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Original Article

Spectrum of Acute Kidney Injury in a Nephrology Unit

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Abstract

Background: To identify etiologic factors causing acute kidney injury (AKI) in our local population that were admitted to tertiary care nephrology unit over one year duration.

Methods: In this prospective cohort study adult patients with elevated serum creatinine, evaluated at least twice,were included. Workup for glomerulonephritis included complements levels, ANA, Anti dsDNA, ANCA,AntiGBM, SPEP. Renal biopsy was performed for suspected RPGN/Vasculitis, AIN, unexplained AKI.Renal replacement therapy was initiated for standard indications. Decreased renal perfusion was diagnosed when blood pressure was less than 90/60 mmHg, signs of volume depletion and severe cardiac failure. Urine output less than 400ml/day was taken as oliguria. The AKI definition and diagnosis was based on RILFE criteria ,i.e, an abrupt (1 to 7 days) and sustained (more than 24 hours) decrease in kidney function.

Results: Majority (62%) were male. Majority of the patients (87.1%) were in failure category. Infection/sepsis was the most common etiology (44.6 %), followed by drugs (10.5%),gastroenteritis (10.2%),surgical cases (8.8%) and obstructive nephropathy (7.5 %). Mortality was 39.1%, reflecting critical condition and markedly deranged renal function.

Conclusion: AKI is a major public health challenge. It is associated with high morbidity and mortality. Infection/sepsis is the predominant etiological factor causing AKI in our patients. Combating infections/communicable diseases is crucial in preventing AKI .

Key Words: Acute Kidney Injury(AKI), Community acquired acute kidney injury (CAAKI), RILFE criteria .

Introduction

AKI is a universal medical issue with high morbidity and mortality. [1] AKI is associated with significantly increased morbidity, mortality, length of stay, and costs. [2,3.] Statistics have shown the global burden of AKI up to 13.3 million cases per year, 11.3 million of which are in low to middle income countries and is responsible for up to 1.4 million deaths per year. AKI accounts for up to 3% of hospital admissions in developing countries.[4] There is progressive increase in incidence of dialysis requiring AKI as well as non-dialysis requiring AKI.[5-8] Epidemiology of AKI differs significantly between high resource countries and low and middle income countries in the western hemisphere where education and training programs can increase the public awareness, improve preventive strategies and management to improve outcomes.[9] The prevalence, morbidity and mortality due to sepsis related AKI is very high in underdeveloped countries.[10] AKI has a major economic impact on healthcare costs in developing countries as it mostly affects young productive people causing severe financial hardship.[11] Despite higher prevalence of AKI in low income countries very limited data is available from them.[12] Community acquired acute kidney injury (CAAKI) is a major problem in developing countries and is markedly different from AKI in developed temperate climate countries because tropical diseases/infections are rife in hot and humid climate stricking the already poor and marginalized populations.[13] The International Society of Nephrology set a goal of eliminating preventable deaths from AKI by 2025, implementation of this program in less developed countries poses major challenges because of the lack of resources and scarce data regarding the epidemiology of AKI, the limited facilities to diagnose and treat AKI, and the poor awareness of the impact of AKI on patient outcomes.[1] There is lack of accurate data of AKI in underdeveloped countries like Pakistan because of poor access to efficient medical facilities, poor recognition of the condition, high burden of infections, nephrotoxins including traditional herbal remedies, obstetric complications, natural disasters, late referral, non affordability,as well as poor documentation, underreporting and no central registry compiling national data.

Patients and Methods

In this prospective cohort study , performed in Department of Nephrology , patients with elevated serum creatinine (evaluated twice), were included. Workup for glomerulonephritis included complement levels, ANA, Anti dsDNA, ANCA,AntiGBM, SPEP. Renal biopsy was performed for suspected RPGN/Vasculitis, AIN, unexplained AKI and was sent for histopathology and immunofluoresence. Exclusion criteria were age less than 14 years, clinical, radiological or laboratory evidence of chronic kidney disease (CKD), disparity in renal sizes more than 2 cm, polycystic kidneys, previous history of haemodialysis, renal transplant, end stage renal disease (ESRD) and pregnant females. Decreased renal perfusion was diagnosed when BP was less than 90/60 mmHg, signs of volume depletion, severe cardiac failure. Sepsis was defined as a serious infection plus ≥2 systemic inflammatory response syndrome criteria, including heart rate >90 beats/min, temperature >38.3 or <36°C), tachypnea (>20 breaths/min) or PCO 2 <32 mm Hg, and leukocytosis (white blood cells >12,000 or < 4,000 cells/mm 3 or >10% band forms. Hypertension was defined as blood pressure above 140/90 mmHg. Urine output less than 400ml/day, was taken as oliguria.The AKI definition and diagnosis was based on RILFE criteria; an abrupt (1 to 7 days) and sustained (more than 24 hours) decrease in kidney function. RIFLE criteria consists of three graded levels of injury (Risk, Injury, and Failure based upon either the magnitude of elevation in serum creatinine or urine output reduction (the worst parameter was used to classify), and two outcome measures (Loss and End-stage renal disease). The RIFLE is staged as :Risk – 1.5 fold increase in the serum creatinine or urine output <0.5 mL/kg per hour for six hours;Injury – Twofold increase in the serum creatinine or urine output <0.5 mL/kg per hour for 12 hour;Failure – Threefold increase in the serum creatinine or urine output of <0.3 mL/kg per hour for 24 hours, or anuria for 12 hours.[14] Baseline serum creatinine was calculated using the modification of diet in renal disease MDRD) equation, assuming a baseline glomerular filtration (GFR) of 75 ml/min/1.73m2, as previous baseline renal functions tests were not available. Also creatinine trend in recovery phase helped to determine baseline creatine and helped in confirmation of AKI occurrence.

Results

Total 294 cases with AKI, fulfilling the inclusion criteria were admitted during the study period (one year). Males constituted 62.6%. Renal-AKI accounted for 60.5 %. Infection/sepsis was the most common etiology(44.6 %) (Table 1). Drugs causing AKI were radio contrast agents (6 cases), aminoglycosides (5 cases),chemotherapeutics(4 cases), NSAIDs (3 cases),acyclovir (3 cases), amphotericin (1 case), unknown(traditional herbal) (2 cases). Combination of drugs (NSAIDs, ACE-1/ARBs, diuretics)causing AKI were responsible in 7 patients.

Table 1: Patients demographic and aetiology of ARF

Total number of patients= 294	Frequency	Percent
Age Mean=46.3980; SD=19.49765,Min=13.00,Max=95.00		
< 25 years	60	20.4
25 - 50 years	102	34.7
51 - 75 years	115	39.1
76 y	17	5.8
Gender		
Male	184	62.6
Female	110	37.4
Category		
Prerenal	87	29.6
Intrinsic/renal	178	60.5
Postrenal/Obstruction	22	7.4
Idiopathic	7	2.3
Etiology		
Infection	131	44.6
RPGN/acute GN	14	4.8
Obstructive nephropathy	22	7.5
Envenomation/poisoning	18	6.1
Rhabdomyolysis	5	1.7
TMA	1	.3
Hepatorenal syndrome	9	3.1
Drugs	31	10.5
Blood loss	5	1.7
Surgical	26	8.8
Miscellaneous/idiopathic	32	10.9

Stones were present in 4.0%. Majority patients (87.1%) were in RIFLE 'Failure' category. Total cases of Poisoning /envenomation were 6.1%. Poisoning cases included wheat preservative pill taken as suicidal intent (1.0%),copper sulphate poisoning (0.6 %), methanol poisoning (0.6%).Envenomation included snake bite (3.0%)(Table 2). Altered consciousness

(33.5%) was the commonest clinical presentation (Table 3). Overall Glomerular etiology was found in 4.8% (Table 4). Intermittent haemodialysis was performed in 33.3 %, whereas 9.9% could not be dialyzed because of hemodynamic instability. Conservative management was done in 45.9%. Mortality was 39.1% reflecting critical condition and markedly deranged renal function on admission.

Table 2: Assessment and outcome of patients

Variables total no of patients= 294	Frequency	Percent
RIFLE		
Risk	1	.3
Injury	37	12.6
Failure	256	87.1
Volume		
Hypovolemia	127	43.2
Euvolemic	89	30.3
Fluid overload	78	26.5
Treatment		
Dialysis	98	33.3
Conservative	135	45.9
Not possible	29	9.9
Refused	32	10.9
Length of stay Mean=5.2823, SD=3.80298, Min=1.00, Max= 21.00		
< 7 days	236	80.3
7 - 14 days	43	14.6
15 - 21 days	15	5.1
Outcome		
Expired	115	39.1
Alive	152	51.7
LAMA	27	9.2

Table 3: Sign and Symptoms Frequencies Multiple responses

Symptoms	cases	
	Number	Percent
Fever	76	25.80%
Altered LOC	91	30.90.%
Jaundice	44	14.96%
Hypotension	84	28.57%
Hypertension	45	15.30%
Oligoanuria	150	51.02%
Acidosis	231	78.57%
DIC	112	38.09%
Sepsis	131	44.55%

Table 4: Final Diagnosis Histopathology / renal biopsy (n=25)

Final Diagnosis Histopathology/renal biopsy (n=25)	Frequency	Percentage
Post infectious GN/MPGN	8	2.7%
RPGN/Cresenteric GN	5	1.6%
Collapsing FSGS/HIVAAN	1	0.3%
AIN	3	1.0%
ATN	2	0.6%
Myeloma kidney	2	0.6%
TMA/HUS	1	0.3%
Cholesterol embolism	1	0.3%
Primary lymphoma kidney	1	0.3%
Inconclusive	1	0.3%

Table 5: Acute Kidney Injury-Comparison with other studies

	Current study Chaudhri et al	Osman etal 2012	Reddyetal 2014	Peres et al 2014	Korula et al 2016	Bhadade et al 2016	Halle et al 2017	Mehta et al 2018
Risk	0.3 %	24.2 %	25.3 %	26 %	20.9 %	8.5 %	32.8 %	41.7 %
Injury	12.6 %	27.9 %	27.7 %	28 %	37.4 %	20.2 %	23.9 %	10.0 %
Failure	87.0 %	47.9 %	46.9 %	46 %	41.7 %	71.2 %	43.3 %	48.2 %
Sepsis	44.6 %	44.0 %	19.8 %	32 %	75.5 %	32 %	50.4 %	19.5%
Mortality	39.1 %	31.2 %	30.1 %	35.9 %	49.5 %	51.9 %	36.9 %	12.1 %
Tertiary Care Setting	Nephrology unit	All wards/ICU	ICU	ICU	ICU	ICU	Med Ward/ICU	Nephrology ward/ICU
Total AKI case	294	384	242	81	115	316	536	230

Discussion

In present study RIFLE category "risk" was present in 0.3%, "injury" was present in 12.6%,whereas maximum number fell in "failure" category 87.1%. Studies from India also substantiated these findings. (Table 6).[15-17] Infection/Sepsis is the main contributing factor to AKI. In our study sepsis was the predominant factor for AKI accounting for 44.6%,whereas in studies from neighboring India it was present in it ranges from 20.6% to 75.5% . [16-22] Studies from African countries showed sepsis in a range from 34.6 to 50%. [23-29] From Pakistan Rabbani et al reported sepsis in 25.4% patients with acute kidney injury . [30] In present study acute febrile illness was seen mainly in July to October (summer/monsoon season). The establishment of etiological diagnosis was difficult in these cases . Present study showed drugs to be responsible in 10.5 % whereas other studies showed variable statistics, i.e., from 2,.1% to 12.4%.[21,22,25, 26,28, 31,32] In our study pre-renal AKI accounted for 29.6 % cases, Renal-AKI 60.5 % and post-renal AKI was present in 8.2 % and idiopathic 2.3 %. Another study from Pakistan, reported pre-renal AKI to be present in 70 %, renal-AKI in 22 % and post-renal in 8%.[30] In present study mortality was around 39.1 %. Other studies showed mortality from 8.7% to 36.9%. [16,17, 19,20, 24-26,30,33,34] Another study from Pakistan reported mortality of 34.0 % .[30]

In present study it was observed that our patients had high mortality because they had severe AKI on presentation. Multiple factors like initially seeking alternative remedies and fallacies, poverty, lack of awareness, poor recognition of the condition, high cost of medical treatment, also play a role. Long distance from tertiary care hospitals, late presentation and late referrals, poor acceptability and limited availability for hemodialysis, high turnover of patients in public hospitals, inadequate laboratory support. Only routine laboratory tests are available in public hospitals, specialized serological tests for infectious and autoimmune diseases, glomerulonephritis/ vasculitis and renal biopsy are expensive and usually expensive.Cost of medicines, nutrition, dialysis catheter and hemodialysis to be borne by patients in addition, loss of work/money (both patient and accompanying family members) incurred by hospital admission. The number of hospital bed and ICU beds were inadequate, as well as CRRT(continuous renal replacement therapy)was not available for hemodynamically unstable patients making management of critical cases difficult. There is vital need for collecting epidemiological data of AKI and to establish a national registry. This can be translated in identifying magnitude of AKI and barriers to care .The review by Olowu et al reported that in most sub-Saharan Africa countries many hurdles to diagnosis and management of AKI exist, the most consistent of which are delays in reaching hospital, prohibitive cost of care, erratic functioning or supply of hospital resources, and female sex. [36] There is extreme shortage of trained health care workers in developing countries internationally. Statistics projected in 2007 showed that sub-Saharan Africa, accounting for 11% earths population, endures 24% of the worldwide disease burden, with only 3% of the global health workforce, and spends less than 1% of global health expenditure.[37] There is crucial need for health sector decentralization and establishing effective public health services in Pakistan with meager reaources.[38]

International Society of Nephrology set on the mission of eliminating preventable or treatable deaths from AKI by 2025, the "0 by 25" initiative.[39] Establishing this program in these resource stricken countries poses significant challenge. Also data regarding epidemiology and causes of AKI from these countries is scarce. [40] Role of non-governmental organizations in promoting political and social change is pivotal in developing communities and promoting citizen participation.

Conclusion

Acute kidney injury is a major public health challenge. Majority of our patients presented with severe AKI/RIFLE category Failure needing renal replacement therapy.AKI is associated with high morbidity and mortality. Infection/sepsis is the predominant etiological factor causing AKI in our patients.

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