

Clinical Profile and Outcome of Acute Kidney Injury in Elderly Adults in a Tertiary Hospital in Cameroon

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Abstract

Background: Elderly patients have a high risk of acute Kidney Injury (AKI) due to aging, decreased renal function and the presence of comorbidities. There is limited data on AKI in elderly patients in low income regions, especially in Sub-Saharan Africa. We therefore sought to describe the clinical profile and outcome of AKI in elderly in a tertiary hospital in Cameroon. **Methods and Materials:** We reviewed the medical records of all patients admitted with the diagnosis of AKI in the internal medicine unit of the Yaounde University Teaching Hospital, from January 2015 to February 2018. Records of elderly patients (≥ 65 years) were retrieved and analysed. AKI was diagnosed and classified using the KDIGO (Kidney Disease Improving Global Outcomes) 2012 classification. The diagnosis, aetiologies and mechanisms of AKI were clinical. Renal outcomes were evaluated on day 7, 14, 28, 60 and 90 of hospital stay. **Results:** We included 76 elderly (66% males) patients with a median [interquartile rate—IQR] age of 69 [65 - 75] years. Hypertension (60.5%), diabetes mellitus (36.8%) and heart failure (26.3%) were the most common comorbidities. The median [IQR] Charlson index was 4 [3 - 5]. Infections (47.4%) and hypovolemia (69.7%) were the most frequent risk factors for AKI. AKI was mainly community acquired (89.5%) and most of the patients were in stage 2 (34.2%) or 3 (29%). Pre-renal AKI (58%) was the leading mechanism involved. Hypovolemia and sepsis were the most common aetiologies. Of the 14.5% with indication for dialysis, only 2.6% had access to it. The overall prognosis was good with a mortality rate of 2.6%, complete and partial renal recovery at 3 months of 70%, and 26.3% respectively. **Conclu-**

sion: AKI in the elderly, in our setting was community-acquired and affected mainly those with comorbidities. Pre-renal AKI was the main mechanism; hypovolemia and sepsis were the major aetiologies. Most participants had complete renal recovery at 3 months.

Keywords

AKI, Elderly, Community Acquired, Hypovolemia, Sepsis

1. Introduction

Acute Kidney Injury (AKI) is an abrupt decline in glomerular filtration rate resulting in accumulation of nitrogenous waste products, hydro-electrolytes imbalance and acid-base disorders. AKI is common, affecting about 13.3 million people worldwide per year [1]. It is also associated with prolonged hospital stay, poor patient outcomes including death and chronic kidney disease [2]. AKI can be due to several conditions such as hypovolemia, sepsis and nephrotoxic drug use. It is encountered in multiple settings and in all age groups. The elderly are more predisposed to developing AKI, either due to kidney senility, or because of high prevalence of comorbidities, which prone them to undergo several procedures, which are also risk factors of AKI [3]. Moreover, in high income regions, high socioeconomic development, increase prosperity and improved medical facilities led to increasing life expectancy, hence an increase in the demand of the elderly population for health service. Thereby, in such countries, AKI mainly affects older patient admitted in intensive care unit with high comorbid burden and usually in a context of multiple organ failure [1]. An analysis of Medicare beneficiaries from 2005 to 2015 in the United States showed that the rate of AKI increases stepwise from 26.8 episodes (66 - 69 years) to 37.4 episodes (70 - 74 years) to 55.4 episodes (75 - 79 years) to 77.1 episodes (80 - 84 years) to 110.5 episodes (85 years and older) per 1000 patient-years, respectively [4]. AKI in the elderly also carries a high risk of both short-term and long-term mortality, while survivors often end up with chronic kidney disease which may progress to end-stage renal disease [3] [4] [5] [6] [7]. The risk of end-stage renal disease may be 13 times higher in hospitalized elderly patients with AKI compared to elderly patients without AKI [7]. An absolute 2-year mortality risk increase of 29% for elderly patients with AKI compared to their elderly counterparts without AKI had also been reported [7]. Furthermore, older patients with AKI experience decreased functional status and impaired quality of life, both contributing to adverse outcomes as well as long term morbi-mortality.

In developing countries, there is scarcity of data on the epidemiology of AKI although it is estimated that 85% of people with AKI live there [1]. In Sub-Saharan Africa, AKI is reported as community-acquired, affecting young healthy people and usually due to preventable conditions such as malaria or diarrheal disease [1] [8] [9]. Mortality is higher ranging from 32% to 86% de-

pending on dialysis accessibility [9]. However, increase in life expectancy has also been noted in these areas. From 1960 to 2018, life expectancy in Sub-Saharan Africa rose from 40 years to 62 years [10]. Meanwhile, a non-neglected proportion of the elderly may experience AKI. As reported by Yao and al, in Ivory Coast [11], mortality among them may be higher compared to younger participants due to environmental setting (inaccessibility to appropriate medical care, reduced capacity to provide intensive care), lack of dialysis facility, financial constraint and comorbid factors. Our aim was to describe the epidemiology of AKI among elderly adults in a tertiary hospital in Cameroon.

2. Methods and Materials

2.1. Study Setting

We conducted a descriptive study from 1st January 2015 to 28th February 2018 at the Yaounde University Teaching Hospital. This health facility is in the political capital of Cameroon and is one of the 6 tertiary health facilities of the country. It is one of the teaching hospitals of the faculty of medicine of the University of Yaounde 1. It consists of many services including internal medicine, surgical, pediatric, gynecological, radiology, laboratory and intensive care units. The nephrology unit is part of the internal medicine service and it is managed by two nephrologists. The dialysis unit is part of the intensive care unit and it is operational daily. Only conventional hemodialysis is available. Polysulfone dialyzers and bicarbonate dialysates are used.

2.2. Participants

We reviewed the medical records of all patients admitted in the internal medicine service during the study period. All records with a diagnosis of AKI were retrieved and analyzed. Record of elderly patients (≥ 65 years) were identified. We excluded records with insufficient data for the diagnosis of AKI and patients with known chronic kidney disease.

3. Methods

We collected socio-demographic, clinical data including comorbidities, diagnosis on admission and hemodynamic parameters from the medical records. Charlson comorbidity index was used to evaluate comorbidity burden. Laboratory parameters such as hemoglobin level, white blood cell count, serum electrolytes were also collected if available. Information about etiology, mechanism and type of AKI, access to dialysis, hospital mortality and renal outcome on day 7, 14, 28, 60 and 90 of AKI diagnosis were also recorded. AKI was diagnosed and classified according to the KDIGO 2012 classification. Diagnosis of etiologies and mechanism of AKI were clinical.

The following definitions were used:

- AKI was defined base on:
 - an increase or a decrease in serum creatinine by ≥ 3 mg/l between 48 hours.

- an increase or decrease of at least 50% of the baseline creatinine (creatinine at admission) during the hospitalization.
- Renal recovery was reported only for survivors at discharge and was defined as.
- Complete renal recovery in case of normalization of serum creatinine within 90 days.
- Partial recovery in case of persistence of renal failure without need of dialysis in those who were receiving dialysis or decrease of at least 25% of serum creatinine.
- Pre-renal AKI was diagnosed based on history, signs of hypovolemia with urine dipstick gravity ≥ 1020 , serum urea and creatinine ratio of more than 20, urine indices when available and normalization of renal function with volume expansion.
- Acute tubular necrosis was diagnosed based on history, presence of risk factors, urinary dipstick gravity < 1015 , urine indices when available and recovery with a polyuric phase.
- Acute interstitial nephritis was defined based on history, presence of risk factor, sterile leucocyturia and enlarged kidney.
- Post-renal AKI was defined as AKI associated with decreased urine output, urinary tract dilation on renal ultrasonography and improved renal function after removal of urinary obstruction.
- Drug induced AKI was diagnosed based on a history of ingestion of a known nephrotoxic drug (NSAID: Non-Steroidal Anti-inflammatory drug, blockers of the RAAS: renin-angiotensin-aldosterone system, Cisplatin, aminoglycoside, iodine contrast) or herbal remedies.
- Sepsis induced AKI was used for patients with clinical diagnosis of sepsis or severe infection together with white blood cell count $\geq 12,000/\text{mm}^3$ and a blank urinary dipstick.
- Need of dialysis referred to patients with indications for dialysis.
- Access to dialysis referred to those who actually benefited from dialysis after the indication was made.
- Sepsis was defined as the presence of a proven or suspected microbial infection in the presence of at least two of the following criteria:
 - Temperature $>38^\circ\text{C}$ or $<36^\circ\text{C}$.
 - Pulse rate >90 beats/minute.
 - Respiratory rate >24 cycles/minute.
 - White cell count $>12,000$ cells/ mm^3 or <4000 cells/ mm^3 .
- Anemia was considered for Hemoglobin level <10 g/dl.
- Very elderly patients referred to patients of 80 years of age and above.

Statistical analysis and ethical considerations:

Data was analyzed using SPSS version 22.0. Continuous data were summarized as means or median as appropriate, while qualitative data were presented as percentages. Chi-square and Student test were used to compare data among

age groups. A statistical significance was set at a p-value < 0.05.

The study was approved by the Ethical Committee for research of the Faculty of Medicine and Biomedical Sciences of Yaounde. All ethical principles were respected.

4. Results

During the study period, 85 elderly patients were identified among 194 medical records found with the diagnosis of AKI. Nine patients were excluded because of known CKD or insufficient data to discriminate AKI from CKD. Hence, a total of 76 elderly patients were included with 66% (n = 50) being males. The median [IQR] age was 69 [65 - 75] years with extremes of 65 to 87 years; 50% (n = 38) were between 65 to 69 years and 14.5% (n = 11) were very elderly. Hypertension (60.5%) and diabetes mellitus (36.8%) were the main comorbidities. Heart failure was more common in very elderly (≥ 80 years: 63.6%; p = 0.003). Charlson index ranging from 0 to 8, was comparable between age groups (65 to 69 years = 4.31 ± 2.6 ; 70 to 79 years = 4.22 ± 1.8 ; ≥ 80 years 5.7 ± 1.5 ; p = 0.06). Infectious conditions were the main reasons for admission. Decreased urine output was reported in 15.8% (n = 12) of participants, **Table 1**.

Twenty-five (33%) patients had hypotension on admission (65 to 69 years = 26.3% n = 10; 70 to 79 years = 33.4% n = 9, ≥ 80 years 54.5% n = 6; p = 0.6). Out of the 11 patients with available serum bicarbonate levels, 8 had metabolic acidosis. The mean serum potassium was 4.6 ± 1.2 mmol/l, **Table 2**.

AKI was mainly community-acquired (n = 66, 87%) and stage 3 was found in 36.8% of patients. Most of the patients had pre-renal AKI (n = 44, 58%) while 17.1% (n = 13) had acute tubular necrosis. Pre-renal AKI was more common among very elderly (72.7%, n = 8) and intrinsic AKI was more common in the elderly <70 years (50%, n = 19). Hypovolemia and malignant hypertension were the main causes of AKI in very elderly patients. In younger patients, AKI was mainly due to hypovolemia, sepsis and nephrotoxic drugs, **Table 3**.

Dialysis was indicated in 11 (14.5%) patients. Dialysis indication was similar among age group (65 - 69 years 10.5% n = 5; 70 - 79 years 18.6% n = 5; ≥ 80 years 9.1% n = 1; p = 0.8). Hyperkalemia was the main indication for dialysis. Among the 11 patients with indications, only 2 patients had access to dialysis. Age and hypotension were the main reason of non-access to dialysis, **Table 4**.

Two deaths (2.6%), due to septic choc, were registered during hospital stay. One patient left against medical advice within the 7 days of hospital stay. Amongst survivors, 51 patients (70%) had a complete renal recovery, 20 patients (27.3%) had partial renal recovery and 2 patients (2.7%) had no renal recovery, **Figure 1**. Among patients with complete follow up data available after 3 months, 8 (11%) developed chronic kidney disease). Outcome was comparable among age group, **Table 5**.

5. Discussion

AKI in low income countries usually affects young people with less comorbid

Table 1. Socio-demographic data, comorbidity and clinical data.

VARIABLES	TOTAL (%) N = 76	65 - 69 years (%) n = 38	70 - 79 years (%) n = 27	≥80 years (%) n = 11	p-Value
Sex					
Male	50 (66)	23 (60.5)	22 (81.5)	5 (45.5)	0.06
female	26 (34)	15 (39.5)	5 (18.5)	6 (54.5)	
Marital status					
Married	61 (80.3)	35 (92.2)	21 (77.8)	5 (45.5)	0.005
Divorced/Widowed	15 (19.7)	3 (7.8)	6 (22.2)	6 (54.5)	
Comorbidity					
Hypertension	46 (60.5)	22 (57.9)	19 (70.4)	5 (45.5)	0.32
Diabetes	28 (36.8)	16 (42.1)	8 (29.6)	4 (36.4)	0.58
Heart failure	20 (26.3)	5 (13.1)	8 (29.6)	7 (63.6)	0.003
HIV	06 (7.9)	6 (17.8)	-	-	0.038
Cancer	03 (3.9)	2 (5.2)	2 (7.4)	-	0.7
Charlson index > 3	45 (59.2)	16 (50)	18 (66.7)	11 (100)	0.32
Reason of admission					
Infectious conditions (n = 33)					0.8
<i>Urinary tract infection</i>	7 (9.2)	4 (10.5)	3 (11.1)	-	
<i>Pneumonia</i>	5 (6.6)	3 (7.9)	2 (10.4)	-	
<i>Gastro-enteritis</i>	4 (5.3)	2 (5.3)	1 (3.7)	1 (9.1)	
<i>Diabetic food</i>	3 (3.9)	2 (5.3)	1 (3.7)	0	
<i>Unspecified sepsis</i>	14 (18.4)	6 (15.8)	7 (25.9)	1 (9.1)	
Diabetes decompensation	11 (14.5)	5(13.1)	6 (22.2)	-	0.3
Hypertensive crisis	5 (6.8)	3 (7.9)	-	2 (18.2)	
Cancer*	03 (3.9)	2(5.2)	1 (3.7)	-	
Decompensated heart failure	03 (3.9)	-	1 (3.7)	2 (18.2)	
Unspecified	21 (27.6)	11 (29)	7 (26)	5 (45.5)	
Clinical signs					
Uremic sign	17 (22.4)	8 (21)	7 (26)	2 (18.2)	0.18
Fluid retention	14 (18.4)	7 (18.4)	4 (14.8)	3 (27.2)	0.66
Decrease urine output	12 (15.8)	5 (13.1)	3 (11.2)	4 (36.4)	0.12
Dyspnea	6 (7.9)	3 (7.9)	2 (7.4)	2 (18.2)	0.65

*Cancer included prostate cancer (n = 2) and cervix cancer (n = 1).

factors while older population are typically found in developed countries [12] [13]. However, we found a significant proportion of elderly (41%) among patient admitted with AKI in our setting. AKI in elderly has been described in other Cameroonian studies with a frequency of 20% - 30% of patient older than 60 years [12] [13]. Yao *et al.*, in Ivory Coast also noted a significant proportion of

Table 2. Blood pressure and laboratory data.

VARIABLES	Total (%) N = 76	65 - 69 years (%) n = 38	70 - 79 years (%) n = 27	≥80 years (%) N = 11	p- value
Systolic blood pressure (mmHg)	130 ± 30	134 ± 30	131 ± 30	114 ± 27	0.15
Diastolic blood pressure (mmHg)	76 ± 16	77 ± 15	76 ± 16	69 ± 18	0.35
White blood cell (cell/mm ³)	9155 ± 4700	9460 ± 5350	9496 ± 3890	7191 ± 4495	0.38
Hemoglobin level (g/dl)	10.8 ± 2.4	10.64 ± 2.8	10.8 ± 1.9	11.13 ± 2.57	0.86
Sodium	138.3 ± 7.45	137.4 ± 6	138 ± 8.6	143.7 ± 7	0.12
Potassium	4.6 ± 1.2	4.4 ± 1	4.7 ± 1.4	4.8 ± 1.3	0.51

Table 3. AKI characteristics according to age.

VARIABLES	TOTAL (%) N = 76	65 - 69 years (%) n = 38	70 - 79 years (%) n = 27	≥80 years (%) n = 11	p
Type of AKI					0.9
Community-acquired	66 (87)	33 (87)	23 (82)	10 (91)	
Hospital-acquired	10 (13)	5 (13)	4 (18)	1 (9)	
Stage of AKI					0.45
Stage 1	26 (34.2)	16 (42.2)	8 (29.6)	2 (18.2)	
Stage 2	22 (29)	8 (21)	10 (37.1)	4 (36.3)	
Stage 3	28 (36.8)	14 (36.8)	9 (33.3)	5 (45.5)	
Supposed mechanism					0.39
Pre-renal AKI	44 (58)	18 (47.4)	18 (66.7)	8 (72.7)	0.17
Post-renal AKI*	2 (2.6)	1 (2.6)	1 (3.7)	0	0.84
Renal AKI	30 (39.4)	19 (50)	8 (29.6)	3 (27.3)	0.17
Type of renal AKI (n = 30)					
Acute tubular necrosis	13 (17.1)	8 (21)	4 (14.8)	1 (9.1)	0.6
Vascular AKI	5 (6.5)	3 (8)	-	2 (18.2)	0.11
Unknown	12 (15.8)	8 (21)	4 (14.8)	-	0.24
Etiologies of AKI					
Hypovolemia*	32 (42.1)	17 (44.7)	9 (33.3)	6 (54.6)	0.7
Sepsis**	22 (29)	11 (29)	10 (37)	1 (9)	0.23
Toxic***	11 (14.5)	5 (13.1)	6 (21.4)	-	0.2
Malignant Hypertension	3 (3.9)	1 (2.6)	-	2 (18.2)	0.028
Cancer****	2 (2.6)	1 (2.6)	1 (3.7)	-	0.84
Unknown	6 (7.9)	3 (7.9)	1 (3.7)	2 (18.2)	0.3

*Hypovolemia included vomiting (n = 9), diarrhea (n = 6), polyuria due to diabetic decompensation (n = 11), decompensated heart failure (n = 3), septic choc (n = 3); **sepsis included pneumonia (n = 5), urinary infection (n = 5), unspecified (n = 12); ***Nephrotoxic drugs = aminoglycoside (n = 5), non-steroidal anti-inflammatory drugs (n = 3) and herbal remedies (n = 3); ****Cancer = 1 cervical and 1 prostate cancer.

Table 4. Dialysis indication and accessibility.

Variable	TOTAL (%) n = 11	65 - 69 years (%) n = 5	70 - 79 years (%) n = 5	≥80 years (%) n = 1
Indication of dialysis				
Hyperkalemia	6 (54.6)	2 (40)	3 (60)	1 (100)
Metabolic acidosis	3 (27.3)	1 (20)	2 (40)	-
Uremic sign	3 (27.3)	1 (20)	2 (40)	-
Fluid retention	3 (27.3)	3 (60)	-	-
Effective dialysis				
Yes	2 (18.2)	1 (20)	1 (20)	0
Reason of non-dialysis				
Age-related	5 (45.4)	1 (20)	3 (60)	1 (100)
Severe hypotension	1 (9.1)	1 (20)	-	-
Not specified	1 (9.1)	1 (20)	-	-
Death	2 (18.2)	1 (20)	1 (20)	-

Table 5. Outcome according to age group.

	65 - 69 years (%) n = 38	79 - 79 years (%) n = 27	≥ 80 years (%) n = 11	P
Complete renal recovery	27 (71)	16 (59.2)	8 (72.7)	
Partial renal recovery	9 (23.8)	9 (33.4)	3 (27.3)	0.9
No recovery	1 (2.6)	1 (3.7)	-	
Death	1 (2.6)	1 (3.7)	-	

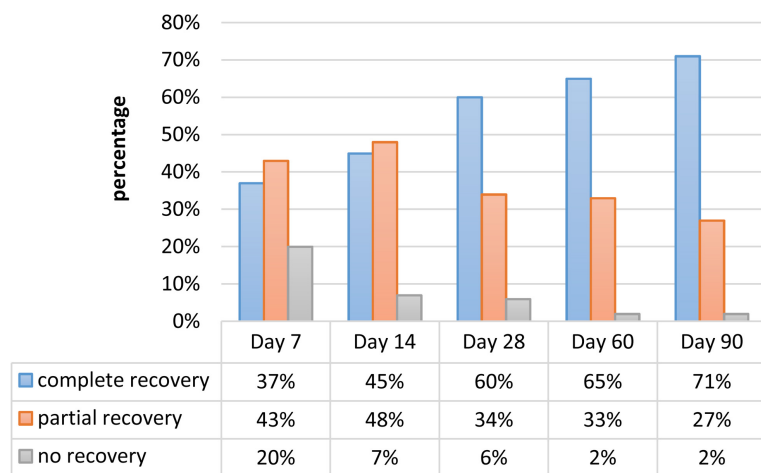


Figure 1. Overall renal outcome among survivors (n = 73).

the elderly with AKI [11]. This data reflects the increase in life expectancy and the susceptibility of aging kidney to AKI.

As described in the literature [12] [13] [14] comorbid burden was high in our

population, especially among very elderly patients. As noted in our study, hypertension, diabetes and cardiac disease were the main comorbidities reported [11] [14] [15] [16] [17] [18] and are all associated with renal vasculature damage and compromised renal perfusion. The need of angiotensin blockers, which interfere with glomerular filtration, is also frequent in these pathologies. All these may contribute to increase risk of AKI in the elderly population.

Community-acquired AKI was the most frequent type of AKI. Mahesh *et al.*, in India and Selmy *et al.*, in Tunisia [17] [18] also found a high rate of community-acquired AKI (94%) in the elderly with AKI. This is contrary to the findings in high income countries, where, AKI in the elderly is mainly hospital-acquired and occurred during intensive care unit stay or after major surgery [12].

AKI in our setting was severe, with most of the patients in stage 2 or 3. Similar findings had been noted by previous reports in nephrology units of low income countries [11] [15] [16] [17] [18]. Since AKI stage 1 is usually asymptomatic, those patients are generally managed by non-nephrologists and only severe cases are referred. Monitoring of urine output and routine measurements of serum creatinine could help for early detection of AKI and hence early management.

Hypovolemia and sepsis were the main aetiologies of AKI in our population. Pre-renal AKI was common and ATN was noted in 17.1% of patients. Hypovolemia and sepsis are the most common aetiologies reported in the elderly with AKI in high income as well as low income regions [11] [15]-[20] as senile kidney may be more susceptible to hypoperfusion. Experimental studies showed that older rats experience more severe kidney damage during ischemia and reperfusion manoeuvres as a result of reduced antioxidant levels and higher oxidative stress than in the kidneys of their younger counterparts [21]. Other physiologic changes noted in the aging kidney are the loss of urinary concentrating and diluting ability, diminished sodium conservation, decreased plasma renin and aldosterone levels, decreased prostaglandin production, and an enhanced response to vasoconstrictive stimuli [22]. These changes result in reduced capacity to retain salt and water thereby increasing the propensity of the elderly to develop volume depletion and dehydration.

Nephrotoxic AKI was observed in 14.5% of the elderly and was mainly due to use of aminoglycoside and herbal remedies. Nephrotoxicity is linked to 10% - 20% of AKI in Cameroonian studies [14] [15] [23]. However, Yao *et al.*, found a lower frequency of nephrotoxic AKI in the elderly (2.8% vs 17%) compared to young adults [11]. Nephrotoxic AKI had a prevalence ranging from 3% to 7% among the elderly, as reported by other authors [17] [20].

Dialysis indication was low in our population (14.5%, n = 11) as pre-renal AKI was the main mechanism of AKI. However, only 2 (18.2%) patients had access to dialysis. Advanced age was the main reason for not doing dialysis. The initiation of renal replacement therapy in AKI is challenging and faces many controversies including time of initiation, methods use, or dose prescribed. In the elderly, the decision is more complex, since life expectancy and quality of life

should be integrated into the treatment plan. Among patients who did not access dialysis, 2 patients died; both had sepsis and multiple comorbidities. After the 3 months follow up, 3 patients had complete remission while 4 had partial remission.

AKI in the elderly is generally reported as having a poor prognosis with increased risk of chronic kidney impairment and long-term mortality [7]. Although complete renal recovery was common in our setting; 30% of patients had partial or no renal recovery after 3 months. Eleven percent of our population developed chronic kidney disease. Yao *et al.*, reported that 62.8% of the elderly with AKI did not normalize their kidney function after 3 months. One meta-analysis on renal recovery after AKI in the elderly revealed that 31% of the elderly failed to recover their renal function after an episode of AKI [24].

6. Limitation

As we conducted a retrospective study, our main limitation was selection bias. It would have been better to make a multicentre study to have the real epidemiology of AKI in the elderly in Cameroon.

7. Conclusion

The elderly with AKI are frequent in our setting. As reported in young adults, AKI is mainly community-acquired and diagnosed at advanced stages. Hypovolemia and sepsis are the leading aetiologies and pre-renal AKI is the main mechanism involved. Decision for dialysis is influenced by age especially among patients of 70 years and above. Some degree of renal impairment was recorded in 30% of the elderly after 3 months of AKI.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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