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Original Research Article

Estimated Glomerular Filtration Rate(eGFR) and Short Term Outcomes in Patients with Acute Decompensated Heart Failure(ADHF) Admitted in a Tertiary Care Centre In Kerala

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ABSTRACT

Background
Admission with acute decompensated heart failure(ADHF) is associated with excessive morbidity and mortality. Despite impressive advances in management of heart failure, ADHF remains one of the major health care problem worldwide. A significant component of heart failure (HF) related mortality occurs during hospital stay. Although there exist many long-term prognostic markers for heart failure (HF), there is a dearth of studies regarding predictors of short term outcomes. In this study, we aimed to determine whether eGFR can be used as a predictor of short-term outcomes in ADHF patients and to find other sensitive, affordable short term outcome predictors if any.

Objectives
1. To identify whether eGFR can be used as a predictor of short term outcomes in ADHF patients.
2. To study factors associated with high in hospital mortality in ADHF patients.

Methodology
A hospital based prospective observational study was conducted among 117 patients admitted with ADHF in Government T.D. Medical College Alappuzha. Samples were selected by convenient sampling method. After obtaining informed written consent data was collected using proforma and it was analysed using SPSS version 20.0. In this study patients were divided into two groups based eGFR (calculated by MDRD formula from admission creatinine values). An eGFR ≥45ml/min/1.73m^2 was considered high and eGFR < 45ml/min/1.73m^{2}was considered low. Then short-term outcomes in both groups were compared. We also divided patients into two groups based on ejection fraction (EF). HFpEF was defined as having EF ≥45% and HFrEF as having EF<45%. Short term outcomes in these groups were also compared.

Result
Majority of study population was elderly with female preponderance (55.6%). Majority of the cases were readmissions for acute decompensation of HF with most common precipitating factor being ischemia (41%), drug default (16%) and volume overload (15.4%). 34.2% had high eGFR and 65.8%

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had low eGFR. 41% patients had HFrEF and 59% had HFpEF. In 61.4% patients who were readmitted with heart failure, GDMT was prescribed for 37%. Only 51.9% patients were adherent to medications.

Study population were treated with antiplatelets (100%), diuretics (82.1%), statins (76.9%), ACEI (41%), ARB (35.9%), MRA (35.9%), beta blocker (30.8%), vasodilator (15.4%)and SGLT2i(8%). None was treated with ARNI, ivabradine, digoxin. Low eGFR was associated with poor short term outcomes as measured by development of hypotension, arrhythmia, need for inotropic support, NIV, invasive ventilation, dialysis support, ICU admission, duration of ICU stay, duration of hospital stay and mortality. Other factors associated with poor short term outcomes are HFrEF, comorbidities like CAD, DM and HTN. Noncompliance to GDMT, higher NYHA FC, readmission, ischemia, LVDD and comorbidities like CAD,DM,HTN are associated with higher in hospital mortality.

Conclusion

Low eGFR and HFrEF was associated with poor short term outcomes as measured by development of complications, requirement of ionotope, ventilator and dialysis support and mortality. There is a strong association between noncompliance to GDMT, higher NYHA FC, readmission, ischemia, LVDD, CAD,DM and HTN with higher in hospital mortality in ADHF.

Keywords: ADHF, low eGFR, high eGFR, short term outcomes, HFrEF, HFpEF

INTRODUCTION

Heart failure (HF) is a complex clinical syndrome that results from structural or functional impairment of ventricular filling or ejection of blood, which in turn leads to cardinal clinical symptoms of dyspnoea and fatigue and signs of heart failure namely oedema and rales. Admission with the diagnosis of ADHF is associated with excessive morbidity and mortality, with nearly half of these patients getting readmitted for management within 6 months, and a high short-term (5% in hospital) and long-term cardiovascular mortality(20% at 1 year).[1] Chronic heart failure involves a complex interaction between the heart and kidneys. The severity of heart failure increases with the release of endogenous vasoconstrictors, such as norepinephrine, renin-angiotensin, vasopressin, and endothelin ,which affect kidney function.[2] Indicators of renal function, such as serum creatinine and eGFR, are independent prognostic factors in patients with heart failure.[3] Prescription and adherence to guide line directed medical therapy(GDMT) is one of the important mortality and morbidity predictor in heart failure patients. Guideline directed medical therapy (GDMT) is defined as being prescribed the combination of beta-blockers (BB), renin angiotensin system (RAS) blockers, such as angiotensin converting enzyme inhibitors (ACE-I) or angiotensin receptor blockers (ARB), and mineralocorticoid receptor antagonists (MRA). GFR (glomerular filtration rate) is equal to the total of the filtration rates of the functioning nephrons in the kidney. GFR is considered the most useful index of kidney function in health and disease, which in conjunction with albuminuria, generally assessed from urine albumin-to-creatinine ratio (uACR), can help determine the presence and severity of chronic kidney disease (CKD).[4] There are several prognostic factor in chronic heart failure such as old age, diabetes, LVEF<45%, higher NYHA FC, cardiomegaly, prior HF hospitalization, male sex, lower BMI and lower diastolic blood pressure. Most of the studies focus mainly on predictors of long-term morbidity and mortality and very few studies have included predictors of in hospital mortality. Also studies on heart failure are sparse from Kerala, except few studies by Trivandrum heart failure registry. Therefore, it is very important to conduct a study in heart failure patients to find the predictors of short term outcomes and in hospital mortality, which can be done easily at an affordable cost and help in aggressive management of high risk heart failure patients. With this background in consideration, the present study was planned to find whether eGFR can be used as a predictor of short term outcomes (including the complications and mortality) in ADHF patients and to find the factors associated with high in hospital mortality.

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MATERIALS AND METHODS

Study design: This is a prospective observational study which was approved by the institutional review board and received the ethics committee approval from the institutional ethics committee.

Study population: Patients admitted in the Medicine and Cardiology wards and ICU of Government T D Medical College Alappuzha.

Study duration: May 2021 to April 2022

Sample size: In the reference study by Kajimoto et al 46% patients had an eGFR<45mL/min per 1.73 m^2

Using the formula for sample size calculation ie, $4PQ/D^2$ (P=46%, Q= 100-P=54, d=20% of Prevalence), the sample size is calculated to be 117.

Sampling procedure

Convenient sampling from patients admitted with acute decompensated heart failure satisfying the inclusion and exclusion criteria in medicine and cardiology wards and ICU, in Government T.D. Medical College, Alappuzha. Definitions used in the study are as follows

Acute decompensated heart failure(ADHF): Documented NYHA functional class ll-lV of heart failure presenting with atleast one sign of HF.

New York Heart Association (NYHA) Functional Classification

Functional capacity	Objective Assessment
CLASS I	No symptoms or limitation while performing ordinary physical activity(walking, climbing stairs etc).
CLASS II	Mild symptoms (mild shortness of breath, palpiations, fatigue and/or angina) and slight limitation during ordinary physical activity.
CLASS III	Marked limitation in activity because of symptoms, even during less than ordinary physical activity (walking short distances 20-100m). Comfortable only at rest.
CLASS IV	Severe limitation with symptoms even while at rest. Mostly bedbound patients.

Or

B) Diagnosis from symptoms and signs(1+2+3)

1. Any 3 out of following symptoms
   Dyspnoea, fatigue, exercise intolerance, orthopnoea, PND, cough, wheezing, presyncope, syncope, palpitations, angina
1. Atleast one sign of Right Heart Failure (RHF)
   Elevated JVP (jugular venous pressure), bilateral pedal odema, abdomino-jugular reflex, tender hepatomegaly, ascites
2. Atleast one sign of Left Heart Failure (LHF)

Pulmonary rales, S3

High eGFR =eGFR ≥45 ml/min per 1.73m^2

Low eGFR =eGFR <45 ml/min per 1.73m^2

Heart failure with reduced ejection fraction(HFrEF)=EF< 45%

Heart failure with preserved ejection fraction(HFpEF)=EF≥45%

Short term outcome variables- length of hospital stay, development of hypotension, arrhythmia, need for ionotropes, NIV, intubation, dialysis, ICU admission, duration of ICU stay, in hospital mortality

Inclusion criteria

1. Patients of both sex aged between 20 to 80 years.

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2. Patients with HFrEF and HFpEF
3. Those willing to participate in study.

Exclusion criteria

1. Evidence of any renal disease
2. Documented CKD/diabetic nephropathy/obstructive uropathy
3. Patients on maintenance hemodialysis(MHD)
4. URE-broad or waxy cast/RBC cast/pyuria/ proteinuria
5. Sonological evidence of CKD -lost corticomedullary differentiation(CMD), shrunken kidney, bilateral hydro-ureteronephrosis
6. Patients presenting with gross hematuria
7. Baseline serum creatinine levels ≥ 2mg/dl
8. Bladder outlet obstruction(BOO){symptoms of BOO, h/o urethral stricture, prostatomegaly}
9. Mimickers of ADHF-massive pulmonary embolism, extensive pneumonia with ARDS, cardiac tamponade

Methodology

study will be carried out in patients presenting with heart failure (diagnosed from history, clinical examination, echo and medical records). Qualifying patients will be undergoing detailed history and clinical examination after obtaining consent. Serum creatinine will be obtained within 24 hrs of admission. eGFR is calculated using MDRD (Modification of Diet in Renal Disease) formula eGFR (mL/min per 1.73 m2) = 186.3 × PCr ($e^{-1.154}$) × age ($e^{-0.203}$)×(0.742 if female) × (1.21 if black).
Echo will be taken to obtain ejection fraction. The patient will be followed up during the entire hospital stay. The treatment received by the patient, their clinical course in the hospital will be noted.

Statistical Analysis

All collected data will be checked and verified thoroughly to reduce inconsistency. Data will be entered into excel sheet. Data will be analysed using SPSS version 20.0. The categorical data will be expressed in rates, ratios and percentage and comparison will be done by chi-square test. The continous data will be expressed as mean +/- SD and comparison will be done using t test. Statistical significance will be calculated using chi-square and Mann-Whitney test. Degree of correlation will be examined by the test according to spearman and Pearson. Results will be presented in the form of tables, graphs and charts

RESULTS

Study was done in 117 patients. Majority of the patients were in the age group of 71-80 (38.5%), followed by 51-60 years (29.1%). The age range varied from 31-80. Study population included 44.4% males and 55.6% females.

Type of admission

64.1% patients were readmitted for acute decompensation of heart failure and 35.9% patients were admitted for the first time for heart failure.

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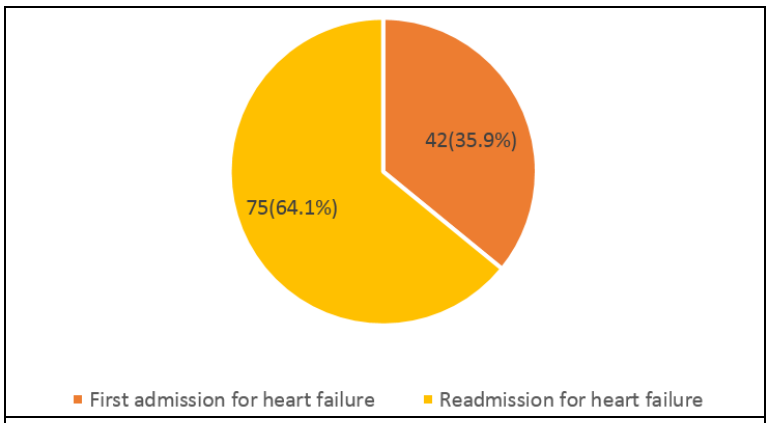

Figure 1 : Type of admission for heart failure

Clinical features of acute decompensated heart failure

The most common symptom was dyspnoea (100%) followed by, orthopnoea (89.7%), pedal oedema (61.5%) and exercise intolerance (59%). Most common sign was pulmonary rales (100%) followed by elevated JVP (89.7%) and pedal odema (66.7%). 79.5% belonged to NYHA FC IV and 20.5% to NYHA FC III.

Symptoms of heart failure	Yes		No	
	Frequency	Percent	Frequency	Percent
Dyspnoea	117	100.0	0	0.0
Easy fatigability	39	33.3	78	66.7
Angina	36	30.7	81	69.3
Cough	24	20.5	93	79.5
Pink frothy sputum	0	0.0	117	100.0
Presyncope	12	10.3	105	89.7
Syncope	6	5.1	111	94.9
Palpitation	24	20.5	93	79.5
Wheezing	12	10.3	105	89.7
Orthopnoea	105	89.7	12	10.3
PND	12	10.3	105	89.7
Exercise intolerance	69	59.0	48	41.0
pedal oedema	72	61.5	45	38.5

Table 1 : Symptoms of heart failure

Signs of heart failure	Yes		No	
	Frequency	Percent	Frequency	Percent
Elevated JVP	105	89.7	12	10.3
pedal oedema	78	66.7	39	33.3
Ascites	6	5.1	111	94.9
Anasarca	0	0.0	117	100.0
Tender hepatomegaly	6	5.1	111	94.9
Abdomino jugular reflex	57	48.7	60	51.3
Altered mental status	33	28.2	84	71.8
Cold extemities	27	23.1	90	76.9
Pulmonary rales	117	100.0	0	0.0
S3	39	33.3	78	66.7
S4	0	0.0	117	100.0

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Tricuspid PSM (Pan Systolic Murmur)	6	5.1	111	94.9
Mitral PSM	24	20.5	93	79.5
Other signs	6	5.1	111	94.9

Table 2 : Signs of heart failure

NYHA FC	Frequency	Percent
III	24	20.5
IV	93	79.5
Total	117	100.0

Table 3 : NYHA functional class

Comorbidities

Out of 117 patients 71.8% had CAD, 56.4% had hypertension, 46.2% had diabetes, 25% had dyslipidaemia and 20.5% had COPD. CKD patients were excluded from study.

	Yes		No	
	Frequency	Percent	Frequency	Percent
Diabetes	54	46.2	63	53.8
Hypertension	66	56.4	51	43.6
dyslipidaemia	30	25.6	87	74.4
CAD	84	71.8	33	28.2
RHD (Rheumatic Heart Disease)	0	0.0	117	100.0
Valvular heart disease	0	0.0	117	100.0
AF	15	12.8	102	87.2
VT (Ventricular Tachycardia)	12	10.3	105	89.7
SVT (Supra Ventricular Tachycardia)	0	0.0	117	100.0
CVA (Cerebro Vascular Accident)	6	5.1	111	94.9
COPD	24	20.5	93	79.5
CKD	0	0.0	117	100.0
CLD (Chronic Liver Disease)	6	5.1	111	94.9

Table 4 : Comorbidities of study population

In study population 44.4% were smokers and 26.5% were alcoholics. 20.5% of study population had anaemia. High urea and creatinine was seen in 28.2% and 59% patients respectively. 71.8% patients had hyponatremia while 53.8% patients had positive Troponin I.

eGFR distribution of study population

34.2% had high eGFR and 65.8% had low eGFR.

eGFR	Frequency	Percent
≥45(high eGFR)	40	34.2
<45(low eGFR)	77	65.8
Total	117	100.0

Table 5 : eGFR distribution of study population

Echo findings in heart failure patients

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41% patients had HFpEF and 59% had HFrEF. Most common echocardiographic finding was mitral regurgitation (56.4%) followed by LV systolic dysfunction(LVSD) (51.3%), LV diastolic dysfunction(LVDD)(43.6%) and RWMA (30.8%). PAH was seen in 12.8% cases.

Echo EF(%)	Frequency	Percent
≥45(HFpEF)	48	41.0
<45(HFrEF)	69	59.0
Total	117	100.0

Table 6 : Ejection fraction in heart failure

Echo findings	Yes		No	
	Frequency	Percent	Frequency	Percent
RWMA	36	30.8	81	69.2
LVSD	60	51.3	57	48.7
LVDD	51	43.6	66	56.4
RV dysfunction	12	10.3	105	89.7
MR	66	56.4	51	43.6
TR	30	25.6	87	74.4
AR	12	10.3	105	89.7
PAH	15	12.8	102	87.2

Table 7: Echo findings in heart failure patients

Pattern of prescription of GDMT during previous admission and adherence to GDMT

In 61.4% patients who were readmited for heart failure, beta blocker was prescribed for 85.2%, ACEI for 44.4%, ARB for 29.6%, MRA for 44.4%. GDMT was prescribed for 37%. 51.9% patients were adherent to medications prescribed.

	Yes		No	
	Frequency	Percent	Frequency	Percent
BB	69	85.2	12	14.8
ACEI	36	44.4	45	55.6
ARB	24	29.6	57	70.4
MRA	36	44.4	45	55.6
BB+ACEI/ARB+MRA (GDMT)	30	37.0	51	63.0
Adherence to medication	40	51.9	37	48.1

Table 8 : Prescription of GDMT during previous admission and adherence

Cause for acute decompensation of heart failure

Most common cause for decompensation was ischemia(41%) followed by, drug default(16%), volume overload(15.4%), infections(11.1%) and accelerated hypertension(8.5%).

Cause for decompensation	Frequency	Percent
Infections	13	11.1
Ischemia	48	41.0
Arrhythmia	3	2.6
Accelerated hypertension	10	8.5
Drug default	19	16.2
Volume overload	18	15.4
Others	6	5.1

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Total	117	100.0

Table 9 : Cause for acute decompensation

Treatment of acute decompensated heart failure

All patients were treated with antiplatelets either single or dual. 82.1% were treated with diuretics followed by statins (76.9%), ACEI (41%), ARB (35.9%), MRA (35.9%), beta blocker (30.8%) and vasodilator (15.4%). None was treated with ARNI, ivabradine and digoxin.

Short term outcomes in ADHF patients

38% needed inotropic support, 59% needed NIV, 31.6% was intubated, 53% required ICU admission, 35.9% developed hypotension, 12.8% developed arrhythmia and 7.7% required dialysis support. Out of 62 patients who required ICU admission, mean duration of ICU stay was >2days and ≤2days, in 54.8% and 45.2% cases respectively. The mean duration of hospital stay was <5 days in 41%, 5-10 days in 39.3% and >10 days in 19.7% cases. Out of 117 patients, 56.4% improved with treatment, in 29.1% condition remained same and 14.5% expired.

	Yes		No	
	Frequency	Percent	Frequency	Percent
Ionotrope support	45	38.5	72	61.5
NIV	69	59.0	48	41.0
Invasive ventilation	37	31.6	80	68.4
ICU admission	62	53.0	55	47.0
Hypotension	42	35.9	75	64.1
Arrhythmia	15	12.8	102	87.2
Dialysis support	9	7.7	108	92.3

Table 10 : Short term outcomes in ADHF patients

Days in ICU	Frequency	Percent
≤2 days	28	45.2
>2days	34	54.8
Total	62	100.0

Table 11 : Duration of ICU stay

Duration of hospital stay	Frequency	Percent
<5 days	48	41.0
5-10 days	46	39.3
>10 days	23	19.7
Total	117	100.0

Table 12 : Duration of hospital stay

Condition at discharge	Frequency	Percent
Improved	66	56.4
Same	34	29.1
Expired	17	14.5
Total	117	100.0

Table 13 : Condition at discharge

Association of eGFR with short term outcomes

Low eGFR (<45ml/min/1.73m2) was associated with poor short-term outcomes as measured by development of hypotension, arrhythmia, need for inotropic support, NIV, invasive ventilation,

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dialysis support, ICU admission, duration of ICU stay, duration of hospital stay and mortality with a p value of 0.0001, 0.003, 0.0001, 0.0001, 0.0001, 0.005, 0.0001, 0.0001, 0.0001 and 0.001 respectively.

Table 14 A, B,C: Association eGFR and short term outcomes

Outcomes	eGFR(ml/min/1.73m2)		Total	p value (chi square test)
	≥45	<45		
inotropic support	0	45	45	0.0001
NIV	11	58	69	0.0001
Invasive ventilation	0	37	37	0.0001
ICU admission	8	54	62	0.0001
Hypotension	0	42	42	0.0001
Arrhythmia	0	15	15	0.003
Dialysis support	0	9	9	0.005

Table 14 A: Association eGFR and short term outcomes

Outcomes		eGFR		Total	p value(chi square test)
		≥45	<45		
Days in ICU	≤2 days	8	20	28	.0001
	>2days	0	34	34	
	Not applicable	32	23	55	
Duration of hospital stay	<5 days	37	11	48	.0001
	5-10 days	3	43	46	
	>10 days	0	23	23	
Condition at discharge	Improved	39	27	66	.0001
	Same	1	33	34	
	Expired	0	17	17	

Table 14 B: Association eGFR and short term outcomes

Mortality	eGFR		Total
	≥45	<45	
Alive	40	60	100
Expired	0	17	17
Total	40	77	117

Table 14 C: Association eGFR and short term outcomes

Chi square p value=0.001

Association between ejection fraction and short-term outcomes

HFrEF was associated with poor short term outcomes such development of hypotension, arrhythmia, need for inotropic support, NIV, invasive ventilation, dialysis support, ICU admission, duration of ICU stay with a p value of 0.0001, 0.02, 0.0001, 0.0001, 0.004, 0.002, 0.0001 respectively. There was no statistically significant association between HFrEF and mortality.

Short term outcomes		EF(%)		Total	p value (Chi square)
		≥45	<45		
inotropic support	Yes	9	36	45	0.0001
	No	39	33	72	
NIV	Yes	18	51	69	0.0001

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	No	30	18	48	
Invasive ventilation	Yes	8	29	37	.004
	No	40	40	80	
ICU admission	Yes	17	45	62	.001
	No	31	24	55	
Days in ICU	≤2 days	14	14	28	0.0001
	>2days	3	31	34	
Hypotension	Yes	8	34	42	.0001
	No	40	35	75	
Arrhythmia	Yes	2	13	15	0.020
	No	46	56	102	
Dialysis support	Yes	0	9	9	.002
	No	48	60	108	
Duration of hospital stay	<5 days	26	22	48	.0001
	5-10 days	21	25	46	
	>10 days	1	22	23	
Mortality	Alive	42	58	100	0.603
	Expired	6	11	17	

Table 15 : Association of ejection fraction and short term outcomes

Association between GDMT and short-term outcomes

There was statistically significant association between GDMT and poor short term outcomes such as duration of hospital stay, mortality with a p value of 0.025 and 0.003 respectively.

Short term outcomes		GDMT		Total	p value(Chi square)
		Yes	No		
inotropic support	Yes	13	31	44	0.128
	No	17	20	37	
NIV	Yes	24	33	57	0.145
	No	6	18	24	
Invasive ventilation	Yes	12	24	36	0.537
	No	18	27	45	
ICU admission	Yes	19	36	55	0.499
	No	11	15	26	
Days in ICU	≤2 days	6	16	22	0.354
	>2days	13	20	33	
Hypotension	Yes	12	29	41	0.143
	No	18	22	40	
Arrhythmia	Yes	7	7	14	0.269
	No	23	44	67	
Dialysis support	Yes	6	3	9	0.055
	No	24	48	72	
Duration of hospital stay	<5 days	6	22	28	0.025
	5-10 days	17	14	31	
	>10 days	7	15	22	
Mortality	Alive	29	35	64	0.003
	Expired	1	16	17	

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Table 16 : Association between GDMT and short term outcomes

Association between type of admission and short term outcomes

Readmission for heart failure was associated with poor short-term outcomes such as development of hypotension, arrhythmia, need for inotropic support, NIV, invasive ventilation and ICU admission with a p value of 0.001, 0.011, 0.0001, 0.008, 0.009, 0.0001 respectively. Readmission was associated with higher mortality with a p value of 0.001.

Short term outcomes		Type of admission		Total	P value(Chi square)
		First admission	Readmission		
Ionotrope support	Yes	7	38	45	0.0001
	No	35	37	72	
NIV	Yes	18	51	69	0.008
	No	24	24	48	
Invasive ventilation	Yes	7	30	37	0.009
	No	35	45	80	
ICU admission	Yes	13	49	62	0.0001
	No	29	26	55	
Days in ICU	≤2 days	6	22	28	0.935
	>2days	7	27	34	
Hypotension	Yes	7	35	42	0.001
	No	35	40	75	
Arrhythmia	Yes	1	14	15	0.011
	No	41	61	102	
Dialysis support	Yes	6	3	9	0.051
	No	36	72	108	
Duration of hospital stay	<5 days	20	28	48	0.546
	5-10 days	15	31	46	
	>10 days	7	16	23	
Mortality	Alive	42	58	100	0.001
	Expired	0	17	17	

Table 17 : Association between readmission and short term outcomes

Factors associated with high in hospital mortality

In addition to low eGFR noncompliance to GDMT, higher NYHA FC, readmission, ischemia, LVDD, CAD, DM and HTN were associated with higher in hospital mortality, all with p value <0.05.

Factors assessed	p value(chi square test)
Low eGFR	0.001
HFrEF	0.603
Non compliance to GDMT	0.003
Hyponatremia	0.072
NYHA FC IV	0.004
Readmission for heart failure	0.001
CAD	0.019
Diabetes mellitus	0.002
Hypertension	0.0001
Ischemia (Troponin I positive)	0.002
LVDD	0.0001

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LVSD	0.706

Table 18 : Factors associated with high in hospital mortality

DISCUSSION

This was a prospective, observational and non-interventional study done in 117 patients admitted with acute decompensated heart failure in government TDMC Alappuzha. Majority of the patients were in the age group of 71-80 (38.5%), followed by 51-60 years (29.1%). The age range varied from 31-80. Study population included

44.4% males and 55.6% females. 64.1% patients were readmitted for acute decompensation of heart failure and 35.9% patients were admitted for the first time for heart failure. In Stigi Joseph et al study, the mean age was 64.3+/-12.9 years and 37% were female.[5] In our study the female preponderance was comparable and mean age group was higher compared to other studies. In this study the most common symptom was dyspnoea (100%) followed by, orthopnoea (89.7%), pedal oedema (61.5%) and exercise intolerance (59%). Most common sign was pulmonary rales (100%) followed by elevated JVP (89.7%) and pedal odema (66.7%). 79.5% belonged to NYHA FC IV and 20.5% to NYHA FC III. None of the patients belonged to NYHA FC 1 or II. In Sanjay et al study, almost one third of participants (32.9%) presented with NYHA class IV heart failure.[6] This was lesser than that found in our study. Out of 117 patients 71.8% had CAD, 56.4% had hypertension, 46.2% had diabetes, 25% had dyslipidaemia and 20.5% had COPD. CKD patients were excluded from study. 44.4% were smokers and 26.5% were alcoholics. 20.5% of study population had anaemia. High urea and creatinine was seen in 28.2% and 59% patients respectively. 71.8% patients had hyponatremia while 53.8% patients had positive Troponin I. In this study eGFR was calculated by MDRD formula from admission creatinine values. An eGFR ≥45ml/min/1.73m2 was considered high and < 45ml/min/1.73m2was considered low. Out of 117 patients 34.2% had high eGFR and 65.8% had low eGFR.

In this study 41% patients had EF >45% and 59% had EF <45%. Most common echocardiographic finding was mitral regurgitation (56.4%) followed by LV systolic dysfunction (51.3%), LV diastolic dysfunction (43.6%) and RWMA (30.8%). PAH was seen in 12.8% cases. In Stigi Joseph et al study more than two-third had reduced ejection fraction (EF) (67.5%). This was higher compared to that found in our study.

In 61.4% patients who were readmitted for heart failure, beta blocker was prescribed for 85.2%, ACEI for 44.4%, ARB for 29.6%, MRA for 44.4%. GDMT was prescribed for 37%. The possible reasons for under-prescription of GDMT may be increasing hemodynamic instability (bradycardia, hypotension, postural hypotension) in heart failure patients, other comorbidities, drug interaction, presence of hyperkalemia and lack of awareness among general practitioners regarding GDMT. We also found that if at all GDMT was prescribed, target medication dose were not achieved in most of the patients. The reasons may be lost followup, lack of regular followup, lack of followup by Cardiologist and poor hemodynamic status. Only 51.9% patients were adherent to medications prescribed. The reasons may be lack of availability of medicine from government hospital, cost of medicine, polypharmacy, increasing age of patient and lack of supervision from family members and side effects of drugs. In Stigi Joseph et al study nearly one-fourth (28%) of patients with HFrEF received GDMT. Compared to it, our study found higher prescription rate of GDMT. Most common cause for decompensation found in this study was ischemia(41%) followed by, drug default(16%), volume overload(15.4%), infections(11.1%) and accelerated hypertension(8.5%). In Chaturvedi et al study the most common aetiology was CAD (55%) followed by valvular heart disease (13%), idiopathic dilated cardiomyopathy (10%), and hypertensive heart disease (6%).[7] Most common cause found in our study is similar to Chaturvedi et al study. All patients were treated with antiplatelets either single or dual. 82.1% were treated with diuretics followed by statins (76.9%), ACEI (41%), ARB (35.9%), MRA (35.9%), beta blocker (30.8%) and vasodilator (15.4%). None was treated with ARNI, ivabradine and digoxin. In Sanjay et al study, during hospital admission, 54% of participants received beta-blockers, and 45% of participants received either an ACEI or ARB. In this study 38%

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needed inotropic support, 59% needed NIV, 31.6% was intubated, 53% required ICU admission, 35.9% developed hypotension, 12.8% developed arrhythmia and 7.7% required dialysis support. Out of 62 patients who required ICU admission, mean duration of ICU stay was >2days and <2days, in 54.8% and 45.2% cases respectively. In this study the mean duration of hospital stay was <5 days in 41%, 5-10 days in 39.3% and >10 days in 19.7% cases. Out of 117 patients, 56.4% improved with treatment, in 29.1% condition remained same and 14.5% expired. In Stigi Joseph et al study, in-hospital mortality rate was 7%, which was almost half of that found in our study.

Low eGFR (eGFR<45ml/min/1.73m2) was associated with poor short term outcomes as measured by development of hypotension, arrhythmia, need for inotropic support, NIV, invasive ventilation, dialysis support, ICU admission, longer duration of ICU stay, longer duration of hospital stay and higher mortality, all with a p value < 0.05. In Chen et al study, patients with eGFR 30–59 ml/min/1.73 m2 were associated with an increased risk of the all-cause death, cardiovascular death and HF hospitalization than patients with eGFR ≥ 60 ml/min/1.73 m2.[8] Mortality rate and association between eGFR in our study was comparable with Chen et al study.

HFrEF was associated with poor short term outcomes such development of hypotension, arrhythmia, need for inotropic support, NIV, invasive ventilation, dialysis support, ICU admission, duration of ICU stay with a p value of <0.05. There was no statistically significant association between HFrEF and mortality. In Sanjay et al study the in-hospital mortality rate was higher for participants with HFrEF compared with those with HFpEF. Also the median duration of hospitalization was 6 (4–9) days and was similar between HF groups. Finding in our study about association of HFrEF with mortality was comparable to Sanjay et al study.

There was statistically significant association between GDMT and poor short term outcomes such as duration of hospital stay, mortality with a p value of <0.05. There were no significant association between GDMT and other short term outcome variables. Sanjay et al study found that beta blockers and ACEI/ARB on admission was associated with lower mortality. As we also got similar results, it emphasise the need for prescription of GDMT to all HF patients, if not contraindicated otherways.

Readmission for heart failure was associated with poor short-term outcomes such as development of hypotension, arrhythmia, need for inotropic support, NIV, invasive ventilation, ICU admission and mortality with a p value of <0.05. There were no statistically significant association between readmission and other short-term outcome variables. Sanjay et al study also found that there is an adverse influence of hospital readmissions on mortality in both HFrEF & HFpEF patients.
Other factors associated with poor short term outcomes are comorbidities like CAD, DM and HTN (p value <0.05). Factors associated with higher in hospital mortality were noncompliance to GDMT, NYHA FC IV, readmission for heart failure, ischemia, LVDD and comorbidities (CAD, DM, HTN), all with p value < 0.05.

LIMITATIONS OF THE STUDY

Selection of sample were done using consecutive sampling and this was a single center based study with relatively small sample size. The study being conducted in a tertiary care centre, many of the cases were referred cases with more number of complications of heart failure, thereby increasing the number of complications and mortality

CONCLUSION

A low eGFR is associated with poor short-term outcomes in terms of development of hypotension, arrhythmia, need for inotropic support, NIV, invasive ventilation, dialysis, ICU admission, duration of ICU stay and mortality in ADHF. Other factors associated with poor short term outcomes are HFrEF, comorbidities like CAD, DM and HTN. There is a strong association between HFrEF, noncompliance to GDMT, higher NYHA functional class, readmission for HF, ischemia and LVDD with in hospital mortality in ADHF. There is an underutilization of drugs that are available for management of HF. More studies are required to find the cause for this underutilization and poor

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compliance to drugs. Prescription and adherence to GDMT can significantly improve the outcomes in HF patients. Therefore, eGFR calculated from admission creatinine with MDRD formula can be considered as a reliable, non-invasive, easily available and cheap prognostic marker in predicting poor short term outcomes in ADHF patients.

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