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RESEARCH ARTICLE

Assessment Of Risk Of AKI In Patients With HTN And DM– A Prospective Study Analysis

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ABSTRACT:- **Aim**: To perform a prospective study on risk of AKI in patients with DM and HTN. **Objectives**: To study the risk of patients with AKI in patients with DM and HTN. And To know the prevalence of the diseases in patients. **Methodology**: The study was conducted at aware Gleneagles global hospitals in L.B. Nagar, Hyderabad, over a 6 month's period among 70 patients in the study. Patients of both genders, IP Patients, Age group: 18-90 years, Patients with comorbidities were included in the study. OP Patients, Pregnant patients, patients with CKD, patients with kidney transplantation, patients with surgical history, Neonates and pediatrics were excluded from the study. Any patient with comorbidities who are at risk of developing AKI had their information collected using a well-designed data collection form that included patient's demographics, prescription charts, laboratory investigations, medical history and other required information. **Result**: A study of 70 patient records revealed a demographic split of 50 males (71.4%) and 20 females (28.6%). The data shows 67 patients had comorbid conditions, primarily DM and HTN. The 71-80 age group was disproportionately affected by AKI. (64.2%) Patients with both comorbid conditions, DM and HTN identified as most common cause for developing AKI, notably (27.1%) patients with only HTN and (8.5%) patients with only DM effected with AKI.Conclusion: This study examined 70 subjects affected by AKI, revealing varying prevalence rates among the participants over the study period.

Keywords: AKI, DM, HTN, CKD.

INTRODUCTION

ACUTE KIDNEY INJURY

Definition:

Acute Kidney injury (AKI)is defined as a clinical and pathological condition marked by a sudden decline in kidney function, typically associated with damage to the renal tubules. AKI leads to a rapid decrease in renal function and often presents with severe oliguria, where urine output falls below 400 mL per day. Acute Kidney Injury (AKI), also referred to as Acute Tubular Necrosis (ATN) or Acute Renal Failure (ARF).[1]

Etiological classification: Acute kidney injury (AKI) is not a singular disease with a consistent cause but rather the result of various underlying diseases and conditions. A practical classification divides AKI into three main categories. A individual patient may experience a combination of these categories. (1) Pre-renal (2) Renal (3) Post-renal.[2]

Pathogenesis:

The key events in both ischemic and nephrotoxic acute tubular injury (ATI) involve two main processes: (1) tubular injury and (2) severe, sustained disruptions in blood flow.

1.Tubular Cell Injury: Tubular epithelial cells, particularly in the proximal tubules, are highly susceptible to ischemia and toxin-induced damage. Several factors make these cells prone to injury, including their large surface area for reabsorption, the

presence of active transport systems for ions and organic acids, their high metabolic and oxygen demands, and their ability to concentrate and reabsorb toxins. Ischemia triggers both structural and functional alterations in these cells. One early, reversible consequence of ischemia is the loss of cell polarity, caused by the redistribution of membrane proteins (such as Na-K-ATPase) from the basolateral to the luminal surface. This leads to abnormal ion transport across the cells, increasing sodium delivery to the distal tubules, which in turn triggers vasoconstriction via tubulo-glomerular feedback. This vasoconstriction lowers the glomerular filtration rate (GFR) initially to preserve blood flow to the distal kidney.[3]

2.Disturbances in Blood Flow: Ischemic renal injury also involves significant hemodynamic changes, particularly intrarenal vasoconstriction, which reduces both glomerular blood flow and oxygen delivery to the critical tubules in the outer medulla (such as the thick ascending limb and straight segment of the proximal tubule).Several pathways contribute to this vasoconstriction, including the activation of the renin-angiotensin system due to decreased sodium delivery to the tubules (a result of low blood pressure) and endothelial injury, which increases the release of the vasoconstrictor endothelin while decreasing vasodilators such as nitric oxide and prostacyclin. There is also evidence that ischemia or toxins directly affect the glomerulus, reducing the ultrafiltration coefficient.[4]

Diagnosis:

A thorough history and physical examination are crucial for identifying the cause of acute kidney injury. Serum creatinine levels, a key component in diagnosing acute kidney injury, are easily measured; however, they are not the ideal marker. Creatinine levels can be influenced by factors such as age, sex, race, muscle mass, and protein catabolism. Furthermore, serum creatinine changes slowly in response to decreases in glomerular filtration rate (GFR) and may take 24 to 72 hours to stabilize after an acute kidney injury.[5]

PHARMACOLOGICAL TREATMENT

Loop diuretics (furosemide, bumetanide, torsemide, and ethacrynic acid) have similar effectiveness at equipotent doses. Ethacrynic acid is typically reserved for individuals with a documented hypersensitivity to sulfanamide-derived diuretics. Continuous infusions of loop diuretics tend to be more effective and cause fewer side effects than intermittent bolus doses. An initial IV loading dose (equivalent to 40 to 80 mg of furosemide) should be given before starting a continuous infusion (equivalent to 10 to 20 mg of furosemide per hour).[6]

HYPERTENSION

Definition:

Hypertension, or high blood pressure, is a significant risk factor for the future onset of cardiovascular disease. It is characterized by elevated blood pressure levels where reducing the pressure provides a clinical benefit. Blood pressure is measured by two components—systolic and diastolic—both of which play a crucial role in assessing an individual's cardiovascular risk.[7]

Pharmacological treatment:

Drug treatment is recommended for individuals with blood pressure readings of 140/90 mmHg or higher. The benefits of antihypertensive medications such as Diuretics ,Renin- Angiotensin blocker, Aldosterone Antagonist, Beta blockers are directly proportional to the extent of blood pressure reduction achieved.[8]

DIABETES MELLITUS

Definition:

Diabetes mellitus is a collection of metabolic disorders characterized by persistent hyperglycemia, resulting from impaired insulin secretion, insulin action, or often both. The prolonged high blood sugar and related metabolic imbalances can lead to secondary damage in various organ systems, particularly the kidneys, eyes, nerves, and blood vessels.[9]

Pharmacological treatment:

Regular insulin has a relatively slow onset when administered subcutaneously, requiring injection 30 minutes before meals to optimize postprandial glucose control and prevent delayed hypoglycemia after eating. And other medication include Insulin analogues,Sulfonylureas,Short acting insulin secretagogues , Biguanides, Alpha- Glucosidase Inhibitor.[10]

AIM AND OBJECTIVES

Aim: To perform a prospective study of risk on AKI in patients with DM and HTN.

Objectives:

- To study the risk of AKI in patients with HTN and DM.
- To know the prevalence of the diseases in patient.

METHODOLOGY

Study site: Study participants were included from the nephrology in-patient department at Gleneagles Global Hospital, located at bairamalguda, LB Nagar, Hyderabad. It is a 300 bedded tertiary care hospital with established clinical work in all major medical specialties. There is an array of specialties within the hospital, which includes emergency care, critical care, cardiology, neuroscience, gastroenterology, orthopedics and renal sciences.

Study Design: A Prospective observational study

Sample size: The study involved a total of 70 patients, who were treated in the nephrology inpatient department of Gleneagles Global Hospital.

Study period: In the study, six months were spent analyzing the data.

Study Criteria:
Inclusion Criteria:

- Patients with age group above 18 years
- Both females and males
- Patients with hypertension
- Patients with diabetes

Exclusion Criteria:

- Pediatric
- Pregnancy and Lactation women
- Previous history of CKD
- Patients with kidney transplant
- Patients with surgical history

Statistical Analysis:

- Chi-square test for categorical variables.

-p-value<0.05 considered statistically significanc

RESULTS

Table 1. Gender wise distribution of AKI patients

S.NO	GENDER	NO OF PATIENTS	P VALUE
1.	MALES	50	<0.05
2.	FEMALES	20	

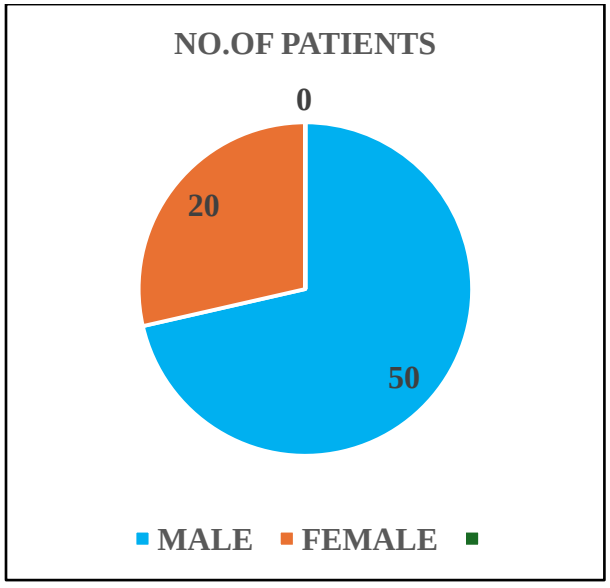

Figure 1: Pie chart presentation of gender wise distribution of AKI patients.

In the study population,50 patients were found to be males (71.4%), and 20 patients were found to be females(28.6).

Table 2. Age wise distribution of AKI patients:

S.NO	AGE GROUP	NO OF PATIENTS	P VALUE
1	18-20	2	
2	21-30	1	
3	31-40	3	
4	41-50	3	<0.05
5	51-60	12	
6	61-70	18	
7	71-80	20	
8	81-90	11	

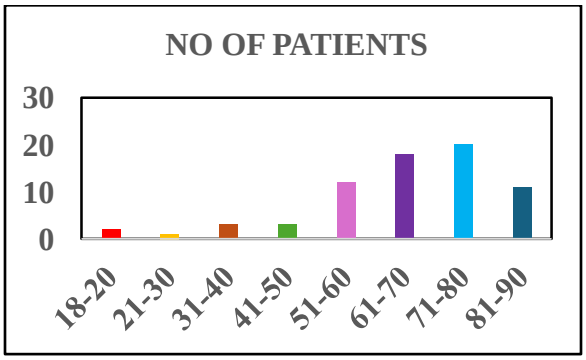

Figure 2: Bar graph presentation of age wise distribution of AKI patients.

In the study population 18 patients were found belonging to the age group between 71-80 and 1 patient were found belonging to the age group between 21-30 years.

Table 3: Age wise distribution of AKI patients in both genders:

S.NO	AGE GROUP	MALES	FEMALES	P VALUE
1	18-20	1	1	
2	21-30	1	-	
3	31-40	3	-	
4	41-50	2	1	<0.05
5	51-60	8	4	
6	61-70	12	6	
7	71-80	16	4	
8	81-90	8	3	

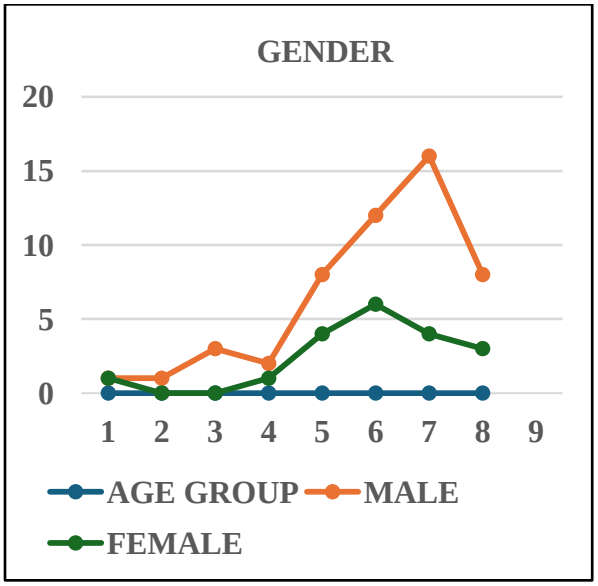

Figure 3: Line Graph presentation of age wise distribution of AKI patients in both genders.

In the study population, males belonging to the age group of 71-80 years were found to be 16, and females belonging to the age group of 61-70 years were found to be 6.

Table 4: AKIN CRITERIA wise distribution of AKI patients:

S.NO	AKIN CRITERIA	NO OF PATIENTS	P VALUE
1	STAGE-1	22	<0.05
2	STAGE-2	33	
3	STAGE-3	15	

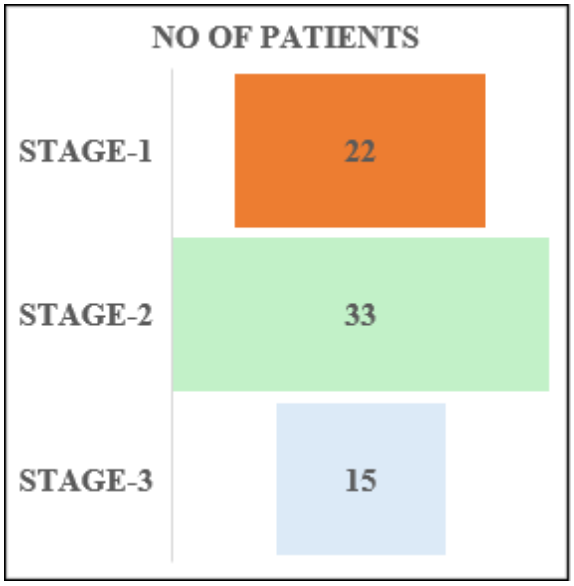

Figure 4: Funnel chart presentation of akin criteria distribution of AKI patients.

In the study population, 33 patients belonging to stage-2 and 15 patients belongs to stage 3.

Table 5: Distribution of AKI patients based on condition:

SNO	CONDITION	NO OF PATIENTS	P VALUE
1	With comorbidities	67	<0.05
2	With out comorbidities	3	

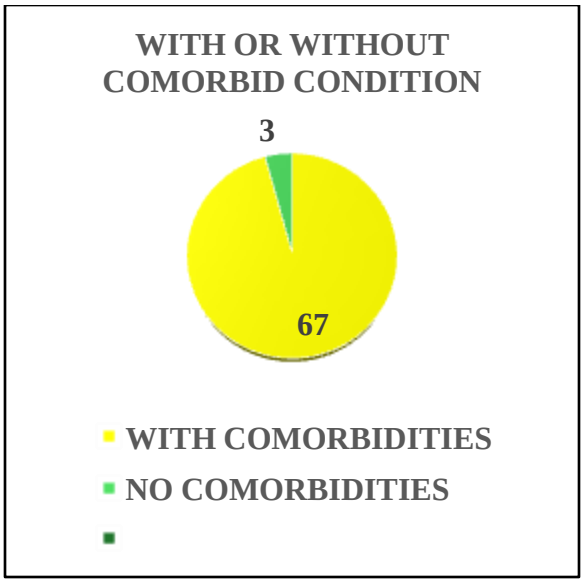

Figure 5: Pie chart presentation of distribution of patients based on condition.

In the study population 67 patients presented with comorbidities and 3 patients presented with no comorbidities

Table 6: Distribution of patients categorized by co-morbid conditions in AKI:

S.NO	CONDITION	NO OF PATIENTS	P VALUE
1	HTN	19	<0.05
2	DM	6	
3	Both HTN and DM	42	

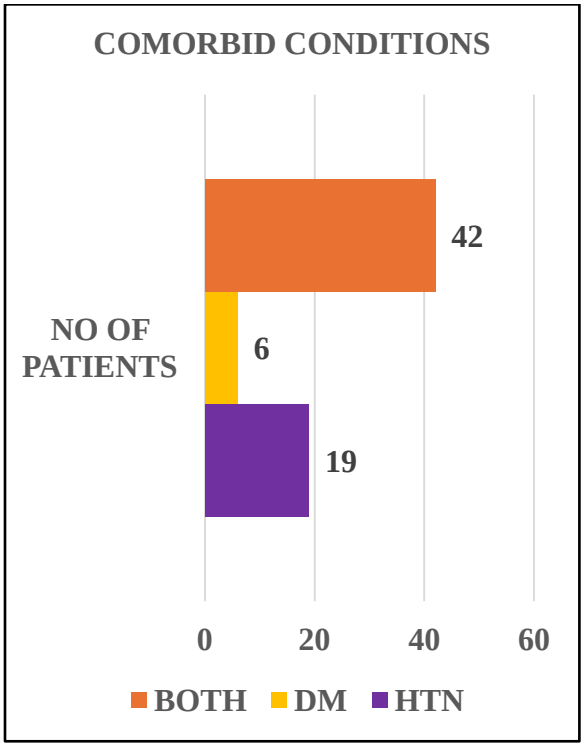

Figure 6: 3D cluster pyramidal graph presentation of distribution of patients categorized by co-morbid conditions in AKI:

In the study population 42 patients presented with Both comorbid conditions and 19 patients presented with HTN and 6 patients presented with DM

DISCUSSION

In our study of 70 patients 50(71.42%) were male and 20(28.57%) were females. Considering the distribution of the age group of patients included in the study, the age group of 61-70 and 71-80 are mostly affected. The comorbidities of the included patients in the study were identified where 67(95.71%) were found with comorbidities and the remaining 3(4.28%) patients were free from comorbidities. In the current study, it was noticed that patients with a history of only hypertension were 19(27.1%), diabetic were 6(8.57%) and both hypertension and diabetes was found as 42(60%), the frequently occurring co-morbid conditions in AKI patients with stage-1, 33(47.14%) patients with stage-2 and 15(21.42%) patients with stage-3.

CONCLUSION

The study also identifies hypertension as a key factor in the pathogenesis of AKI, with higher prevalence rates associated with postrenal AKI (85%) compared to prerenal (30%) and renal (75%) causes, reinforcing the need for careful blood pressure management in AKI patients The findings also suggest that age and the presence of multiple comorbid conditions such as hypertension and diabetes significantly impact the progression and severity of AKI, highlighting the importance of comprehensive patient management strategies in preventing adverse renal outcomes.

LIST OF ABREVATIONS

AKI	Acute kidney injury
DM	Diabetes mellitus
HTN	Hypertension
CKD	Chronic kidney disease
ATN	Acute tubular necrosis

ARF	Acute renal failure
ATI	Acute tubular injury
GFR	Glomerular filtration rate
AKIN	Acute kidney injury network

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