

Risk stratification of Acute Heart Failure among adult patients admitted to Black Lion Specialized Hospital.

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A research thesis submitted to the Department of Internal medicine, school of medicine college of Health science and medicine, Addis Ababa University for partial fulfillment of specialty in internal medicine.

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I would like to thank TASH'S Card room staffs.

Acronyms

- AHF-Acute Heart Failure
- CHF-Chronic Heart Failure.
- NA-North America
- NYHA- New York Health Association functional.
- US-united states.
- UoG-University of Gonder.
- TASH-Tikur anbesa specialized hospital.

EXECUTIVE SUMMERY

INTRODUCTION

Heart failure (HF) is a complex clinical syndrome resulting from structural and functional impairment of ventricular filling or ejection of blood. It is one of the major public health problems worldwide. It is one of major public health problem worldwide. Acute Heart failure is broadly defined as a rapid onset of new or worsening signs and symptoms of HF. Most of registries done in the developed world showed it is more common in elderly male, 66-75% of the patients has history of HF.

In Sub Saharan African countries, Unlike developed nations; the most prevailing causes of HF in Africans remains largely non-ischemic, patients tend to be younger and most likely to present with severe symptoms.

In Ethiopia, there are few hospital-based studies done. One retrospective chart review done at the University of Gonder showed of 311 patients; HFpEF is more common (52.73%) and tends to be women (76.22%). They predominantly had etiologies of valvular and hypertensive heart diseases. Another prospective study done at TASH showed; among 128 patients, 75 (58.6%) female, CRVHD was the most common (52.3%). A recent prospective study done at showed: median age of 34 years. The leading precipitating factor and underlying disease at the time of admission were pneumonia (47.5%) and chronic rheumatic heart disease (48.5%), respectively. In hospital, mortality was found to be 17.2%.

In this retrospective chart review 259 patients charts was revied of which 33 patients were died and 226 were discharged improved. Mean age was 39 years and CRVHD was the commonest cause of AHF. With regards to comorbidity Hypertension and DM was associated with it in 25.5% and 19.7% of the cases. AF and CAP was the commonest identified precipitating factors. Low Hgb, lowsodium ,low potassium and increased creatine were predictors of mortality.

General objective

To characterize and predict mortality of AHF among adult patients who were admitted to TASH with diagnosis of AHF from May 2019 to May 2020.

Specific objectives

To determine causes of AHF, types of AHF and precipitating factors of AHF among adult patients who were admitted to TASH with diagnosis of AHF from May 2019 to May 2020.

- To determine predicting factors of mortality of AHF among adult patients who were admitted to TASH with diagnosis of AHF from May 2019 to Sep.2020.
- To develop mortality risk score of AHF patients who were admitted to TASH with diagnosis of AHF from May 2019 to Sep.2020.

Methods and Materials

Study design

- A Retrospective chart review of patients who were admitted to TASH with diagnosis of AHF from May 2019 to May 2020 will be conducted from July to August 2020.
- Source population: All patient whose age is 18 and above population who were admitted to TASH with diagnosis of AHF from May 2019 to May 2020.
- Sampling population: All patient whose age is 18 and above population who were admitted to TASH with diagnosis of AHF from May 2019 to May 2020.

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Introduction

Background

Heart failure (HF) is a complex clinical syndrome resulting from structural and functional impairment of ventricular filling or ejection of blood. It is one of the major public health problems worldwide. The prevalence of HF is projected to continue to increase because of an aging population, reduction in hypertension-related mortality and the greatly improved survival after myocardial infarction (MI) and availability of effective therapy for prevention of sudden death.(1)

Acute Heart failure is broadly defined as a rapid onset of new or worsening signs and symptoms of HF. It is often a potentially life-threatening condition, requiring hospitalization, and emergency treatment is aimed predominantly at managing fluid overload and hemodynamic compromise.

It includes decompensation of CHF (the most common one), acute hypertensive heart failure and cardiogenic shock. Previously considered part of the natural history of chronic HF, AHF is increasingly recognized as a distinct disorder with unique epidemiology, pathophysiology, treatments, and outcomes.(1)

Different registries from North America and European countries showed it is more common in elderly male patient and 66-75% of the patients has history of HF. (2)

AHF is among the most common causes of hospitalization in patients older than 65 years in the developed world. In the United States alone, 4 million patients are hospitalized each year with a primary or secondary diagnosis of heart failure (HF), and AHF contributes to more than 7 million hospital days annually. AHF has a similar burden in Europe and is increasingly recognized as a global public health problem.(1) There is a high burden of comorbid disease including diabetes mellitus (up to 40% in some registries) and chronic obstructive pulmonary disease (approximately 20% of patients). (2)

On the basis of available registry data, 40% to 50% of patients hospitalized have HFpEF. The

hospital mortality of patients with HFpEF appears to be lower compared with that of patients with HFrEF, but post-discharge rehospitalization rates are similarly high for both groups. (1)

In most of the published registries of AHF including ADHERE, OPTIMIZE and the EHFS, the inhospital mortality ranges from 4 to 7% with a median length of stay between 4 and 11 days. (2) There is variation in global mortality compared with developed world low and middle incoming countries have higher mortality 16.5% 1-year mortality, highest in Africa (34%), India (23%), South East Asia (15%) and lowest in China (7%)(3)(4)(5)(6)

Risk score are multivariable predictive models in which relative weights are assigned to each variable in order to calculate the probability that a specific event (death, rehospitalization) will occur in the future. They are tools that help clinicians to estimate prognosis in a more unbiased way and may be useful to inform patient triage and treatment decisions.(13)

Statement of the problem

In 2012 HF was estimated to affect 26 million people worldwide with estimated health expenditure of around 108 billion \$ per year. Projections are even more alarming, however, with total costs expected to increase by 127 % between 2012 and 2030. (7) In the United States, the most recent epidemiologic data suggest that 6.2 million Americans have HF, and it is estimated that by 2030 the prevalence will increase 25% from current estimates. The estimated prevalence of symptomatic HF in the general European population is similar to that in the United States and ranges from 0.4% to 2%. (1)(8)

In Sub Saharan African countries (SSA), HF has turned out as a leading form of cardiovascular disease and has considerable socioeconomic impact owing to its high prevalence, mortality and impact on young generations. Unlike developed nations; the most prevailing causes of HF in Africans remains largely non-ischemic, patients tend to be younger and most likely to be in NYHA class IV. (9)

In Ethiopia, there are few studies done and all of them are hospital-based. One retrospective chart review done at the University of Gonder showed of 311 patients; the Majority of the patients had HFpEF (52.73%) and tends to be women (76.22%). They predominantly had

etiologies of valvular and hypertensive heart diseases.(10)

Another prospective study done at Tikur anbesa specialized hospital showed; among 128 patients, 75 (58.6%) female, CRVHD was the most common echocardiographic finding in 67 (52.3%) of the patients followed by DCMP 14(10.9%), Corpulmonale 10 (7.8%), IHD 8 (6.3%), HHD 4 (3.1%) and peripartal cardiomyopathy 2 (1.6%). The most common precipitating factor identified was pneumonia 46 (35.9%) followed by arrhythmias 29 (22.7%), discontinuation of CHF therapy 20 (15.6%) and natural course of the disease or refractory CHF in 10 (7.8%) of the patients. (11)

A recent prospective study done at Tikur anbesa specialized hospital showed: Out of the 169 patients, the median age of patients with AHF was 34 years. The leading precipitating factor and underlying disease at the time of admission were pneumonia (47.5%) and chronic rheumatic heart disease (48.5%), respectively. In hospital, mortality was found to be 17.2% and associated with smoking, diabetes mellitus, pulmonary hypertension and presence of adverse drug events.(12)

The correct risk stratification of patients could improve clinical outcome and resources allocation, avoiding the overtreatment of low-risk subjects or the early, inappropriate discharge of high-risk patients.

Many clinical scores have been derived and validated for in-hospital and post-discharge survival; predictive models include demographic, clinical, hemodynamic and laboratory variables. Data sets are derived from public registries, clinical trials, and retrospective data. Because risk of mortality varies across patient populations, a mortality prediction model that estimates an individual patient's risk can be a useful aid for making clinical decisions at the bedside.(13)(14)

There is no study done in Ethiopia to predict AHF mortality with risk score or validate different risk scores developed in different registries and clinical trial. So this study will be done with aim of predicting mortality, developing risk score and.

Literature review

Global perspective

Heart failure (HF) is a major public health problem worldwide. Over 26 million people estimated to live with it in the world. Total global HF costs in 2012 were estimated at \$108 billion. Direct costs accounted for ~\$65 billion (60%) and indirect costs ~\$43 billion (40%) per annum.(7)(15)Its prevalence range from 2 -3 % in Europe and NA. In ASIA range from as low 1% Japan, 1.3% in China, and 4.5% Singapore and 6.7 % in Malaysia.(7)It contributes to 1 to 3 % of all hospital admission in Europe and USAcost mainly due to hospitalization 60%, 17% primary care, 9% drugs, 6% outpatientthe average length of stay is 5 to 10 days.Re Hospitalization rate 25% in the first 1 month and 46%. The lifetime risk of acquiring heart failure 33% in men 28% in female.(7)

Research is scarce in lower and middle income regarding characteristics and out come of patients with AHF. The INTER-CHF prospective cohort studydepicted overall 1-year mortality was 16.5%: highest in Africa (34%) and India (23%), intermediate in Southeast Asia (15%), and lowest in China (7%), South America (9%), and the Middle East (9%). Mortality was highest in Africa and India despite younger study population (3)

AHF in China has distinctive epidemiology and receive substandard care, but have low inpatient mortality despite a long length of stay. The median age of the cohort was 73 years (interquartile range, 65–80), and 48.9% were women. More than half (56.2%) of the patients were hospitalized in rural areas. Prevalence of ejection fraction 50%, 40% to 50%, and <40% was 60.3%, 17.7%, and 22.0%, respectively. The combined rate of in-hospital mortality and treatment withdrawal in our study was 3.5%, and median length-of-stay was 9 days (interquartile range, 7–13). (16)

AFRICAN Perspective

In Sub-Saharan Africa (SSA), chronic non-communicable diseases and cardiovascular diseases, in particular, are progressively taking over infectious diseases as the leading cause of morbidity and mortality.

The sub-Saharan Africa Survey of Heart Failure (THESEUS-HF) study characterized the causes, treatment and short-term outcome in 1006 Africans from nine SSA countries. Compared with data from prior to 2005, it highlighted hypertension as a rising cause of heart failure (from 23 % to 43 %), an increasing importance of cardiomyopathies (from 20 % to 29 %), a reduced recognition of rheumatic heart disease (from 22 % to 17 %), and a rise in ischemic heart disease (from 2 % to 8 %) in the etiology of heart failure.

Recent studies that have specifically looked for evidence of ischemic heart disease have shown a higher prevalence than previously reported. A case-control study from Kenya recently suggested that ischemic heart disease was the second most common cause of heart failure.(17)

ETHIOPIAN Perspective

A retrospective cohort study carried out at the University of Gondar Referral Hospital showed of 311 patients. The majority of the patients had HFpEF (52.73%) and tend to be women (76.22%). They predominantly had etiologies of valvular and hypertensive heart diseases and took calcium channel blockers and anticoagulants. Conversely, patients with HFrEF had etiologies of ischemic heart disease and dilated cardiomyopathy and were prescribed angiotensin converting inhibitors (ACEI) and beta-blockers. Advanced age, lower sodium level, higher creatinine level and absence of medications like ACEI, spironolactone, and statins independently predicted mortality in all HF patients. (10)

Another prospective cross-sectional study conducted on 128 patients who were admitted to adult emergency medicine department of Tikur Anbessa specialized hospital, 75 (58.6%) female. Fifty percent of patients were within the age range of 12 to 29 years. CRVHD was the most common ECHO finding in 67 (52.3%) of the patients followed by DCMP 14(10.9%), Corpulmonale 10 (7.8%), IHD 8 (6.3%), HHD 4 (3.1%) and peripartal cardiomyopathy 2 (1.6%). The most

common precipitating factor identified was pneumonia 46 (35.9%) followed by arrhythmias 29 (22.7%), discontinuation of CHF therapy 20 (15.6%) and natural course of the disease or refractory CHF in 10 (7.8%) of the patients. (12)

Retrospective patient chart review conducted at St. Paul's Hospital Millennium Medical College in Addis Ababa. A data of 496 patients admitted with acute heart failure over five years. September 2010 –September 2015. It showed a mean age of 47.1 years, 57.8% were male. Rheumatic heart disease (30%) was the most frequent cause of heart failure. 136 (31.8%) Ejection fraction was 40% or less and electrocardiography results showed atrial fibrillation in 27.5%. On discharge, angiotensin-converting enzyme inhibitors, beta-blockers, and spironolactone were prescribed for 38.9%, 27.9%, and 71% of the patients, respectively. In-hospital mortality was 24.4%. The median duration of hospitalization was 11 days. Chronic kidney disease as comorbidity, female sex, systolic blood pressure (BP) <90mmHg and high heart rate at admission were predictors of low in-hospital survival.(18)

Objectives of the study

General objective

To characterize and predict mortality of AHF adult patients who were admitted to TASH with diagnosis of AHF from May 2019 to Sep. 2020.

Specific objectives

To determine causes of AHF, types of AHF and precipitating factors of AHF.

To assess the outcome of adult patients admitted with a diagnosis of AHF.

To determine predicting factors of AHF patients.

To develop mortality risk score of patients who were admitted to TASH with diagnosis of AHF from May 2019 to Sep.2020.

Methods and Materials

Study area and period

The study was conducted from July to Sep. 2020 at TASH.

Study design

A retrospective chart review was taken from adult patients who were admitted to TASH with diagnosis of AHF from May 2019 to Sep.2020.

Population

Source population:All Adult patients (whose age was 18 or more) admitted to TASH with diagnosis of AHF from May 2019 to Sep.2020.

Sampling population:All Adult patients who were admitted to TASH with diagnosis of AHF from May 2019 to Sep.2020 and whose Chart can be retrieved.

Sample Size determination

All Adult patients who were admitted to TASH with diagnosis of AHF from May 2019 to Sep. 2020.

VARIABLES

Dependent variables:In hospital mortality and length of hospital stay.

Independent variables:*Socio-demographic factors*; age, sex and residence, *clinical factors*; causes of AHF, type of AHF, precipitating factors of AHF, *laboratory values*; BUN, Creatinine, Sodium & echocardiographic findings, and *Comorbidities*; hypertension, diabetes mellitus, COPD.

An operational definition of terms

Acute heart failure: signs and symptoms of new-onset of HF and/or decompensation or worsening of chronic stable HF.

Heart failure with preserved ejection fraction (HFpEF): Heart failure with EF above 50%.

Heart failure with reduced ejection fraction (HFrEF): Heart failure with EF less than 40%

Adults: population whose age more than or equal to 18 years.

Method of data collection and analysis

Chart and ICARE number were first collected from MICU, CCU and Medical wards of TASH.

Those with diagnosis of CHD were taken.

A total of 670 chart numbers with diagnosis of heart failure taken from Log Books of Medical ward (B8), CCU and MICU over a period from Jan. 2019 to Sep.2020. Among those only 259 could be traced and used for analysis.

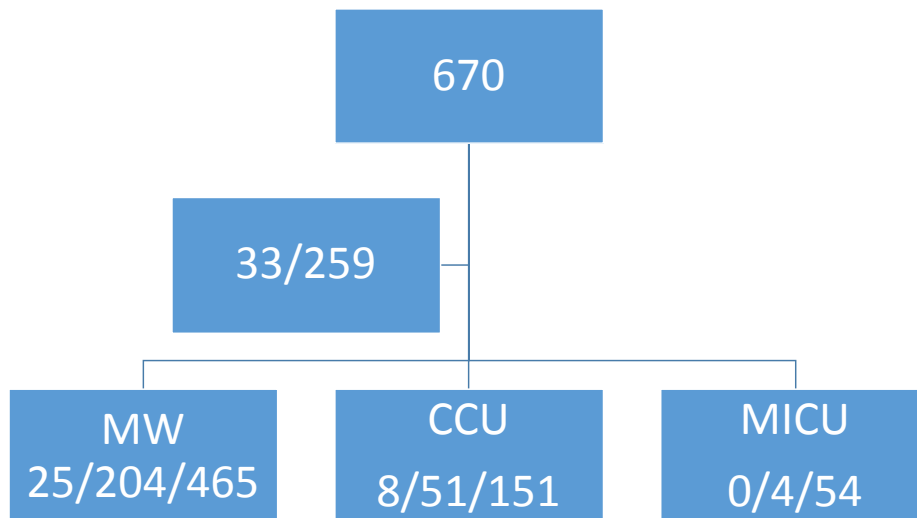


Fig.1 charts collected with numbers found from logbooks, could be traced, and number of mortality from each group.

A questionnaire format used to collect data on selected socio-demographic characteristics, clinical features, laboratory data, precipitating factors, underlying diseases, comorbidity and length of hospital stay and outcome.

The data was entered into SPSS 20.3 categorical variables will be reported as percentages and frequency Tables. A chi-square test was used for categorical variables. Bivariate and multivariate logistic regression will be used to analyze factors that predict mortality, and variables whose p-values < 0.2 in the Bivariate analysis will be included in the multivariate model. The level of significance will be chosen at p-value 0.05 and results were reported as 95% confidence intervals.

Risk score which can predict probability of mortality was derived from multivariate equation.

Data quality Assurance

The collected chart was reviewed and checked for completeness and relevance by the principal investigator each day. Data was checked for completeness and internal consistencies just after collection.

Ethical considerations

Ethical clearance was secured from the Ethical Review Committee of the College of Public Health and Medical Sciences, Addis Ababa University.

Dissemination and utilization of results

The results of this study will be disseminated or communicated to Addis Ababa University, collage of medicine and health science and department of internal medicine.

Result

Sociodemographic characteristics

Among 259 patients' chart, which could be traced, 132(51%) are male and 127(49%) are female.

Most of the patients are from Addis Ababa, 126(48.6%), followed by Oromia 92(35.5%).

Average age of the patients was 39.2, with max age of 91 and min age of 18.

With the regards to outcome 226 patients were discharged from hospital with improvement and 33 patients passed away. Median length of stay is 10.8 days.

TABLE 1: Sociodemographic characteristics

Variables	Frequency	Percentage
Age Group		
18-30	115	
30-40	45	44.4
40-50	27	17.4
50-60	29	10.4
60-70	28	11.2
>70	15	10.8
		5.8
Sex		
Male	132	51.0
Female	127	49.0
Residency		
Addis Ababa		
Oromia	126	48.8
Amhara	92	35.7
South NN	17	6.6
Other	19	7.4
	4	1.6

Comorbidities and clinical characteristics

With regards to comorbidities 25.5 % of patients were Hypertensive and 19.7% were Diabetic. Most of the cause of AHF was CRVHD (55.6%) followed by DCMP (13.9%) and IHD (12%).

With regards to precipitating factors documented CAP (30%) and AF (27%) constitute in most of the patients. Most of the patents (66.8%) have EF>50%, 28.2% of the patients have EF<40% and 5% have mid-range EF.

Most of the patients were admitted to Medical Ward (78.8%), 19.7% of patients were admitted to CCU and only 1.5% of patients were admitted to MICU

Table 2 comorbidities and clinical characteristics

Variables	Frequency	Percentage
Hypertension		
Yes	66	25.5
No	193	74.5
DM		
Yes	51	19.7
No	208	80.3
COPD		
Yes	23	8.9
No	236	91.1
CKD		
Yes	11	4.2
No	248	95.8
Stroke		
Yes	8	3.1
No	251	96.9

Causes		
CRVHD	144	55.6
IHD	31	12
DCMP	36	13.9
HHD	7	2.7
CHD	13	5
Others	28	10.8
Precipitating Factors	70	27
AF		
CAP	78	30
AMI	10	3.9
Drug discount nation	36	13.9
Others	65	25.1
Type of HF		
EF>50	173	66.8
<40	73	28.2
40-50	13	5
Place of admission		
M/Ward	204	78.8
MICU	4	1.5
CCU	51	19.7

Fig.2 causes of AHF

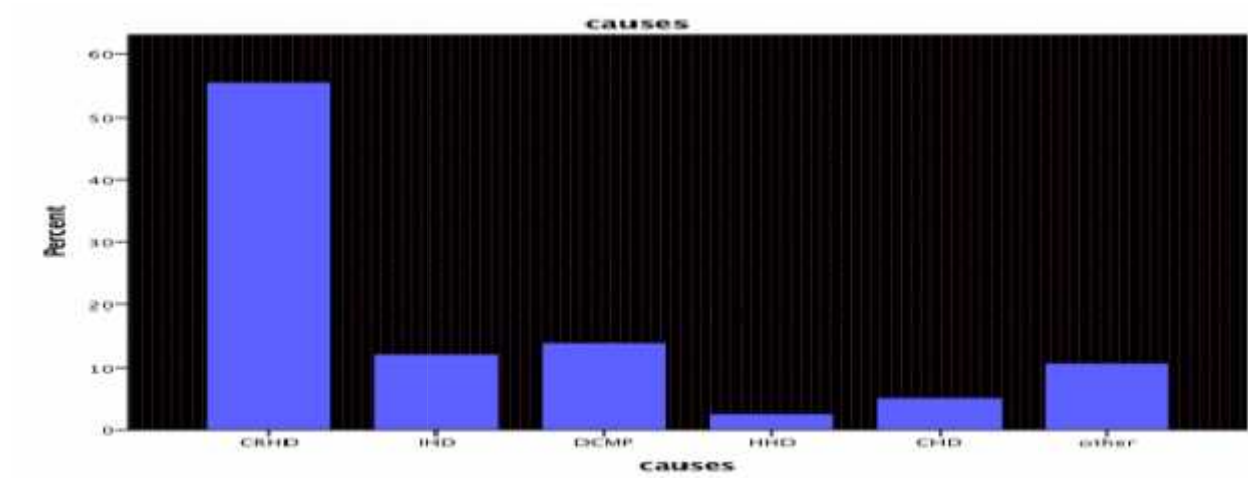
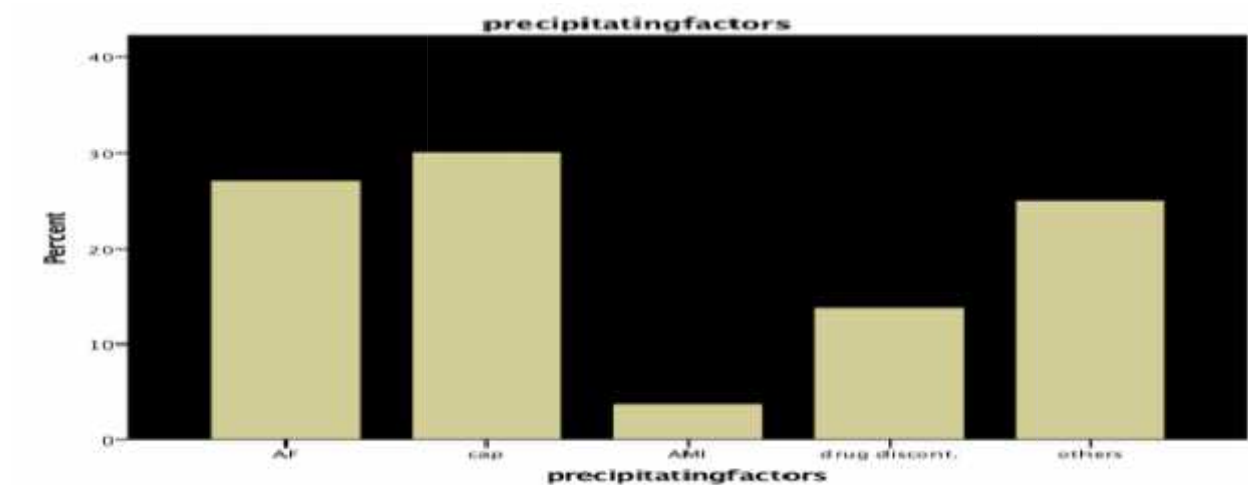


Fig.3 Precipitating factors of AHF



Laboratory results

48.8% of patients had normal hemoglobin, whereas 39.4 of the patients had anemia and 12% had polycythemia. 46.3% of patients had hyponatremia, 21.2% of patients had hypokalemia, and 3.9% of patients had hyperkalemia.

Table 3 Lab. Results

Lab.	freq	percentage
Sodium(meq/dl)		
<135	139	53.7
>=135	120	46.3
Potassium(meq/dl)		
<3.5	194	74.9
3.5-5.5	55	21.2
>5.5	10	3.9
Hgb(gm/dl)		
Normal	126	48.6
Anemia	102	39.4
polycythemia	31	12.0

Predictors of mortality

Among 259 patients chart reviewed 33 patients were died and 226 were discharged improved.

Factors associated with Mortality

Bivariate logistic regression showed increasing age, history of DM, stroke, reduced DBP, increasing creat, sodium, potassium and Hemoglobin level are significantly associated with mortality.

Multivariate logistic regression showed only Creat., sodium, potassium and Hemoglobin are significantly associated with mortality.

Table 3 Bivariate and Multivariate Association

Variables	B	SE	P value	COR	AOR
Age	0.027	0.010	0.006	1.027	
Hypertension	0.752	0.389	0.053	2.12	
DM	1.008	0.402	0.012	2.74	
stroke	2.035	0.734	0.006	7.655	
SBP	-0.014	0.010	0.154	0.986	
DBP	-0.032	0.014	0.021	0.969	
Creat.	1.107	0.3	0.01	3.024	2.496
Sodium	-0.079	0.036	0.03	0.924	0.919
potassium	-0.698	0.282	0.013	0.498	0.487
PR	0.011	0.007	0.104	1.011	
Hg	-0.253	0.072	0.104	0.01	0.75

Risk score

Log of odds of mortality= 14.482+Hg(-0.278) + creat(0.915) + Na(-.084) +K(-0.719)

So probability of mortality can be calculated with formula; OR/1+OR

Discussion

This study showed younger population with average age of 39.2 years, which is younger than similar studies done at GUH (53 years) and ST Paul (47 years) this may be due to referral of younger population with CRVHD to TASH. This study also showed younger population compared with THESUS HF registry of SSA which showed mean age of 52.4 years.

With the regards to outcome 226 patients were discharged from hospital with improvement and 33 patients passed away. This is comparable to 14.02% of GUH study In hospital mortality was 12.7% and median length of stay is 10.8 days. This is lower compared to 24.4% of ST Paul study.

A 25.5 % of patients were Hypertensive and 19.7% were Diabetic; which lower compared with different studies done in Europe and US.

The most common identified precipitating factor documented was CAP (30%) which higher than OPTIMIZE-HF registry showing 15%.

Most of the patents (66.8%) have EF>50% which is higher than similar study done at GUH which showed 52.73% this may be due higher prevalence CRVHD in this study. It is also higher than different registries in developed countries.

This study showed patients baseline increased creatine, low sodium, low potassium and low hemoglobin were predictors of mortality in AHF patients admitted to TASH. It is similar to OPTIMIZE-HF with regards to low sodium and increased creatinine but unlike it; this study didn't showed age and SBP as a predictor of mortality. This may be because of lower proportion of older age group and lower proportion low SBP in this study.

Unlike ADEHERE this study doesn't show BUN and low SBP as a predictor of mortality, this because of missing lab. Result of BUN in this study. Similar to THESUS-HF this study showed younger population and non-ischemic cause of AHF.

Limitation of the study and strength of the study

Limitation of the study

It is a retrospective chart review which may not represent the real data.

Incomplete data.

Some laboratory data were taken from I care which couldn't not represent baseline data during admission.

The score couldn't be validated because of lack adequate sample.

Strength of the study

Used Multivariate logistic regression for data analysis and predicted mortality among admitted AHF patients.

Conclusion and Recommendation

Conclusion

This retrospective chart review showed increased creatinine, low sodium, low potassium and low hemoglobin were predictors of mortality.

Recommendation

To validate the score with further prospective studies.

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Annex 1: QuestionnaireFormat.

Addis Ababa University, department of internal medicine research questionnaire format for retrospective chart review on risk stratification of AHF among adult patients admitted to TASH May 2019 to May 2020.

Identification.

Sociodemographic characteristics

1. Sex 1. male 2.female
2. age _____
- 3.Residency? 1. A.A 2. Oromia 3.Amhara 4.Tigray. 5.SNN 6._____

Comorbidities

Raised Blood Pressure, yes or no

Diabetes, yes or no

CKD,yes or no

COPD, yes or no

Clinical presentation

VS: BP: _____ RR_____ PR_____

Laboratory results at admission

Hg: _____

BUN_____

Create. _____

Echocardiography_____

Out come

Length of stay _____

Passed away_____

Discharged improved_____

