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RESEARCH ARTICLE OPEN ACCESS

OCCURRENCE OF ACUTE KIDNEY INJURY IN PATIENTS IN CRITICAL CONDITION HOSPITALIZED DUE TO DECOMPENSATED HEART FAILURE: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Heart failure is the leading diagnosis at hospital discharge for elderly patients. At least part of the extreme mortality and morbidity of HF has been considered attributable to the existence of co-morbid conditions. Perhaps one of the most important comorbidities in terms of pathophysiology, prognosis and treatment of HF is the co-existence of renal failure. ***Aim*:** The present study aims to observe the occurrence of acute kidney injury in patients in critical condition hospitalized due to decompensated heart failure. ***Methodology*:** The present study was conducted in the department of Medicine at Chattrapati Shivaji Subharti Hospital from September 2018 to June 2020. The study group consisted of 100 patients, aged 18 years and above with decompensated heart disease, without pre-existing renal disease. The data was collected by a preformed structured interviewer-administered questionnaire that was pretested with modifications made prior to its use in the study. The observation interval was from the admission to hospital till discharge or death. Detailed clinical history including associated symptoms was noted. Detailed systemic examination of patients was done. ***Statistical analysis***: It was performed using IBM SPSS version 20. All categorical data were expressed as a percentage of the whole. ***Results*:** The current study showed the mean hospital stay of 16.91±11.50 days among Non-AKI subjects whereas 35.78 ± 45.80 days among AKI subjects. The mean ICU stay of 5.38 ± 2.14 days was seen among Non-AKI subjects where as 9.41 ± 15.82 days amongAKIsubjects.Mortality among Non-AKI subjects was 5% where as among AKI subjects were 11.67%. Other factors like serum creatinine and mean urea were higher too among AKI subjects was 1.27 ± 0.49 mg/dL and mean urea. ***Conclusion*:** The presence of AKI during hospitalization was associated with poor outcomes in patients with decompensated heart failure as it can be appreciated from the results.Acute kidney injury, a common problem in ICU, has a strong impact on mortality and morbidity.

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INTRODUCTION

Heart failure (HF) is not only a syndrome characterized by its clinical symptoms, signs and poor prognosis, but also by its high degree of co-morbid organ dysfunction and co-morbidities (Dickstein *et al.,* 2008; Groenveld *et al.,* 2008; Lang and Mancini, 2007; Le Jemtel *et al.,* 2007; MacDonald *et al.,* 2008; Smith *et al.,* 2006 and Sturm *et al.,* 2006). Heart failure is the leading diagnosis at hospital discharge for elderly patients. At least part of the extreme mortality and morbidity of HF has been considered attributable to the existence of co-morbid conditions (Lang and Mancini, 2007 and Hillege *et al.,* 2000). Perhaps one of the most important comorbidities in terms of patho-physiology, prognosis and treatment of HF is the co-existence of renal failure (Smith *et al.,* 2006; Sturm *et al.,* 2006 and Hillege *et al.,* 2000). The close relationship between cardiovascular and renal function in physiology is also apparent in the disease. About 40% of patients with HF have chronic kidney disease, defined as a serum creatinine level of >133 mmol/l or a creatinine clearance rate of 60 ml/min (Lang and Mancini, 2007). In routine clinical practice, left ventricular function (including left ventricular ejection fraction [LVEF]), the clinical severity of the disease (eg. New York Heart Association functional class ([NYHA]), and cause of the disease all carry independent prognostic value. Biochemical markers, including serum sodium, urea, and creatinine, and neurohormones may have additive value (Hillege *et al.,* 2000). Patients with severe decompensated heart failure need care in intensive care units (ICUs) where the described general occurrence of acute kidney injury (AKI) is of 1 to 30%, even if underdiagnosed, depending on the used criteria, with mortality rates ranging from 28 to 90% (Bocchi *et al.,* 2005). Many studies have confirmed the applicability of both classifications, which are currently accepted as the main diagnostic criteria (Bagshaw *et al.,* 2008;

Garzotto *et al.,* 2011). Despite the common pathologies in patients in critical condition, little is known about the interaction between acute kidney injury and decompensated heart failure (Ronco and Maisel, 2010 and Macedo and Mehta, 2010). It could thus be postulated that renal function can indirectly be used as an indicator of cardiovascular status in HF and may, therefore, potentially be a powerful prognostic indicator (Hillege *et al.,* 2000). In a recently published sample, acute kidney injury was related to longer hospital stay and higher in-hospital mortality in patients with decompensated heart failure (Hata *et al.,* 2010). Hence, the present study aims to observe the occurrence of acute kidney injury in patients in critical condition hospitalized due to decompensated heart failure. To observe the occurrence of acute kidney injury in patients in critical condition hospitalized due to decompensated heart failure. The objectives of the present study to determine risk factors for itsoccurrence, to analyze the clinical-demographic profile ofsubjects and the time of ICU stay and finaloutcome.

MATERIALS AND METHODS

The present study was conducted in the department of Medicine at ChattrapatiShivajiSubharti Hospital from September 2018 to June 2020. The study group consisted of 100 patients, aged 18 years and above with decompensated heart disease, without pre-existing renal disease. Patients were enrolled in the study after obtaining written informed consent and approval from the Institutional Ethical Committee.

Study duration: 2 years
Type of study: Prospective observational study
Study centre: Department of Medicine, Chattrapati Shivaji Subharti Hospital
Sample size: 100

Inclusion criteria:

All Patients of congestive heart failure as documented by

1) Clinical evidence of decompensated heart disease
2) All the patients with Decompensated Heart Disease with age18 years and above.
3) All the patients who gave written informed consent.

Exclusion criteria:

1) All known cases of Chronic Kidney Disease.
2) All known cases of diabetes mellitus.
3) All known cases of pre-existing renal disease.

Ethical clearance: The study protocol for all procedures was approved by the Institutional Review Board for Ethical Clearance of ChattrapatiShivajiSubharti Hospital and was performed in accordance with the Code of Ethics of the World Medical Association according to the Declaration of Helsinki of 1975, as revised in 2000. All patients were asked to sign a written consent form prior to commencement of thestudy.

Case selection: The data was collected by a preformed structured interviewer-administered questionnaire that was pretested with modifications made prior to its use in the study. The patients were interviewed that requests for the demographic, socioeconomic status, medical history and previous history of taking any medications and supplements.All the patients who were eligible for the research, their information right after admission, concerning age, ethnicity, gender, co-morbidities, risk factors and habits, heart failure etiology, recent lab tests (serum creatinine), cause of clinical decompensation, functional class according to the "New York Heart Association" (NYHA) and body weight was obtained.

Clinical Assessment: The observation interval was from the admission to hospital till discharge or death. Detailed clinical history including associated symptoms was noted. Detailed systemic examination of patients was done. The heart failure diagnosis was established by the "Boston" criteria 13, with scale > 8 (Table 1), which was confirmed with additional examinations (echo cardiography and thoracic x-ray). Acute kidney injury will be diagnosed by the "AKIN" classification, and patients were divided into two groups according to the acute kidney injury development. Subjects who presented with acute kidney injury were separated according to the parameter used for diagnosis, that is, increased creatinine or reduced urinary output. In case both parameters were determinant, the earliest one was prioritized. As to staging, the most severe one demonstrated by each patient during hospital stay was considered.

Table 1 BOSTON CRITERIA TO DIAGNOSE HEART FAILURE

Category I: History	Number of points
Dyspnea at rest	4
Orthopnea	4
Paroxysmal nocturnal dyspnea	3
Dyspnea when walking on the level	2
Dyspnea when climbing	1
Category II: Physical examination	**Number of points**
Tachycardia 91 – 110 bpm	1
> 110 bpm	2
High venous pressure	2
High venous pressure with leg swelling	3
Basilar lung crackles	1
Above the basilar point	2
Wheezing	3
Third heart sound	3
Category III: Chest radiography	**Number of points**
Alveolar pulmonary edema	4
Interstitial pulmonary edema	3
Bilateral pleural effusion	3

Adapted from Carlson *et al.*[13].

Laboratory Investigation: Hemoglobin and serum creatinine was measured at the moment of admission and 48 hours after; afterwards. Information on urinary output was collected every six hours. A complete blood count was performed for all patients using a automated complete blood count analyzer and the following parameters were studied- haemoglobin, total WBC count, differential count, RBC count, MCV, MCH, MCHC, hematocrit and platelet count. Blood Sugar levels were checked for all the patients by HbA1c blood test. This test shows average blood sugar level over the last 2 to 3 months. Recommended target glucose levels of 110–149 mg/dL to be achieved in ICU patients.

Lipid Profile

Cholesterol: It is measured using a colorimetric reflectance spectrophotometric method. Normal ranges for adults are Desireable :< 200 mg/dL; Borderline: 200 – 239 mg/dL; High: => 240 mg/dL. The reportable range for this assay is 50-325mg/dl. The expected CV of this assay is <2%.

Direct Hdl: Cholesterol is assayed by colorimetric reflectance spectrophotometry after samples are treated with phosphitungstic acid/magnesium chloride to precipitate HDLs and non-HDLs. Normal ranges for adults are Highly Desireable: > 60 mg/dL; Desireable: 35-60 mg/dL; High Risk: <40 mg/dL. The reportable range for this assay is 5.0-110.0 mg/dL. The expected CV of this assay is approximately 7%.

Ldl Cholesterol: It is calculated: Total Cholesterol – {HDL + (Triglycerides/5)}. Normal ranges for adults are Desireable: < 130 mg/dL; Borderline: 130-159 mg/dL; High Risk: >= 160 mg/dL. TRIGLYCERIDE: It is measured by colorimetric reflectance spectrophotometry. Normal ranges for adults are Normal:<150 mg/dL; Borderline High: 150-199 mg/dL; High; Very

High:>=150mg/dL . The reportable range for this assay is 10.0-525.0 mg/dL. The expected CV of this assay is <2%.

LFT

Serum Bilirubin: This is measured as the amount, which reacts in 30 minutes after addition of alcohol. Normal range is 0.2-0.9 mg/dl (2-15µmol/L). It is slightly higher by 3-4 µmol/L in males as compared to females.

M KFT

Urea: It is estimated using commercial test kit (Autozyme new blood urea, manufacturer Accurex Biomedical private limited, Thane, India, kit) Normal range vary from 2.5 to 7.1 mmol/L. High blood urea of greater than 10.0 mmol/L is termed Uremia which could be indicative of decompensated heart failure.

Serum Creatinine: Measurement of Serum Creatinine was performed by Autozyme new serum creatinine, manufacturer Accurex Biomedical private limited, Thane, India, kit. Normal levels of creatinine in the blood are as follows:

- Males: 0.6 to 1.2 mg/dL
- Females: 0.5 to 1.1 mg/dL

High serum creatinine levels are indicative of decompensated heart failure.

Serum electrolytes: Subjects with heart failure may show hyponatremia, magnesium, and potassium deficiencies; the latter two play a pivotal role in the development of cardiac arrhythmias.

Serum sodium: The normal serum sodium level is 135-145 mEq/L. Sodium below135 mmol/l and above 145 mmol/l are defined as hyponatraemia and hypernatraemia respectively.

Serum potassium: The normal potassium level in the blood is 3.5-5.0 milli Equivalents per liter (mEq/L). Potassium levels below 3.5 mmol/l and above 5.5 mmol/l were categorized as hypokalemia and hyperkalemia, respectively.

ECG: Evaluated for arrhythmia as evidence of previous myocardial infarction. High precordial QRS voltage, poor precordial R wave progression and low limb lead voltage is said to have high specificity in diagnosis of Heart failure.

Chest X ray: To evaluate Signs of heart failure. Alveolar Pulmonary Edema Interstitial Pulmonary Edema Bilateral Pleural Effusion Also used to evaluate for infection

Echocardiogram: Use to confirm diagnosis and to classify heart failure (heart failure with preserved ejection fraction [HFpEF], heart failure with reduced EF [HFrEF]). Assist with determining etiology – evaluate for ventricular hypertrophy, valvular pathology, wall motion changes. Test of choice before natriuretic peptide testing if patient has had urinary tract infection within 2 weeks (National Institute for Health and Clinical Excellence [NICE], 2010)

Statistical Analysis

Statistical analysis was performed using IBM SPSS version 20. All categorical data were expressed as a percentage of the whole. The continuous variables were expressed as Mean ± Standard Deviation. The statistical procedures were carried out in 2 steps: 1. Data compilation andpresentation, 2. Statistical analysis.

RESULT

Table 1 showed the distribution of study subjects according to AKI . It showed that 31% subjects already had AKI during their admission and 29% subjects developed it during hos pitalization.

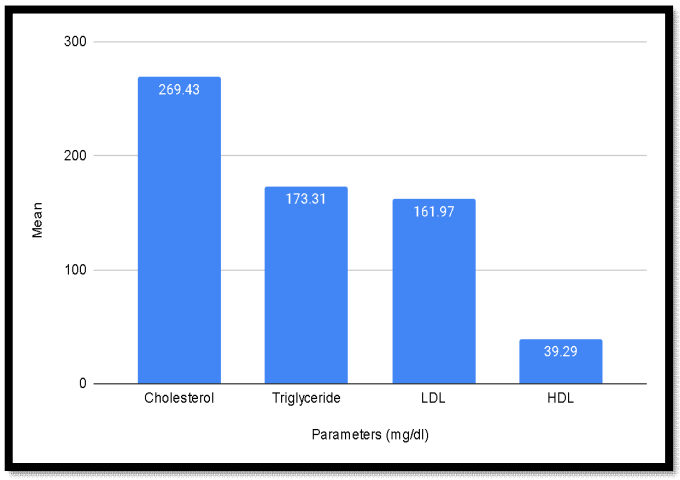
Table 1. Distribution of the study subjects according to AKI (Acute Kidney Injury)

AKI	N=100	%
On Admission	31	31
Developed During Hospitalization	29	29
Total	60	60

Table 2. Lipid Profile parameters of patients

Parameters (mg/dl)	Mean	SD
Cholesterol	269.43	53.07
Triglyceride	173.31	39.97
LDL	161.97	30.04
HDL	39.29	5.99

Table 2 showed the lipid profile parameters of the patients. Mean cholesterol, triglycerides, LDL, and HDL values were 269.43, 173.31, 161.97, and 39.29 respectively.

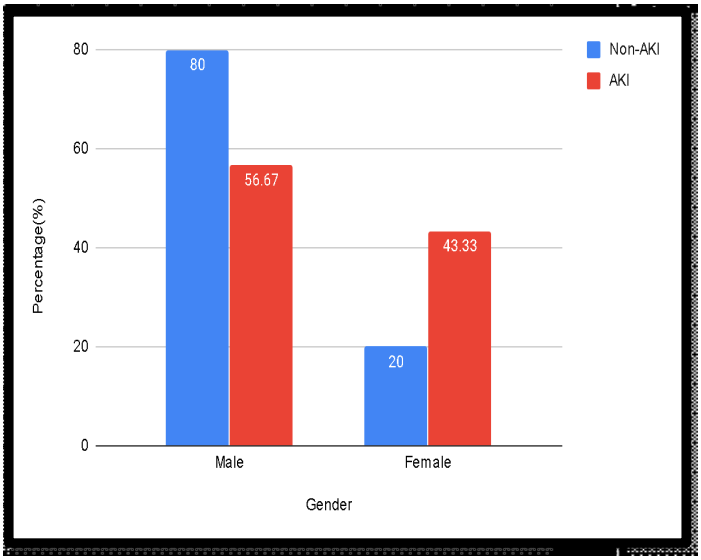


Graph 2. Lipid Profile parameters of patient

Table 3. Gender distribution among the study subjects according to AKI

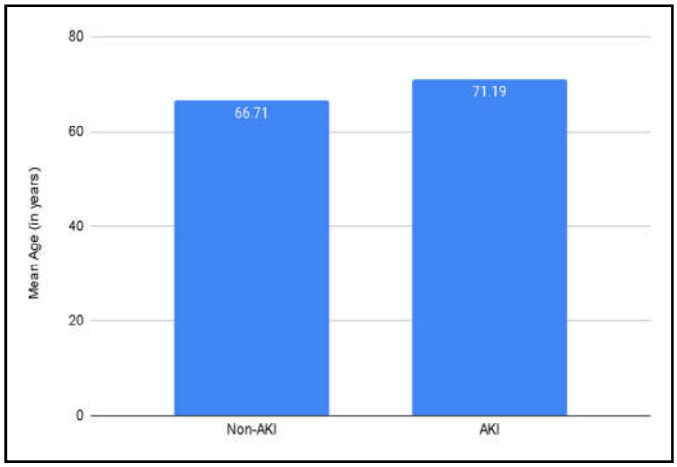
Gender	Non-AKI (N=40)		AKI (N=60)		p value
	N	%	N	%	
Male	32	80	34	56.67	0.007*
Female	8	20	26	43.33	

*: statistically significant



Graph 3. Gender distribution among the study subjects according to AKI

Table 3 showed the gender distribution among the study subjects according to AKI. It showed that 56.67%% males had AKI whereas 80% had Non-AKI. Similarly, 43.33% females had AKI and 20% had Non-AKI. The results were statistically significant (p=0.007)



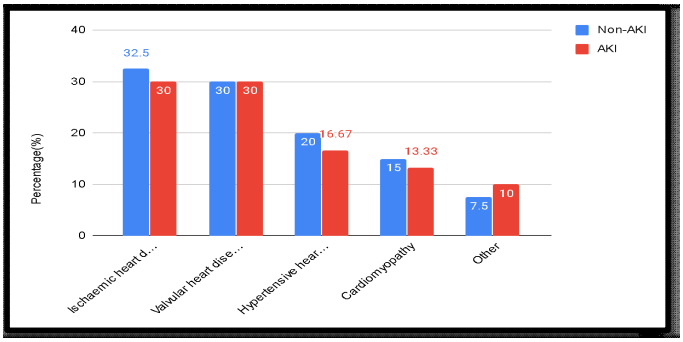
Graph 4. Mean age among the study subjects according to AKI

Table 4. Mean age among the study subjects according to AKI

Group	Age (in years)		p value
	Mean	SD	
Non-AKI (N=40)	66.71	12.70	0.004*
AKI (N=60)	71.19	11.68	

*: statistically significant

Table 4 showed the mean age among the study subjects according to AKI. It showed that among subjects with AKI mean age was 71.19 ± 11.68 years and among Non- AKI subjects it was 66.71 ±12.70 years.

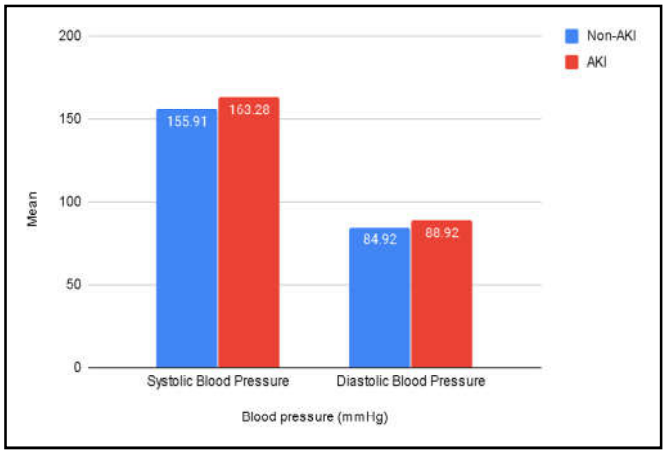


Graph 5. Aetiology of heart failure among the study subjects according to AKI

Table 5. Aetiology of heart failure among the study subjects according to AKI

Aetiology	Non-AKI (N=40)		AKI (N=60)	
	N	%	N	%
Ischaemic heart disease	13	32.5	18	30
Valvular heart disease	12	30	18	30
Hypertensive heart disease	8	20	10	16.67
Cardiomyopathy	6	15	8	13.33
Other	3	7.5	6	10

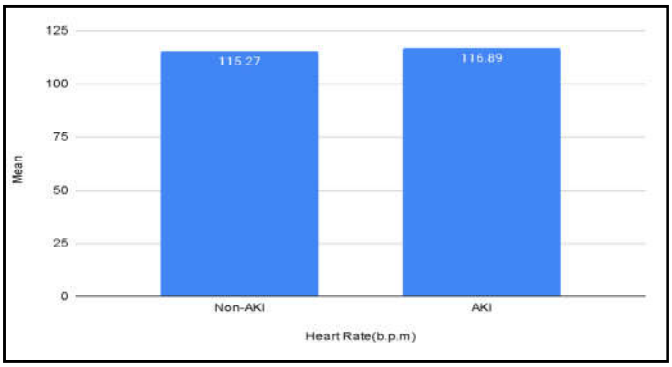
Table 5 showed the aetiology of heart failure among the study subjects according to AKI. Among Non-AKI subjects 32.5% had ischemic heart disease, 30% had valvular heart disease, 20% had hypertensive heart disease, 15% had cardiomyopathy, and 7.5% had other aetiologies. Among AKI subjects 30% had ischemic heart disease, 30% had valvular heart disease, 16.67% had hypertensive heart disease, 13.33% had cardiomyopathy, and 10% had other aetiologies. Table 6 showed blood pressure comparison according to AKI. Mean systolic BP among Non-AKI subjects was 155.91 ±32.8 mmHg and among AKI subjects was163.28 ±30.17 mmHg. Mean diastolic BP among Non-AKI subjects was 84.92±19.46 mmHg and among AKI subjects was88.92 ±21.19 mmHg



Graph 6. Blood pressure comparison according to AKI

Table 6. Blood pressure comparison according to AKI

Blood Pressure (mmHg)	Non-AKI (N=40)		AKI (N=60)		p value
	Mean	SD	Mean	SD	
Systolic Blood Pressure	155.91	32.8	163.28	30.17	0.13
Diastolic Blood Pressure	84.92	19.46	88.92	21.19	0.09

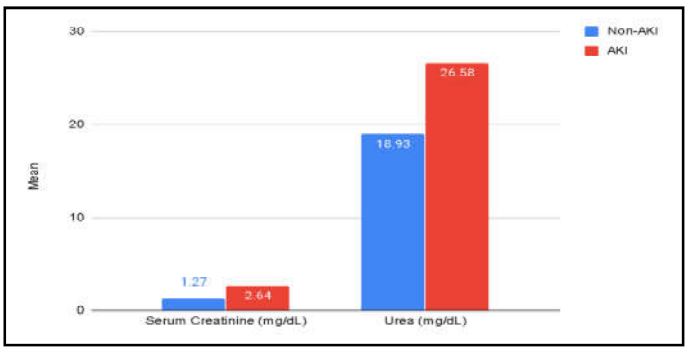


Graph 7. Mean Heart rate (b.p.m.) among the study subjects according to AKI

Table 7. Mean Heart rate (b.p.m.) among the study subjects according to AKI

Group	Heart Rate (b.p.m.)		p value
	Mean	SD	
Non-AKI (N=40)	115.27	11.37	0.32
AKI (N=60)	116.89	12.14	

Table 7 showed the mean Heart rate (b.p.m.) among the study subjects according to AKI. Mean Heart Rate among Non-AKI subjects was 115.27 ± 11.37 b.p.m whereas among AKI subjects was 116.89 ±12.14 b.p.m.



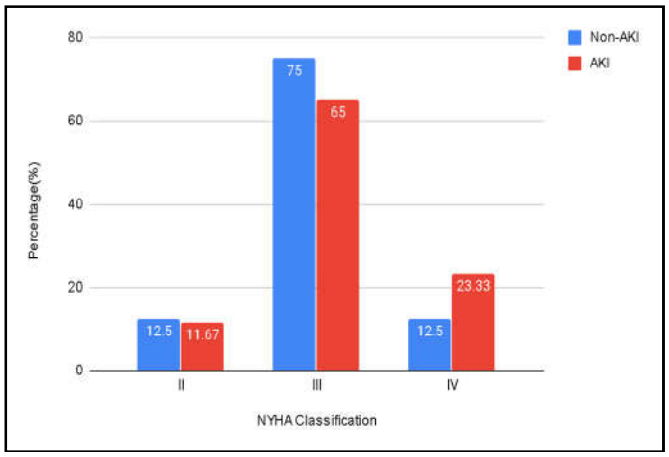
Graph 8. Mean serum creatinine (mg/dL) and urea (mg/dl) among the study subjects according to AKI

Table 8. Mean serum creatinine (mg/dL) and urea (mg/dl) among the study subjects according to AKI

Parameters	Non-AKI (N=40)		AKI (N=60)		p value
	Mean	SD	Mean	SD	
Serum Creatinine (mg/dL)	1.27	0.49	2.64	0.43	<0.01*
Urea (mg/dL)	18.93	3.67	26.58	4.13	0.008*

*: statistically significant

Table 8 showed mean serum creatinine (mg/dL) and urea (mg/dl) among the study subjects according to AKI. Among Non-AKI subjects mean serum creatinine was 1.27 ± 0.49 mg/dL and mean urea was 18.93 ± 3.67 mg/dL. Among AKI subjects mean serum creatinine was 2.64 ± 0.43 mg/dL and mean urea was 26.58 ± 4.13 mg/dL.

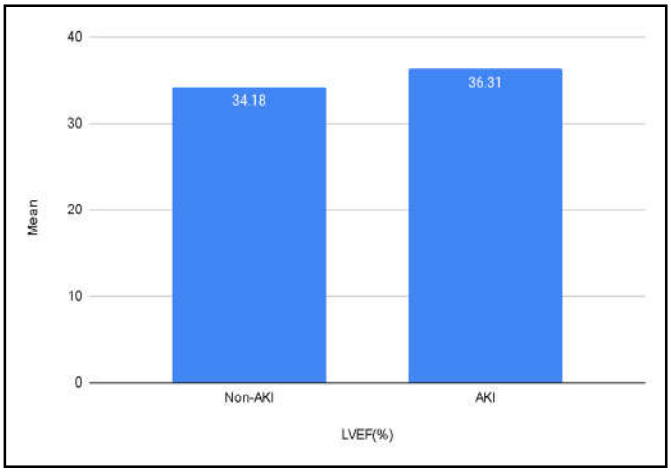


Graph 9. NYHA classification according to AKI

Table 9. NYHA classification according to AKI

NYHA Classification	Non-AKI (N=40)		AKI (N=60)		p value
	N	%	N	%	
II	5	12.5	7	11.67	0.78
III	30	75	39	65	0.14
IV	5	12.5	14	23.33	0.08

Table 9 showed the NYHA classification according to AKI. Among Non-AKI subjects 12.5%, 75%, and 12.5% had class II, class III, and class IV respectively. Among AKI subjects 11.67%, 65%, and 23.33% had class II, class III, and class IV respectively.

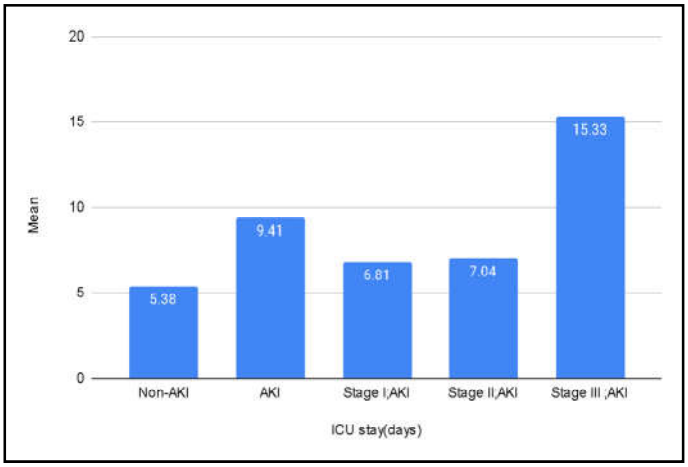


Graph 10. LVEF (left ventricular ejection fraction) upon admission (%) according to AKI

Table 10. LVEF (left ventricular ejection fraction) upon admission (%) according toAKI

Group	LVEF (%)		p value
	Mean	SD	
Non-AKI (N=40)	34.18	12.38	0.21
AKI (N=60)	36.31	12.71	

Table 10 showed the LVEF (left ventricular ejection fraction) upon admission according to AKI. Mean LVEF among Non-AKI subjects was 34.18 ±12.38% whereas among AKI subjects was 36.31 ±12.



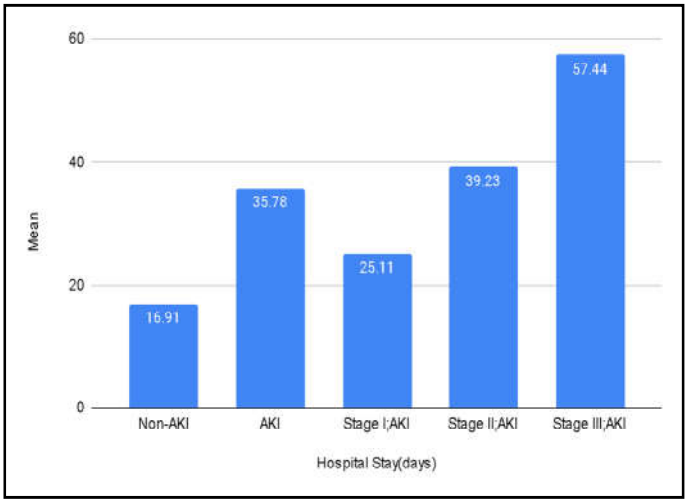
Graph 11. ICU stay (days) according to AKI

Table 11. ICU stay (days) according to AKI

Group	ICU stay (days)		p value
	Mean	SD	
Non-AKI (N=40)	5.38	2.14	0.004*
AKI (N=60)	9.41	15.82	
Stage I (N=36)	6.81	2.1	
Stage II (N=14)	7.04	2.4	
Stage III (N=10)	15.33	20.67	

*: statistically significant

Table 11 showed the ICU stay(days) according to AKI. Mean ICU stay among Non- AKI subjects was 5.38 ± 2.14 days whereas among AKI subjects were 9.41 ± 15.82 days. Among AKI subjects mean ICU days for stage I was 6.81 ± 2.1 days, for stage II was7.04 ± 2.4 days and for stage III was 15.33 ± 20.67 days. The results were statisticallysignificant.



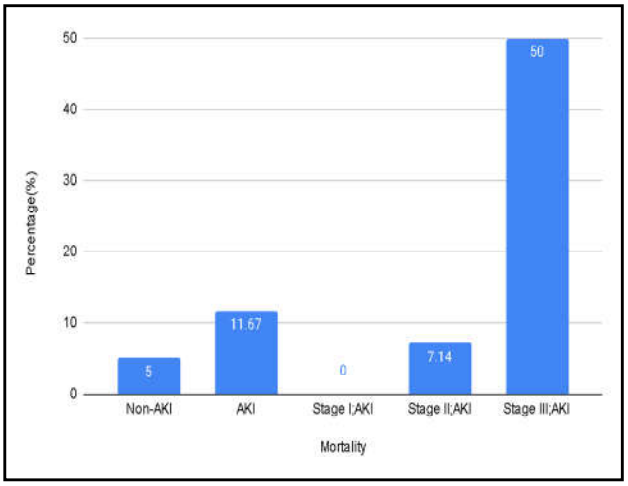
Graph 12. Hospital stay (days) according to AKI

Table 12. Hospital stay (days) according to AKI

Group	Hospital stay (days)		p value
	Mean	SD	
Non-AKI (N=40)	16.91	11.50	<0.01*
AKI (N=60)	35.78	45.80	
Stage I (N=36)	25.11	22.13	
Stage II (N=14)	39.23	14.88	
Stage III (N=10)	57.44	40.09	

*: statistically significant

Table 12 showed the hospital stay(days) according to AKI. Mean hospital stay among Non-AKI subjects was 16.91 ± 11.50 days whereas among AKI subjects were 35.78.



± 45.80 days. Among AKI subjects mean hospital days for stage I was 25.11 ± 22.13 days, for stage II was 39.23 ± 14.88 days and for stage III was 57.44 ± 40.09 days. The results were statisticallysignificant.

Graph 13. Mortality among the study groups

Table 13. Mortality among the study groups

Group	Mortality		p value
	N	%	
Non-AKI (N=40)	2	5	<0.01*
AKI (N=60)	7	11.67	
Stage I (N=36)	0	0	
Stage II (N=14)	1	7.14	
Stage III (N=10)	5	50	

*: statistically significant

Table 13 showed the mortality among the study groups. Mortality among Non-AKI subjects was 5% whereas among AKI subjects were 11.67%. Among AKI subjects the mortality for stage I was 0, for stage II was 7.14% and for stage III was 50%. The results were statistically significant.

DISCUSSION

We conducted a prospective observational study among 100 patients, aged 18 years and above with decompensated heart disease, without pre-existing renal disease. Patients were enrolled in the study after obtaining written informed consent and approval from the Institutional Ethical Committee. Those patients who had diabetes mellitus, and chronic kidney disease were excluded from the study. The study showed that 31% subjects already had AKI during their admission and 29% subjects developed it during hospitalization. Yang et al [15] did a study on AKI within 7 days of admission and reported an incidence of 47.6 % which was more comparable to the present status. The higher incidence in the study done by Yang et al could be attributed to the reason because in that study the participants enrolled were taking diuretics. Mean cholesterol, triglycerides, LDL and HDL values were 269.43, 173.31, 161.97, and 39.29 respectively. A study done by Rim et al[16] showed mean cholesterol, triglycerides, LDL and HDL values as 173.31, 150.80, 44.53, and 99.21 which were less compared to the present study. Gender distribution showed that 56.67%% males had AKI whereas 80% had Non-AKI. Similarly 43.33% females had AKI and 20% had Non-AKI. Similarly, a study done by Yang et al[49] showed 63.3% males had AKI and 74.1% had Non-AKI. The present study showed that among subjects with AKI mean age was 71.19 ± 11.68 years and among Non-AKI subjects it was 66.71 ±12.70 years. Similar results were found in a study done by Yang et al[15] which showed a mean age of 69 ± 2 years among subjects with AKI and 67 ± 2 years among subjects with Non-AKI. Out of total, 32.5% had ischemic heart disease, 30% had valvular heart disease, 20% had hypertensive heart disease, 15% had cardiomyopathy, and 7.5% had other aetiologies among Non-AKI subjects whereas 30% had ischemic heart disease, 30% had valvular heart disease, 16.67% had hypertensive heart disease, 13.33% had cardiomyopathy, and 10% had other aetiologies among AKI subjects. The findings by Hata et al[17] were in contrast to the findings of the present study which stated that 32.36% had ischemic heart disease, 32.36% had valvular heart disease, 17.45% had hypertensive heart disease, 13.45% had cardiomyopathy, and 4.36% had other aetiologies among AKI subjects whereas 34.65% had ischemic heart disease, 23.76% had valvular heart disease, 15.84% had hypertensive heart disease, 22.77% had cardiomyopathy, and 2.97% had other aetiologies among Non-AKI subjects. Silverberg[18] reported that about half of all patients with congestive heart failure have chronic kidney disease, whereas congestive heart failure is 15 times more frequent in patients with chronic kidney disease than in those with normal renalfunction[18]. The present study showed that mean systolic BP among Non-AKI subjects was 155.91 ±32.8 mmHg and among AKI subjects was163.28 ±30.17 mmHg. Mean diastolic BP among Non-AKI subjects was 84.92 ±19.46 mmHg and among AKI subjects was 88.92 ±21.19 mmHg. The findings by Hata et al[17] were in contrast with the present study where mean systolic BP among Non-AKI subjects was 163.1 ± 40.0 mmHg and among AKI subjects was155.7 ± 44.9 mmHg. Mean diastolic BP among Non-AKI subjects was 88.8±22.0 mmHg and among AKI subjects was 84.7 ±24.8 mmHg. Gheorghiade et al.[19] found that multiple evaluations demonstrated the prognostic value of SBP and indices of renal function in acute heart failure syndromes[57]. In the current study, mean heart rate among Non-AKI subjects was 115.27 ±11.37 b.p.m whereas among AKI subjects was 116.89 ±12.14 b.p.m which was in contrast with the study done by Hata et al[17] which showed 116.7 ±29.4 b.p.m among Non-AKI subjects and 113.7 ±32.3 b.p.m among AKI subjects. Lopes et al.[20] reported that serum creatinine seemed to be a better predictor of mortality than urine output. Fonarowet al.[21] reported that BUN, SBP, and creatinine levels were the three variables most predictive of in-hospital mortality in the Acute Decompensated Heart Failure National Registry (ADHERE). Lassnigget al.[22] reported that small changes in serum creatinine are associated with a worse outcome for patients after cardiothoracic surgery.

The study showed that among Non-AKI subjectsmean serumcreatinine was1.27±0.49mg/dLandmeanureawas18.93±3.67 mg/dL. Among AKI subjects mean serum creatinine was 2.64 ± 0.43 mg/dL and mean urea was 26.58 ± 4.13 mg/dL. A study done by Hata et al[17] showed that mean serum creatinine among Non-AKI subjects was 1.29±0.54mg/dLandamongAKI subjects was 1.33 ± 0.79 mg/dL. The present study showed the NYHA classification according to AKI. Among Non-AKI subjects 12.5%, 75%, and 12.5% had class II, class III, and class IV respectively. Among AKI subjects 11.67%, 65%, and 23.33% had class II, class III, and class IV respectively. Similar findings were shown by Hata et al[17] which stated that among Non-AKI subjects 16.83%, 65.34%, and 17.82% had class II, class III, and class IV respectively. Among AKI subjects 10.54%, 62.54%, and 26.90% had class II, class III, and class IVrespectively. In the current study, the mean LVEF(%) am ong Non-AKI subjects was 34.18 ±12.38% whereas among AKI subjects was 36.31 ± 12.71%. Similarly, in the study done by Hata et al[17], mean LVEF(%) among Non-AKI subjects was 34.3 ±15.3% and among AKI subjects was 36.2 ±16.4%. The present study showed the mean ICU stay of 5.38 ± 2.14 days among Non- AKI subjects whereas 9.41 ± 15.82 days

among AKI subjects. Similarly, Hata et al[17] stated the mean ICU stay among Non-AKI subjects as 5.0 ± 2.8 days and among AKI subjects as 8.8 ± 15.4 days. The current study showed the mean hospital stay of 16.91 ± 11.50 days among Non-AKI subjects whereas 35.78 ± 45.80 days among AKI subjects. Hata et al[17] conducted a study which stated mean hospital stay of 25.7 ± 16.8 days among Non-AKI subjects and 48.6 ± 47.6 days among AKIsubjects. The mortality seen in the present study among Non-AKI subjects was 5% whereas among AKI subjects were 11.67% which is more as compared to the study done by Hata et al[17] that is 1.0% in Non-AKI subjects and 10.5% in AKI subjects. Another study done by Yang et al[15] showed 5.6% mortality among Non-AKI subjects and 22.4% mortality among AKI subjects comparatively. The relationship of AKI with mortality in patients with DHF has remained unclear, and the present study, therefore, adds one piece of evidence that onset time of AKI may be useful for risk stratification of mortality in DHF patients develpingAKI.

Limitations of Our Study

- The sample size issmall.
- It has been done in a singlecenter.
- The postoperative cases, trauma cases, surgical cases have not beenincluded.
- Only the in-hospital mortality has beencalculated.
- Single group of the population has been studied, so we cannot find heterogenous epidemiology of acute kidneyinjury.

CONCLUSION

Acute kidney injury, a common problem in ICU, has a strong impact on mortality and morbidity. In the current study, the mean LVEF (%) among Non-AKI subjects was 34.18 ±12.38% whereas among AKI subjects was 36.31 ± 12.71%. The presence of AKI during hospitalization was associated with poor outcomes in patients with decompensated heart failure as it can be appreciated from the results that the mean ICU stay of 5.38 ± 2.14 days among Non-AKI subjects whereas 9.41 ± 15.82 days among AKI subjects.Th current study showed them eanhospital stay of 16.91±11.50 days among Non-AKI subjects whereas 35.78 ± 45.80 days among AKI subjects. Mortality among Non-AKI subjects was 5% whereas among AKI subjects were 11.67%. Other factors like serum creatinine and mean urea were higher too among AKI subjects was 1.27 ± 0.49 mg/dL and mean urea. Therefore, it can be concluded that acute kidney injury is associated with a poorer outcome for patients with ADHF.

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