline in glomerular filtration rate (GFR) and renal blood flow with age. Serum creatinine may remain within the normal range despite a 40% reduction of total GFR, more so in the elderly¹². Thus, the usual method of employing serum creatinine as a crude index of renal function to guide drug dosage leads to a greater incidence of AKI in the elderly⁶. This aspect has also been observed in the present study where nephrotoxic drugs (aminoglycosides and nonsteroidal anti-inflammatory), either alone or in combination with other factors, were responsible for more than 50% of AKI. This also accounted for a higher percentage of non-oliguric AKI in the geriatric patients in comparison to the younger AKI. During a 4-year period, Fleury *et al.*¹³ found 27.4% of 146 cases of AKI to be due to drugs. Makdassiet *al.*¹⁴ found a combination of drugs like aminoglycosides, non-steroidal anti-inflammatory agents, and ACE inhibitors

as common drugs responsible for AKI. Bridoux *et al.*¹⁵ found a high incidence of AKI due to a combination of ACE inhibitors and diuretics in older patients without any evidence of renal artery stenosis, and recommend caution while prescribing this combination in older patients. Recovery of AKI took longer in the elderly as compared to the young. Arteriosclerotic changes in the vessels have been shown to be associated with delayed renal recovery from AKI.¹⁶ The influence of age is regarded by some as a negative factor in the outcome of AKI, while others believe that it is not the age as such but rather the etiology and presence of systemic diseases that govern the prognosis.⁴ In the present study mortality in the elderly was greater though the difference was not statistically significant. The cause of death in two cases in the geriatric group was coronary artery disease and not AKI. Low complication rate and low mortality in the present study could be due to less severe underlying causes of AKI.

CONCLUSION

Nephrotoxic drugs (aminoglycoside antibiotics and non-steroidal anti-inflammatory), sepsis and prostate-related causes were the important factors for AKI in the elderly. It is therefore suggested that nephrotoxic drugs should be used with great deal of caution in elderly patients. Geriatric AKI takes a longer time to recover. Thus, these patients need to be taken care of for longer periods of time both for dialysis or otherwise. The prognosis and outcome of geriatric patients is not much different from their younger counterparts so they deserve the same vigorous therapy as would any AKI patient.

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