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RISK FACTORS AND OUTCOME OF ACUTE KIDNEY INJURY: A SINGLE CENTER STUDY

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Abstract

Objective: *To determine the risk factors and outcomes of acute kidney injury in hospitalized patients.*

Study design: *Descriptive Cross-Sectional Study*

Place of the study: *Department of Nephrology and Intensive Care Unit, Liaquat University of Medical and Health Sciences Jamshoro/Hyderabad*

Methodology: *A total of 104 patients of either gender admitted under nephrology care with the diagnosis of Acute Kidney Injury had age between 18-70 years were included. Acute Kidney Injury was defined as reversible loss of renal function within hours to days, determined by any of the following: a) rise in serum creatinine of 0.3mg/dl in 48 hours from the baseline and b) drop in urine output to 0.5 ml/kg/hour for 6 hour by noting the urine output from the 24 hour urine output charts. Severity of AKI was defined by the KDIGO staging. Outcomes (full recovery, partial recovery, no recovery & mortality) were recorded at 90-day follow-up after discharge. Risk factors were also noted. Data was analyzed on SPSS Version 27. Mean and standard deviations were calculated for the quantitative variables. Frequencies and percentages were calculated for the qualitative variables. Chi-square test was applied to compare the risk factors between survivors and non-survivors' group. P-value < 0.05 was taken as significant.*

Results: *The mean age of the patients was 65.73 ± 15.41 years. 59 (57%) were male and 45 (43%) were female. 83 (79.8%) had community acquired AKI and 21 (20.19%) had hospital acquired AKI. On assessment of outcomes of AKI, 51(49%) were fully recovered, 19 (18.2%) were partially recovered, 23 (221.1%) were not recovered. Mortality occurred in 11 (10.57%) of AKI patients. The most common co-morbid found in our study population was hypertension 74 (71%). All factor were found to be statistically significantly associated with mortality except hypertension*

Conclusion: *AKI is a prevalent disease and it is associated with an increased ICU mortality. The findings of this study highlight the need to take appropriate measures to increase awareness among patients and healthcare providers of risk factors associated with kidney injury in a community or hospital setting.*

INTRODUCTION

Acute kidney injury (AKI) is now well established as a common, often under recognized disorder, which is associated with a high risk for mortality, development of chronic kidney disease (CKD), and other organ dysfunction. Annually, the worldwide occurrence of AKI is projected at approximately 13.3 million cases, with a striking 85% emerging from low- to middle-income countries. [1] Recent meta-analytical study have shed light on the global prevalence of Acute Kidney Injury (AKI), revealing an estimated incidence rate of 22% across diverse patient populations and a significantly higher rate of 55% among Intensive Care Unit (ICU) admissions. [2]

Acute Kidney Injury (AKI) presents differently across economic spectrums: in high-income countries, it predominantly affects already hospitalized patients with multiple health issues, while in lower-income regions; it strikes those who were previously healthy. This variation is due to the intricate interplay of geography, environment, and poverty. [3] In Pakistan Acute Kidney Injury (AKI) in Pakistan is primarily associated with preventable factors such as infections, diarrhea, Malaria, Viral infection drug toxicity, pregnancy induced, traumatic injury, post-surgical and complications from cardiovascular diseases.[4,5,6,7] A study conducted by Arshad et al. revealed that sepsis was involved in nearly half of the AKI cases 45%, followed by diarrhea 17%, nephrotoxic drug use 19%, and cardiac pathology 18%.[8]

Acute Kidney Injury (AKI) significantly increases the risk of developing Chronic Kidney Disease (CKD), End-Stage Renal Disease (ESRD), and higher mortality rates.[9,10]

Due to lack of a central registry, there are limited data on the overall in this area, especially in Pakistan. Understanding AKI's risk factors and outcomes is critical for creating effective interventions, especially in resource-limited settings like Pakistan. This research aimed to determine the risk factors and outcome of acute kidney injury in hospitalized patients at Liaquat University Hospital which may help in filling the knowledge gaps, tailor prevention and treatment strategies to high-risk populations.

METHODOLOGY:

This study was conducted after the approval of research protocol from Ethical Review Committee on inpatient Department of Nephrology and Intensive Care Unit, Liaquat University of Medical and Health Sciences Jamshoro/Hyderabad. A total of 104 patients of either gender admitted under nephrology care with the diagnosis of Acute Kidney Injury as per operational definition had age between 18-70 years were included via non-probability consecutive sampling technique. Known Case of Pre-existing Chronic Kidney Disease, ESRD patients on Maintenance Hemodialysis or Peritoneal Dialysis, h/o Renal Transplant, h/o Chronic Liver Disease and h/o Pregnancy were excluded. The sample size was calculated OpenEpi using the prevalence of AKI = 22%[2], margin of error = 8%, level of confidence = 95%, then estimated sample size was **104** patients. Acute Kidney Injury was defined as reversible loss of renal function within hours to days, determined by any of the following: a) rise in serum creatinine of 0.3mg/dl in 48 hours from the baseline and b) drop in urine output to 0.5 ml/kg/hour for 6 hour by noting the urine output from the 24 hour urine output charts. Severity of AKI was defined by the KDIGO staging and will be classified into the following stages: Stage 1: Increase in SCr 1.5–1.9 times compared to baseline or ≥0.3 mg/dL increase or urine output <0.5 mL/kg/h for 6–12 hours, Stage 2: Increase in SCr 2.0–2.9 times compared to baseline or urine output <0.5 mL/kg/h for ≥12 h and Stage 3: Increase in SCr 3.0 times compared to baseline or increase in SCr to ≥4.0 mg/dL or initiation of renal replacement therapy (RRT). All patients were explained about the purpose of the study. Brief history of demographic/baseline data was taken. Etiology of Acute Kidney was divided into Community-acquired acute kidney injury (CA-AKI) was defined as patients whose admission serum creatinine was sufficiently elevated to meet above mentioned criteria for AKI, while hospital-acquired acute kidney injury (HA-AKI) was defined as an increase in serum creatinine that occurred twenty-four hours or longer after hospitalization. Outcomes (full recovery, partial recovery, no recovery & mortality) were recorded at 90 day follow-up after discharge. Risk factors were also noted. Data was

analyzed on SPSS Version 27. Mean and standard deviations were calculated for the quantitative variables like age, duration of hospital stay and BMI. Frequencies and percentages were calculated for the qualitative variables. Chi-square test was applied to compare the risk factors between survivors and non-survivors group.

Results:

A total of 104 patients of AKI were included in this study. The mean age of the patients was 65.73 ± 15.41 years and mean BMI was 29 ± 4.3 kg/m^2. 59 (57%) were male and 45 (43%) were female. Most of the patients were rural resided 70 (67%). In terms of AKI stage, the incidence was 80% for AKI-I, 10.5% for AKI-II and 9.6% for AKI-III **(table#1)**. Out of 104 AKI patients, 83 (79.8%) had community acquired AKI and 21 (20.19%) had hospital acquired AKI **(table#2)**. On assessment of outcomes of AKI, 51(49%) were fully recovered, 19 (18.2%) were partially recovered, 23 (221.1%) were not recovered. Mortality occurred in 11 (10.57%) of AKI patients **(table#3)**. The most common co-morbid found in our study population was hypertension 74 (71%) followed by Diabetes mellitus 59 (57%), sepsis 41 (39.4%), obstetric complications 31 (30%), cardiac causes 10 (9.6%), drug history 9 (8.6%) surgical causes 7 (6.7%) and 2 (1.9%) of the patients had other causes of AKI. All factor were found to be statistically significantly associated with mortality except hypertension **(table#4)**.

Table#1: Demographic Data of the Patients:

Demographic Data	**(mean ± sd)/n(%)**
Age (Years)	65.73 ± 15.41
BMI (kg/m^2)	29 ± 4.3
Gender • Male • Female	 59 (57%) 45 (43%)
Residential Status • Urban • Rural	 34 (33%) 70 (67%)
AKI stage: • AKI-I • AKI-II • AKI-III	 83 (80%) 11 (10.5%) 10 (9.6%)

Table#2: Etiology of Acute Kidney injury

Etiology of Acute Kidney injury	**n** (%)
Community acquired AKI	83 (79.8%)
Hospital acquired AKI	21 (20.19%)

Table#3: Outcomes of Acute Kidney injury

Outcomes of AKI	**n** (%)
Full Recovery	51 (49%)
Partial Recovery	19 (18.2%)
No Recovery	23 (22.1%)

Mortality	11 (10.57%)

Table#4: Risk Factors of Mortality in Acute Kidney injury

Risk Factors of AKI	Total n(%)	Mortality		P-value
		Yes (n=11)	No (n=93)	
Diabetes mellitus	59 (57%)	10	49	0.015
Hypertension	74 (71%)	10	64	0.9
Surgical Causes	7 (6.7%)	06	01	0.00
Cardiac Causes	10 (9.6%)	10	00	0.00
Sepsis	41 (39.4%)	09	32	0.002
hypervolemia	5 (4.8%)	05	00	0.00
Obstetric Complications	31 (30%)	10	21	0.00
Drug history	9 (8.6%)	07	02	0.00
Others	2 (1.9%)	02	00	0.00

Discussion:

In this study, we explored essential data regarding AKI's risk factors and outcomes, AKI settings (HA-AKI and CA-AKI), and complications. Several factors, including age and diseases such as diabetes, CKD, low blood pressure, and heart disease, as well as taking some medications, contribute to AKI.[11]

In this study, CA-AKI was predominant compared with HA-AKI. A higher prevalence of CA-AKI has been reported in many developing countries, and a similar finding was reported in a large retrospective cohort study.[12] The mean age of patients diagnosed with AKI was 65.73 years. Previous studies have shown that the risk of developing acute renal failure is three times higher in patients aged >65 years than in younger patients. Increased age has been reported as a risk factor in AKI patients because of the physiological and structural changes in the kidneys with aging, which reduce nephron mass and glomerular filtration rate with an increased tendency towards cellular apoptosis.[13] The results showed a strong association between age and mortality ($P < 0.001$). It is widely recognized that the elderly have a higher incidence of AKI, poor prognosis, and a higher mortality risk than other age groups. Elderly patients have frequent comorbidities, including diabetes, hypertension, and heart failure, and take many drugs; this can be associated with the severity and complexity of their condition and mortality.[14,15]

In terms of AKI stage, the incidence was 80% for AKI-I, 10.5% for AKI-II and 9.6% for AKI-III. This incidence varies between studies.[13,15–17] This could be due to differences in how AKI was diagnosed, mainly whether baseline creatinine was obtained and whether oliguria was assessed for AKI diagnosis. Some trials used ambulatory data.[15,16] Others used ambulatory data and, if unavailable, they used creatinine at hospital admission and Modification of Diet in Renal Disease (MDRD).[17]

Among the 104 patients of AKI, 57% were male. Some studies have reported the presence and

development of AKI in males due to the presence of androgens, which are essential factors that contribute to the destruction and disruption of kidney function by disrupting hemodynamics, which can be due to the more resistant efferent arterioles. In females, during the menstrual cycle, estrogen acts as a protective and therapeutic agent for the kidneys; however, this short-term effect decreases with age.[13]

Here we describe that hypertension, diabetes and obstetrics complications are risk factors for the development of AKI, as observed in previous studies.[8,13,15] Cardiovascular disease is another risk factor often reported in the literature.[13,16–18] This is consistent with our results, as our patients had a high incidence of CHF and myocardial dysfunction.

Studies from India reported that the etiology of the AKI has changed in recent times from drug-induced to sepsis and volume depletion. In these studies, sepsis was the most frequently associated factor (39.4 %) found among AKI patients, which was 48% and 34.88% in other studies.

On assessment of outcomes of AKI, 51(49%) were fully recovered, 19 (18.2%) were partially recovered, 23 (221.1%) were not recovered. Mortality occurred in 11 (10.57%) of AKI patients. A comprehensive meta-analysis conducted focusing on AKI within South Asia, including Pakistan, noted a considerable variation in patient outcomes. They found that full recovery rates ranged between 40% and 80%, while mortality fluctuated between 2.2% and 52%.[10] In critically ill AKI patients, high mortality rates were associated with factors such as sepsis, hypertension, older age, Stage 3 AKI, and elevated potassium levels.[11] Abbas R et al. revealed that complete recovery was observed in 33.8% of patients, partial recovery in 34.76%, and no recovery in 16.1% of patients who required maintenance renal replacement therapy.[12] Another study demonstrate the outcomes of AKI reported that 53.35% of patients showed total recovery, while partial recovery was noted in 22.81%, and 9.19% developed End-Stage Renal Disease.[19]

The limitation of this study is single center and lack of follow up after discharge from the hospital. Moreover, we acknowledge that our sample size is small, large sample would yield more meaningful insight.

Conclusion:

In conclusion, AKI is a prevalent disease and it is associated with an increased ICU mortality. The findings of this study highlight the need to take appropriate measures to increase awareness among patients and healthcare providers of risk factors associated with kidney injury in a community or hospital setting. The healthcare system in Pakistan faces many challenges due to the lack of resources, such as hospital beds and dialysis units, adding more stress and responsibilities to healthcare providers; therefore, a thorough patient evaluation for early diagnosis and detection of AKI during admission or office visits, addressing modifiable risk factors for AKI, lead to an early intervention to prevent complications, adverse outcomes, hospital stay, and admission.

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