INCIDENCE OF ACUTE KIDNEY INJURY IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION

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ABSTRACT

Acute kidney damage (AKI) is a complicated disorder with bad prognosis and can be brought on by several illnesses. In India, the morbidity of AKI has grown during the previous few decades from 3/1000 to 17.3/1000. [1]

AKI is thought to occur in 5% of all hospitalizations, with related healthcare costs exceeding $10 billion annually, while exact figures are unknown. Rapid loss of renal performance is the hallmark of acute kidney injury (AKI), which might result in multitude of problems such as fluid imbalance, metabolic acidosis, and uremia.

One in five patients who are admitted in hospital for an acute myocardial infarction (AMI) experience an acute kidney damage (AKI). Slight increases in blood creatinine levels are linked to higher rates of death both immediately and later on, longer lengths of stay(LOS), and higher costs. [2] Patients with AMI who also developed AKI had a death rate that was 20–40 times higher than those who did not develop AKI. However, there is still a lack of knowledge regarding the morbidity, risk factors, and effects of AKI in individuals with AMI.

The current criteria for AKI include the Kidney Disease Improving Global Outcomes (KDIGO) Clinical Practice Guidelines for AKI developed in 2012, the Acute Kidney Injury Network (AKIN) criteria developed in 2007, and the Risk Injury Failure Loss End-Stage

Renal Disease definition developed in 2004 by the Acute Dialysis Quality Initiative group. [3] KDIGO definition of AKI, which stipulates a rise in serum creatinine as a prerequisite, was used in our investigation. [4]

KEY WORDS : ACUTE KIDNEY INJURY, ACUTE MYOCARDIAL INFARCTION, PROGNOSIS, COMORBIDITIES.

MAIN TEXT

Aim:- To study the incidence of acute kidney injury in patients with acute MI

Objectives:-

1. To estimate the incidence of AKI in patients admitted with MI

2. To study the comorbidities associated with development of AKI

3. To assess five day in hospital mortality in MI patients

MATERIAL AND METHODS

Study Area

The study was conducted among patients attending department of General medicine/ Emergency medicine of Government General Hospital. Kadapa.

Study Design : Cross- sectional study.

Study Period : FEBRUARY 1ST 2021 TO AUGUST 31ST 2022.

Study Population

Subjects presenting with acute myocardial infarction to the department of general medicine/ emergency medicine (in and out patient) of Government General Hospital. Kadapa.

Inclusion Criteria

1. Patients admitted with acute MI in medical ICU at GGH, KADAPA

2. Age more than 18 years.

Exclusion Criteria

1. Age less than 18 years

2. Pre existing chronic kidney disease.

Sample Size

The mean prevalence of acute myocardial infarction in India was 16.2% in a study by A. Sreeniwas K and Nakul S [5] using this as basis the present study sample size can be estimated using the formula $N = 1.96*1.96*pq/L^2$ (absolute precision)

P: Prevalence

Q: 1- prevalence

L: Allowable error

- p= 16.2% = 0.162

- q= 0.838 (1-p)

- L=6% = 0.6

N= 1.96*1.96* 0.162*0.838/0.6*0.6

= 0.5215/ 0.0036

= 145

The minimum sample size required for the study was 145. As the study progressed a total of 150 were included.

Study Tools

Pre-designed pre-tested questionnaire.

Data collection methodology

- The subjects were included in the study after their consent socio demographic details were noted.

- History will be taken from patients and attendants. Important history regarding sudden onset of seizure, altered behavior or altered sensorium, loss of consciousness and any associated history was noted.

- Detailed past medical history that includes the presence or absence of diabetes, duration of diabetes and other known clinical illness like RHD, CAD, CKD, DCLD, Pulmonary Tuberculosis, Bronchial Asthma, Seizure disorder etc.

- Personal history related to addictive habits, sleep, diet, alcohol, smoking and narcotics will also be taken. Examination will be done according to proforma.

- All patients were subjected to complete physical examination, systemic examination and anthropometry.

- All the routine investigation including the complete blood counts, cardiac biomarkers, serum creatinine, ESR, routine urine examination, renal function test, liver function test, serum electrolytes, thyroid profile, urine and blood culture and sensitivity and chest X- ray was done.

Definition

Acute kidney injury: According to KDIGO if there is an increase in serum creatinine by 0.3mg/dl or more within 48 hours [or] increase in serum creatinine to 1.5 times baseline or more within the last 7 days [OR] urine output <0.5ml/kg/hr for 6 hours.

Data analysis

- The data collected was coded, entered into Microsoft excel work sheet and exported to SPSS.

- Data was analyzed using statistical package for social sciences (SPSS) version 21.

- Data is presented as percentage in categories and then presented as tables and diagrams. Chi-square test and Independent T test was used for test of significance.

- A p- value of 0.05 will be considered statistically significant for all statistical tests performed.

RESULTS

I. Distribution according to age

Age group	Frequency	Percent
36- 45 years	10	6.7%
46- 55 years	39	26%
56- 65 years	66	44%
66- 75 years	21	14%
>75 years	14	9.3%
Total	150	100%
Mean age: 59.94± 9.35 years		

TABLE I: AGE DISTRIBUTION

Table 1 shows the age distribution, among the 150 subjects 66 of them were between 56 and 65 years, 39 were between 46- 55 years, 21 were between 66- 75 years, 14 were above 75 years and 10 were in between 36- 45 years. The mean age was 59.94± 9.35 years.

II. Gender distribution

The study consisted of 80 (53.3%) males and 70 (46.7%) females with the sex ratio being 1.1: 1 [M: F]
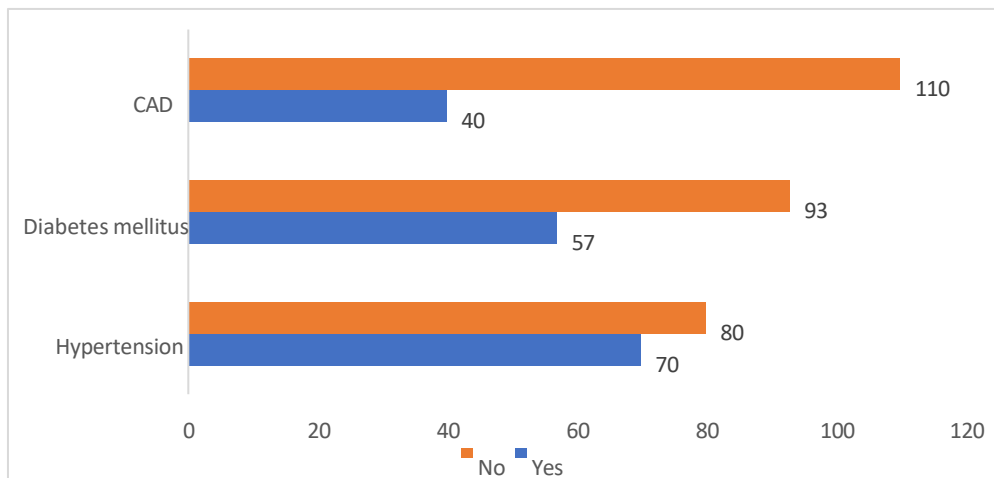
III. Distribution according to comorbidities

CHART I: Distribution according to comorbidities

Comorbidities were noted for all the subjects 70 (46.7%) were hypertensives, 57 (38%) diabetics and 40 (26.7%) had history of coronary artery disease as shown in above bar chart

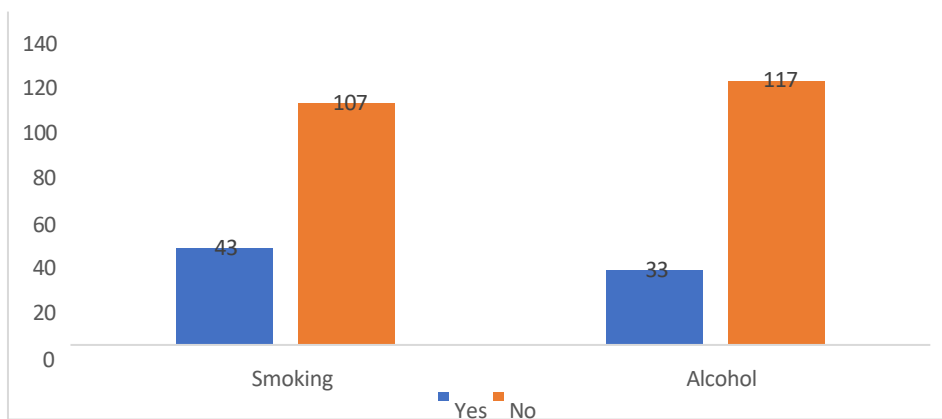## IV. Distribution according to habits

CHART II: Distribution according to habits

The habits were noted for all the subjects where 43 were smokers and 33 were alcoholics as shown in above column chart

V. Distribution according to blood pressure

Mean SBP was 134.8± 31.59 mm of Hg and mean DBP was 84.33± 11.37 mm of Hg.

VI. Distribution according to investigations

Investigation	Frequency	Percent
Haemoglobin (gm/dl)		
>11 gm/dl	102	68%
10- 11 gm/dl (mild)	27	18%
7- 10 gm/dl (moderate)	21	14%
4- 7 gm/dl (severe)	-	-
Total	150	100%
Mean Hb: 12.01± 1.56 (gm/dl)		
Total cholesterol		
>200 mg/dl	35	23.3%
<200 mg/dl	115	76.7%
Total	150	100%
Mean cholesterol: 183.73± 42.4		
Triglycerides		
>150 mg/dl	30	20%

<150 mg/dl	120	80%
Total	150	100%
Mean triglycerides: 131.27± 61.49		
Random blood sugar at admission		
Mean RBS: 163.75± 59.13 mg/dl		

TABLE II: Distribution according to investigations

The mean haemoglobin % in the study was 12.01± 1.56 (gm/dl) . The mean total cholesterol was 183.73± 42.4 mg/dl with 35 of the 150 having elevated levels and the mean triglycerides was 131.27± 61.49 mg/dl with 30 of the subjects having increased levels as shown in table 6. The mean random blood sugar at admission was 163.75± 59.13 mg/dl.

VII. Serum creatinine levels

Serum creatinine	Frequency	Percent
At admission		
<0.7 mg/dl	14	9.3%
0.7- 1.4 mg/dl	129	86%
>1.4 mg/dl	7	4.7%
Total	150	100%
Mean: 0.89±0.29		
After 48 hours		
<0.7 mg/dl	2	1.3%
0.7- 1.4 mg/dl	116	77.4%
>1.4 mg/dl	32	21.3%
Total	150	100%

Mean: 1.14±0.46

TABLE III: SERUM CREATININE LEVELS

At admission the mean serum creatinine was 0.89±0.29 mg/dl and 48 hours later the mean was 1.14±0.46. It was clearly evident that rise in the creatinine levels 48 hours later suggesting AKI as shown in table .
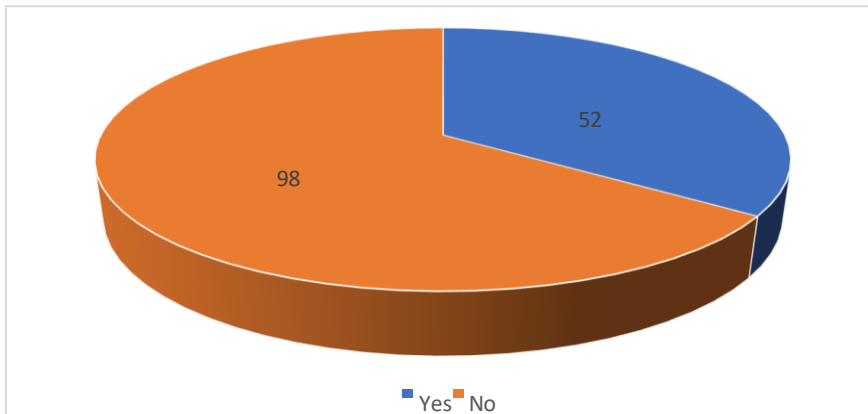
VIII. AKI distribution

CHART III: AKI DISTRIBUTION

In the study 52 (34.6%) had AKI and the remaining 98 (65.4%) did not have AKI as seen in table 8. The incidence of AKI in the study was 34.6%.
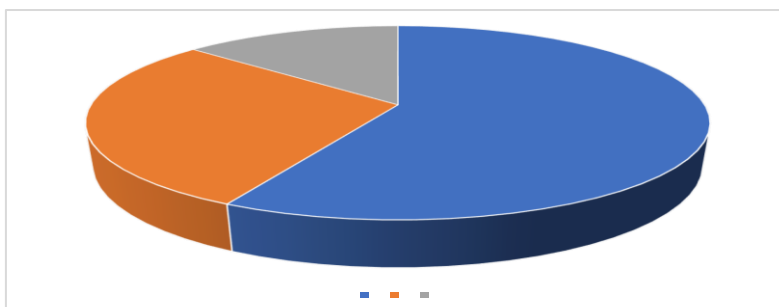
IX. AKI stages

CHART IV: AKI STAGES

Among the 52 subjects with AKI majority (57.7%) were stage 1, 28.8% were stage 2 and 13.5% were stage 3 .

X. Thrombolysis distribution

Thrombolysis	Frequency	Percent
Lysed	102	68%
No	48	32%
Total	150	100%

TABLE IV A: THROMBOLYSIS DISTRIBUTION

Thrombolysis among the AKI subjects (n=52)

Thrombolysis	Frequency	Percent
Lysed	44	84.7%
No	8	15.3%
Total	52	100%

TABLE IV A: THROMBOLYSIS AMONG AKI PATIENTS

In the study 102 (68%) had thrombolysis and the remaining 48 (32%) were non- lysed as seen in table 10a. And among the 52 AKI subjects 44 had thrombolysis .

XI: Duration of chest pain

The duration of chest pain among the subjects showed 40 (26.6%) the pain was <2 hours, in 29 (19.3%) pain was between 2- 4 hours, in 30 (20%) the pain was between 4- 6 hours and in the remaining 51 (34) the pain was for >6 hours. The mean duration of chest pain was 60.3± 8.03 hours.

XII. Distribution according to outcome of the subjects (n=150)

Outcome	Frequency	Percent
Alive & discharged	127	84.6%
Dead	23	15.4%
Total	150	100%

TABLE V: Distribution according to outcome of the subjects

Pie chart showing outcome among the AKI subjects
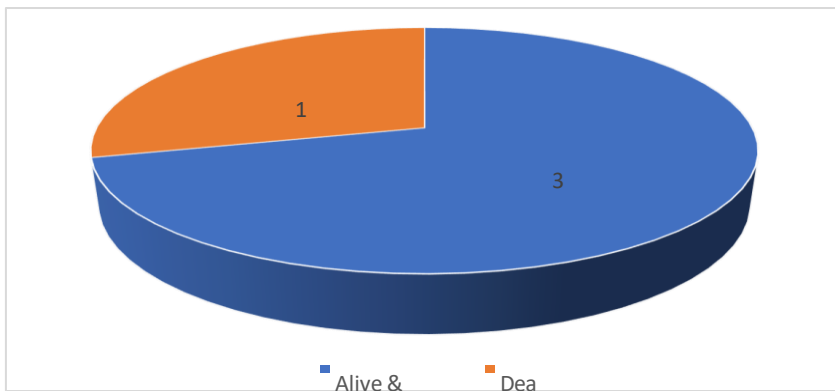

CHART V : outcome among the AKI subjects

The overall mortality rate in the study was 15.4% and among the 52 AKI subjects

the mortality rate was 28.8% respectively.

XIII. Distribution according to hospital stay

The mean days of hospital stay was 12.46± 7.51days with majority of them were hospitalized

for >5 days.

XIV. Association between outcome and various factors

	Variable	Mean	SD	95% CI		pvalue
				Lower	Upper	
	Age	59.94	9.35	56.57	59.6	**0.001***
	Gender	1.46	0.5	0.48	0.27	**0.001***
	Hypertension	1.53	0.5	0.41	0.21	**0.001***
	DM	1.62	0.48	0.32	0.12	**0.001***
	CAD	1.73	0.44	0.20	0.02	**0.01***
	Smoking	1.71	0.45	0.22	0.03	**0.001***
	Alcohol	1.78	0.41	0.15	0.02	0.15
	Cholesterol	183.73	42.4	175.04	188.72	**0.001***
	Triglycerides	131.27	61.49	119.49	139.35	**0.001***
	Creatinine after 48 of admission	1.14	0.46	0.79	0.61	**0.001***
	AKI stage	0.4	0.73	1.56	1.31	**0.001***
Outcome	Thrombolysis	1.32	0.47	0.62	0.41	**0.001***
	Chest pain	6.03	80.3	2.88	5.48	**0.001***
	Hospital stay	10.18	7.51	7.35	9.31	**0.001***
	*Level of significance: p<0.05					

TABLE VI : Association between outcome and various factors

Above table shows the association between the subject's outcome and other factors were a highly statistically significant (p<0.001) association was obtained for all except alcohol. From the study it can be concluded that increasing age, male population, hypertensives, diabetics, history of CAD and smoking were at a higher risk of AKI and mortality. The other contributing factors were increased total cholesterol levels, increased triglycerides and increased creatinine levels. Increasing AKI stage, thrombolysis, chest pain and hospital stay were directly associated.

DISCUSSION

AGE DISTRIBUTION

In this study, 44% were in the age group of 56 and 65 years, 26% were between 46- 55 years, 14% were between 66- 75 years, 9.3% were above 75 years and 6.7% were between 36- 45 years. The mean age was 59.94± 9.35 years.

Our study findings were comparable to a study by Wang C et al in which mean age of study subjects was 67 years[6]. This findings were similar to a study by Wetmore JB et al in which the mean age of participants was 59 years.[7] These findings were similar to a study by Liu KL et al in which the meanage was 59 ± 13 years.[8]

This study findings were almost similar to a study by Queiroz RE et al in which the mean age of patients was 62.5 ± 12.5years.[9]

GENDER DISTRIBUTION:

This workup consisted of 53.3% males and 46.7% females with the sex ratio being 1.1: 1 [M: F].

Results of this study were comparable to a study by Wang C et al in which 26% were females and 74% were males.[6]

The results of the our study were similar to a study by Wetmore JB et al in which 67% were males and 33% were females.[7]

HYPERTENSIVE PATIENTS

In this study, the common comorbidities among study subjects were hypertension (46.7%), Diabetes (38%) and coronary heart disease(26.7%).

Our study results were comparable to a study by Wang C et al in which the comorbidities were hypertension (63.1%), Diabetes (29.9%), coronary artery disease (9.8%) and cerebral infarction (14.3%).[6]

This results were similar to a study by Wetmore JB et al in which major comorbidities reported were hypertension (87%), Diabetes (70.4%), dyslipidemia (39.5%) and chronic heart failure (23.5%).[7]

The obtained results of our study were similar to a study by Liu KL et al in which the comorbidities observed were hypertension (48.5%), Diabetes (27.3%), hyperlipidemia (25%) and CAD history (15.2%).[8]

These findings were similar to a study by Tsai TT et al in which comorbidities were diabetes (35.8%), dyslipidemia (79.9%), and hypertension (81.7%). The majority of patients (71.2%) presented with acute coronary syndromes

COMPARISON OF DIFFERENT STAGES OF AKI AMONG DIFFERENT STUDIES:

In this study, at admission the mean serum creatinine was 0.89±0.29 mg/dl and 48 hours later the mean was 1.14±0.46 mg/dl. There was increase in the creatinine levels after admission suggesting acute kidney injury in MI patients.

The results were comparable to a study by Wang C et al in which mean serum creatinine levels were 85 µmol/L.[6]

These results were comparable with a study by Abdul Hussein MA et al in which mean serum creatinine was 0.783 ±0.241 mg/dl.[10]

This findings concurred with a study by Zhang H et al in which the mean serum creatinine was 98.50± 38.59 mmol/L.[11]

In this study the incidence of acute kidney injury in the study was 34.6%. The results were similar to a study by Wang C et al in which the incidence of AKI was 26%.[6] This findings differed with a study by Liu KL et al in which incidence of AKI was 9.8%.[8]

The results in this study were comparable with a study by Abdul Hussein MA et al in which incidence of AKI was 12.7%.[10]

This findings concurred with a study by Fox CS et al in which 16.1% had AKI[11].

The findings of this study differed with a study by Shacham Y et al in which 9.6% developed AKI.[12]

COMPARISON OF INCIDENCE OF AKI AMONG DIFFERENT STUDIES

In the above study , among the subjects with AKI majority (57.7%) were stage 1, 28.8% were stage 2 and 13.5% were stage 3. The resulted findings were similar to a study by Wang C et al in which 11.9% patients had stage 1, 9.1% patients had stage 2, and 5.0% patients had stage 3 diseases.[6]

This study results were almost similar to a study by Queiroz RE et al in which 11.6% were stage 1, 6. 4% were stage 2 and 2.5% were stage 3.

The findings of this differed with a study by Tsai TT et al in which 6% had AKI stage 1, 0.5% had AKI stage 2 and 0.3% had AKI stage 3.

The findings of this study were comparable with a study by Abdul Hussein MA et al in which 57% were in Stage 1, 29% in stage 2 and 14% in stage 3[10] .

The findings in this study concurred with a study by Fox CS et al in which 6.5% had mild AKI, 5.6% had moderate AKI and 4% had severe AKI.[11] The results of this study were similar to a study by Shacham Y et al in which majority had stage 1 followed by stage 2 and stage 3 disease [12]

COMPARISON OF DIFFERENT STAGES OF AKI COMPARING IINCIDENCE OF AKI IN THROMBOLYSED PATIENTS AMONG DIFFERENT STUDIES:

In our study ,overall, 68% had thrombolysis and among the subjects with AKI, 84.6% had thrombolysis.

The current study results were different compared to a study by Wang C et al in which 2.7% overall and 3.4% among AKI patients needed thrombolysis therapy.[6]

The findings of this study differed with a study by Tsai TT et al in which 1.4% overall and 15.8% of AKI patients had thrombolysis.

The present study findings were comparable with a study by Abdul Hussein MA et al in which 73% had thrombolysis.[10]

This study findings concurred with a study by Fox CS et al in which 8.4% and 32.7% of patients with and without AKI had major bleeding.[13]

COMPARING THROMBOLYSED PATIENTS WITHOUT AKI COMPARISON OF MORTALITY RATES AMONG DIFFERENT STUDIES

In the above study, the overall mortality rate was 15.4% and among the AKI subjects the mortality rate was 28.8%.

The findings of thi concurred with a study by Wang C et al in which the mortality rate of the AKI group was 20.5%, and the mortality rate of the non-AKI group was 0.6%.[6]

The current study results were almost similar to a study by Queiroz RE et al in which overall mortality rate was 11.8% and was higher in patients with AKI (34.9%).[38]

The in-hospital mortality rate was 9.7% for patients with AKI and 34% for those requiring dialysis compared with 0.5% for patients without AKI in a study by Tsai TT et al.

These results were comparable with a study by Abdul Hussein MA et al in which mortality rate was 3.6% while among subjects with AKI the mortalityrate was 50%.[10]

This study findings were similar to a study by Hossain M et al in which mortality was significantly high in AKI group (7.15%) compared to no AKI group (1.25%).

This study findings concurred with a study by Fox CS et al in which Inhospital mortality rates for those with mild, moderate and severe AKI were 6.6%, 14.2%, and 31.8% compared to 2.1% without AKI.[13]

The mean days of hospital stay in this study was 12.46 ± 7.51 days and majority of them were hospitalized for >5 days.

The results were similar to a study by Wang C et al in which length of hospital stay was 12 days among non- AKI patients and 20 days among AKI patients.[6]

The findings of this study differed with a study by Tsai TT et al in which the mean $\pm$ SD length of stay was 2.2 ± 4.4 days.

The findings of the study concurred with a study by Hossain M et al in which mean hospital stay was 10.71 ± 1.91 days and 5.86 ± 0.84 days in AKI and Non – AKI patients.

In this study, association between the subject's outcome and other factors was found to be highly statistically significant ($p<0.001$) association for all except alcohol. From the study it can be concluded that increasing age, male population, hypertensives, diabetics, history of CAD and smoking were at a higher risk of AKI and mortality. The other contributory factors were increased total cholesterol levels, increased triglycerides and increased creatinine levels. Increasing AKI stage, thrombolysis, chest pain and hospital stay were directly associated with mortality.

The findings of this study were similar to a study by Wang C et al in which logistic regression analysis showed that the independent risk factors for AKI in patients with AMI included: age (>60 years old), hypertension andchronic kidney disease.[6]

This study findings were similar to a study by Liu KL et al in which AKI was associated with hypertension and coronary artery disease.[37]These findings differed with a study by Liu KL et al in which there was no significant association for age, gender, diabetes mellitus, and hyperlipidemia with acut kidney injury.[8]

The above findings were almost similar to a study by Queiroz RE et al in which age was found to be associated with AKI and mortality.[9]

This study results were similar to a study by Tsai TT et al in which age, thrombolysis and diabetes were independent predictors of AKI and mortality.

These findings were comparable with a study by Abdul Hussein MA et al in which patients who developed AKI were significantly associated with older age, hypertension, previous CAD and diabetes mellitus.[10]

This findings concurred with a study by Hossain M et al in which older age (>65 years), diabetes mellitus, dyslipidemia and smoking were significantly correlated with the development of AKI.

The results of the above study were similar to a study by Shacham Y et al in which mortality was higher among AKI patients. It was also reported that Age, hypertension, chronic kidney injury and low left ventricular ejection fraction were independent predictors of developing AKI.[12]

These findings concurred with a study by Amin AP et al in which AKI risk factors were chronic kidney disease, cardiogenic shock, diabetes mellitus
and heart failure.[14]

This study results were comparable with a study by Kanic V et al in which bleeding, heart failure, age ≥ 70 years, renal dysfunction, diabetes, and hypertension predicted AKI.[15]

SUMMARY AND CONCLUSION

This cross- sectional study was conducted in the department of general medicine of Government General Hospital. Kadapa with the aim to determine the prevalence of acute kidney damage (AKI) and its relationship with comorbidities among patients with acute myocardial infarction.

The study was done from FEBRUARY 1ST 2021 TO AUGUST 31ST 2022. This study consisted a total of 150 subjects. After obtaining consent from all the subjects' detailed history and clinical examination was noted using a pre tested questionnaire.
The results of the study showed the overall mean age was 59.94± 9.35 years and consisted of 80 males and 70 females. In the study 46.75 were hypertensives, 38% were diabetics and 26.7% had CAD. Among the 150 subjects 43 were smokers and 33 were alcoholics.

The mean haemoglobin was 12.01± 1.56 (gm/dl), mean cholesterol was 183.73± 42.4 mg/dl, mean triglycerides was 131.27± 61.49 mg/dl and the mean random blood sugar was 163.75± 59.13 mg/dl. The mean serum creatinine at admission was 0.89±0.29 mg/dl and after 48 hours the mean was 1.14±0.46. The incidence of acute kidney injury in the study was 34.6% (52 subjects).

Among these 52, 30 were stage 1, 15 were stage 2 and 7 were stage 3. The mean duration of chest pain was 60.3± 8.03 hours.

The mortality was 15.4% (23 subjects) in the study and among the 52 AKI subjects the mortality was 28.8% (15 subjects).

The hospital duration was 10.18± 7.51 days. the association between the subject's outcome and other factors were a highly statistically significant ($p < 0.001$).

LIMITATIONS

1. Small sample size

2. There could be an element of information bias in this study.

3. Limited previously conducted studies.

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