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Disposition of Heart Failure- Admission, Discharge & Terminal Care: A review

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ABSTRACT
Background: Heart failure (HF) is a multisystemic disorder characterized by profound disturbances in circulatory physiology and a plethora of myocardial structural and functional changes that adversely affect the systolic pumping capacity and diastolic filling of the heart. A discrete inciting event, such as myocardial infarction (MI) or administration of a chemotherapeutic agent, may be identifiable as a proximate trigger in some cases. However, in the vast majority of instances, contributory risk factors (e.g., hypertension, obesity, ischemic heart disease, valvular disease, or diabetes) or genetic and environmental cues are uncovered during the diagnostic workup. Heart failure management starts from the point of a patient gets admitted to terminal care. Heart failure patients are increasing day by day and they constitute a major balk of mortality & morbidity of daily routine practice of the physicians. **Objective:** The objective of this review article is to know the management of heart failure patients starting from the admission to terminal care on the basis of published & proposed guidelines of the cardiological authorities.**Conclusion:**The study team concluded that evidence-based guideline directed diagnosis, evaluation and therapy should be the mainstay for all patients with HF. Effective implementation of guideline-directed best quality care reduces mortality, improves quality of life and preserves health care resources.

Keywords: Heat failure, Admission, Discharge, Terminal care, Treatment, Guideline.

Universal Definition of Heart Failure[1]

Heart failure is a clinical syndrome with current or prior→

- ❑ Symptoms and or signs caused by a structural and/or functional cardiac abnormality (as determined by an EF of <50%, abnormal cardiac chamber enlargement, E/E' of >15, moderate/severe ventricular hypertrophy or moderate/severe valvular obstructive or regurgitant lesion) and corroborated by at least one of the following:
- Elevated natriuretic peptide levels (BNP: ambulatory→ ≥35 pg/mL, Hospitalized/ Decompensated ≥100 pg/mL; NT-pro BNP: ambulatory→ ≥125 pg/mL, Hospitalized/ Decompensated ≥300 pg/mL).
- Objective evidence of cardiogenic pulmonary or systemic congestion by diagnostic modalities, such as imaging (e.g., by chest radiograph or elevated filling pressures by echocardiography) or haemodynamic measurement (e.g., right heart catheterization, pulmonary artery catheter) at rest or with provocation (e.g., exercise)

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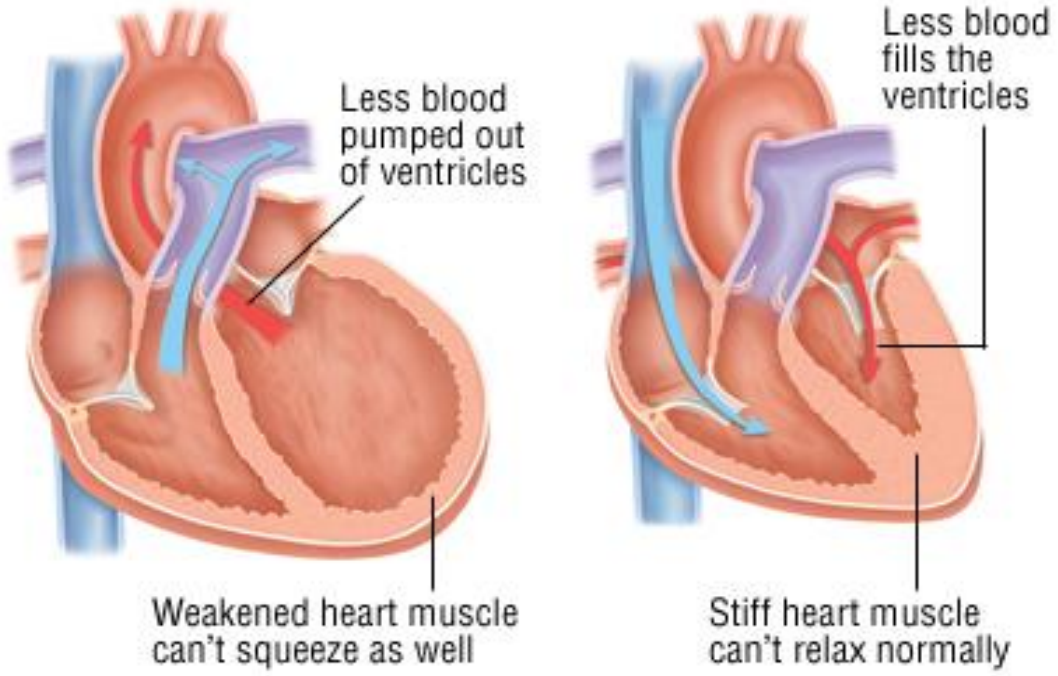

Figure: Showing the difference between normal & a failed heart.

Demography of Heart Failure[2]

Despite the wide variation in the reported prevalence of heart failure (undoubtedly caused by differing research methods, in addition to inherent differences in the sociodemographic and risk factor profiles of study cohorts), overall, these data demonstrate that the prevalence of clinically overt heart failure increases considerably with age. These data also suggest that the prevalence of heart failure has increased over the past few decades.

Stages & Classification of heart failure[1]

Before going into details of heart failure we need to know the different stages & classification of heart failure. They are:

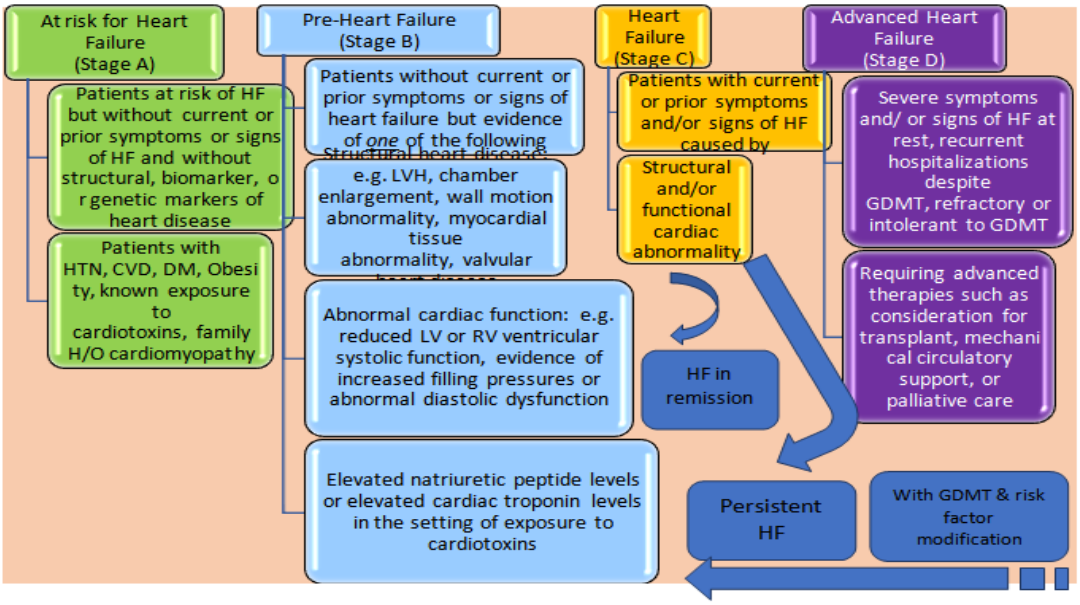

Figure: Flow chart showing different stages of heart failure.

Studies of patients visiting a general practitioner

There have been several large studies examining the number of patients being treated for

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signs and symptoms of chronic heart failure by a general practitioner, undertaken in the UK over the past 40 years. Only some of the more recent of these can be reviewed here. For example, Parmeshwar and colleagues[3] examined the clinical records of diuretic treatedpatients in three general practices in northwest London in 1992 to identify possible cases of heart failure. From a total of 30 204 patients, a clinical diagnosis of heart failure was made in 117 cases (46 male and 71 female), giving an overall prevalence of 3.9 cases/1000. Prevalence of heart failure increased considerably with age—in those aged under 65 years the prevalence rate was 0.6 cases/1000 compared to 28 cases/1000 in those aged over 65 years.However, objective investigation of left ventricularfunction had been undertaken in lessthan one third of thesepatients. Using similarmethods, Mair and colleagues[4] identified atotal of 266 cases of heart failure from 17 400patients within two general practices in Liverpool.Undertaken in 1994, the overall prevalencerate was 15 cases/1000 patients with 80cases/1000 in those aged > 65 years.More recently, Clarke and colleagues[5]reported an even larger survey of heart failurebased on similar methods and including analysisof prescription of loop diuretics for all residentsof the English county of Nottinghamshire.They estimated that between 13 017 and26 214 patients had been prescribed frusemide(furosemide) in this region of central England.Case notes review of a random sample of thosepatients receiving such treatment found that56% were being treated for heart failure. Onthis basis they calculated an overall prevalencerate of 8–16 cases/1000. Once again, heart failureprevalence increased with advancing agewith the rate increasing to between 40–60cases/1000 among those aged > 70 years.

Population studies based on clinical criteria

There are now many population studies ofheart failure and only some can be reviewedhere. At entry into the Framingham study, 17of 5209 persons (3cases/1000) screened forheart failure on the basis of clinical criteriawere thought to have heart failure; all were lessthan 63 years of age.[6] After 34 years follow up, prevalence rates increased as the cohort aged.The estimated prevalence of heart failure in theage groups 50–59, 60–69, 70–79, and > 80years was 8, 23, 49, and 91 cases/1000 personsrespectively.[7] NHANES-1 (national health andnutritionexamination survey) reported theheart failure prevalence rate within the USpopulation. Based on self- reporting, and aclinical scoring system, this studyscreened14 407 persons of both sexes, aged 25–47years, between 1971 and 1975, with detailedevaluation of only 6913 subjects and reported aprevalence rate of 20 cases/1000[6 8]. The studyof men born in 1913 examined the prevalenceof heart failure in a cohort of 855 Swedish menat ages 50, 54, 57, and 67 years.[8]Theprevalence rate of "manifest" heart failure rosedramatically from 21 cases/1000 at age 50years to 130 cases/1000 at age 67 years.

Prevalence of left ventricular systolic dysfunction

In only a few of the two types of prevalencestudy described above was objective evidenceof cardiac dysfunction obtained. Consequently,it is unclear whether all patients really hadheart failure and, if they did, what the cause ofheart failure was. There have, however, beenfour recent estimates of the population prevalenceof left ventricular systolic dysfunction asdetermined by echocardiography emanatingfrom Scotland, the Netherlands, England, andFinland.[9]The Scottish study targeted a representativecohort of 2000 persons aged 25–74 years livingnorth of the River Clyde in Glasgow. Of thoseselected 1640 (83%) underwent a detailedassessment of their cardiovascular status andunderwent echocardiography. Left ventricularsystolic dysfunction was defined as a leftventricular ejection fraction (LVEF) < 30%.The overall prevalence of left ventricular systolicdysfunction using this criterion was 2.9%.Concurrent symptoms of heart failure werefound in 1.5% of the cohort, while the remaining1.4% were asymptomatic. Prevalence wasboth greater in men and increased with age: inmen aged 65–74 years it was 6.4% and in agematched women 4.9%.

The Rotterdam study in the Netherlands,though examining individuals aged 55–74years, reported similar findings. Overall, theprevalence of left ventricular systolic dysfunction,defined in this case as fractional shorteningof < 25%, was 5.5% in men and 2.2% inwomen.[10]The Helsinki ageing study describes clinicalandechocardiographic findings in 501 subjects(367 female) aged 75-86 years.[11] The prevalenceof heart failure, based on clinical criteriawas 8.2% overall (41 of 501) and 6.8%, 10%,and 8.1% in those aged 75, 80, and 85 yearsrespectively. These individuals had a highprevalence of moderate or severe mitral or aorticvalve disease (51%), ischaemic heart disease(54%), and hypertension (54%). However, ofthe 41 subjects with "heart failure" only 11(28%) had significant left ventricular systolicdysfunction (diagnosed by the combined presenceof fractional

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shortening < 25% and leftventricular dilation), and in 20 cases noechocardiographic abnormality was identified.Of the 460 without symptoms of heart failure(9%) also had left ventricular systolicdysfunction. The overall prevalence of left ventricularsystolic dysfunction was therefore10.8% (95% confidence interval (CI) 8.2% to13.8%).More recently, Morgan and colleagues[12]studied 817 individuals aged 70–84 yearsselected from two general practices in Southampton,England. Left ventricular functionwas assessed qualitatively as normal, mild,moderate or severe systolic dysfunction. Theoverall prevalence of all grades of dysfunctionwas 7.5% (95% CI 5.8% to 9.5%). Prevalenceof left ventricular dysfunction doubled betweenthe ages of 70–74 years and > 80 years.

Heart failure is classified on the basis of left ventricular systolic function (i.e., LVEF) as follows:

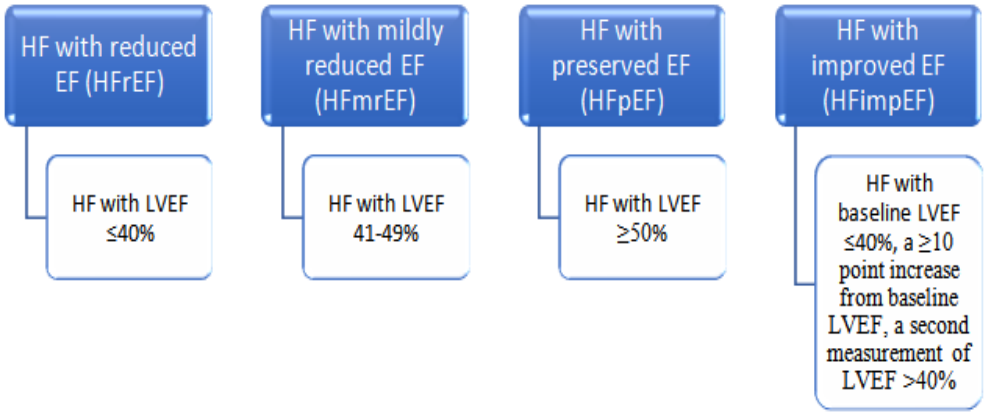

Figure: Flowchart showing classification of heart failure according to LVEF[1]

Preserved left ventricular systolic function

One of the most controversial issues pertainingto the subject of heart failure at present is theoccurrence of the syndrome in patients withpreserved left ventricular systolic function (andno other obvious cause, such as valve disease).A fulldiscussion of this topic is beyond thescope of this article. There are, however, tworecent studies of this type of heart failure. TheOlmsted County Study, Minnesota, found that43% of patients with chronic heart failure hadan LVEF > 50%.[5] Similarly, the Framinghaminvestigators found that 51% of their cohortwith heart failure had an LVEF of > 50%[13].

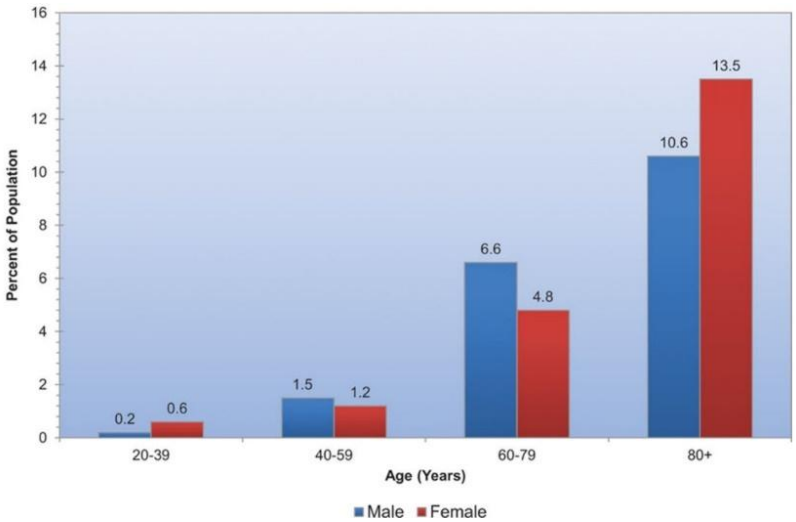

Figure: Prevalence of Heart Failure in different age groups.

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There is much less known about the incidence than the prevalence of heart failure. The most detailed incidence data emanate from the Framingham heart study.[6] Like other population-based prevalence studies heart failure was defined according to a clinical scoring system. The only "cardiac" investigation was chest radiography. At 34 years follow up, the incidence of heart failure was approximately 2 new cases/1000 in persons aged 45–54 years, increasing to 40 new cases/1000 in men aged 85–94 years. Using similar criteria, the study of men born in 1913 reported incidence rates of "manifest" heart failure of 1.5, 4.3, and 10.2 new cases/1000 in men aged 50–54, 55–60, and 61–67 years, respectively[8]. The Rochester epidemiology project also reported the incidence of heart failure in a US population during 1981 in persons aged 0–74 years[14]. The annual incidence was 1.1 new cases/1000. Once again incidence was higher in men compared to women (1.57 v 0.71 cases/1000, respectively). It also increased with age, the rate of new cases increasing from 0.76/1000 in men aged 45–49 years to 1.6/1000 in men aged 65–69 years.

The most recent incidence study was reported by Cowie and colleagues from the Hillingdon district of London14 with a population of approximately 150 000[15]. In a 15 months period, 122 patients were referred to a special heart failure clinic. This represented an annual referral rate of 6.5/1000 population. Using a broad definition of heart failure, only 29% of these patients were clearly diagnosed as having heart failure (annual incidence 1.85/1000 population).

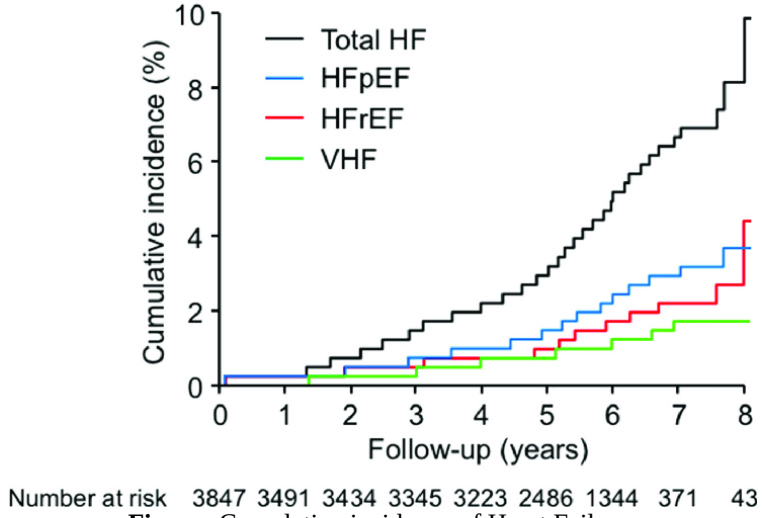

Figure: Cumulative incidence of Heart Failure.

Heart failure death rate is increasing day by day. The recent statistics showed that heart failure topped the ranking over many deadly diseases.

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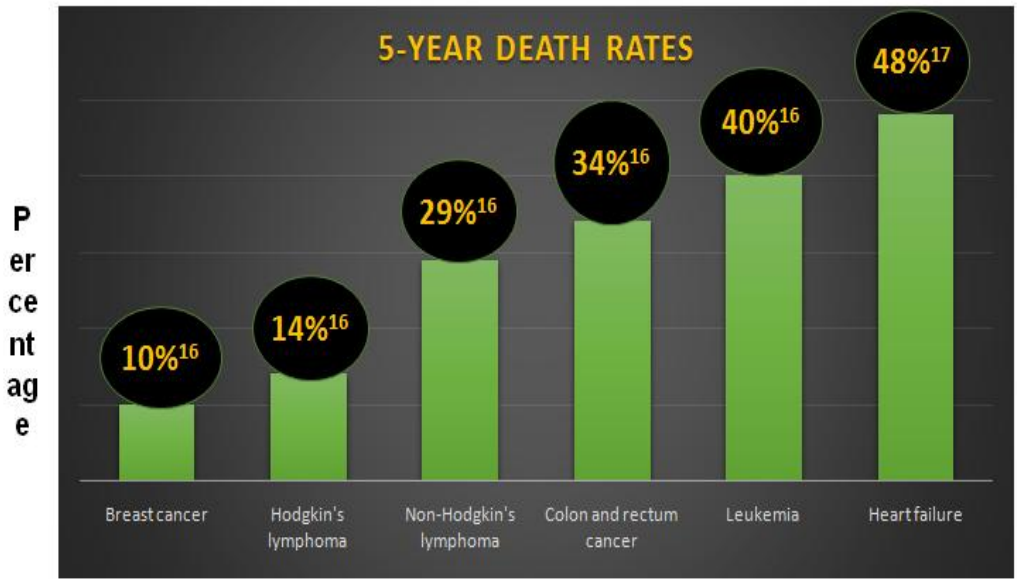

Figure: 5- year death rates of top chronic diseases

Initial Serial Evaluation of Heart Failure Patients

Now it's the time to deal with the patients. It includes the following steps:

- History & physical examination
- Etiology of heart failure
- The criteria for ICU/ CCU admission
- Risk scoring
- Diagnostic tests
- Biomarkers
- Hospitalized
- Role of cardiac imaging
- Treatment of different stages of heart failure
- Discharging the patient
- Rehabilitation& terminal care of the patient

History & physical examination:

When a patient enters the emergency a complete history & physical examination is mandatory to initiate the management. By history & physical examination we need to assess the severity of the disease & our next step in the management.

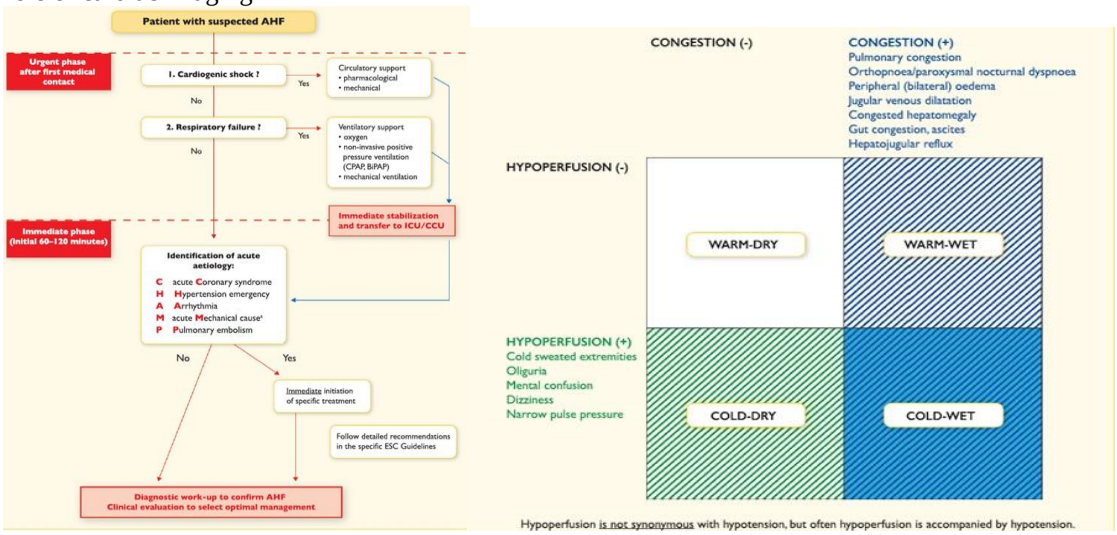

Figure: Initial assessment of a patient with suspected heart failure

Etiology of heart failure:

We need to find the cause of heart failure first and treat the patient accordingly. Because we know "What Mind Doesn't Know Eyes Can't See!!!!!"

The causes can be sub-divided into:

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- Disease of the myocardium
- Abnormal loading
- Arrhythmia

❖ Disease of the myocardium:

a) Ischaemic:
- Epicardial Coronary Artery Disease
- Myocardial stunning/ Hibernation
- Myocardial Scar
- Abnormal Coronary Micro-circulation
- Endothelial Dysfunction

b) Non- ischaemic:
- Toxic Damage
- Immune mediated & Inflammatory Damage
- Infiltration
- Metabolic derangements
- Genetic Abnormalities

❖ Abnormal Loading:

a) Hypertension
b) Valve & myocardial structural defects. i.e., congenital & acquired
c) Pericardial & endomyocardial pathologies. i.e., pericardial & endomyocardial
d) High output states
e) Volume overload

❖ Arrhythmia:

a) Tachyarrhythmias. i.e., Atrial, Ventricular
b) Bradyarrhythmias. i.e., Sinus node dysfunction, Conduction disorders.

The criteria for ICU/ CCU admission:

It includes the followings:
- Need for intubation (or already intubated)
- Signs/symptoms of hypo perfusion
- Oxygen saturation (SpO_2) <90% (despite supplemental oxygen)
- Use of accessory muscles for breathing, respiratory rate>25/min
- Heart rate <40 or >130 bpm, SBP <90 mmHg.

Which patient need tobe artificially ventilated it has also some criteria. The patients whose→
- ❑ If respiratory failure, leading to hypoxaemia (PaO_2<60 mmHg (8.0 kPa)), hypercapnia
- ❑ $PaCO_2$>50 mmHg (6.65 kPa) and acidosis (pH <7.35), cannot be managed non-invasively.

According to ESC 2017 heart failure guideline these criteria fall in ICrecommendation.

Risk Scoring:

The assessment of heart failure patient by risk scoring is an important tool for the management. According to ACC/ AHA recommendation it says→

Recommendation	Class	Level
Validated multivariable risk scores can be useful to estimate subsequent risk of mortality in ambulatory or hospitalized patients with HF.	**IIa**	**B**

The following risk scoring models are used to predict outcomes in heart failure:

Risk Scores
All Patients with Chronic HF
Seattle Heart Failure Model
Heart Failure Survival Score
CHARM Risk Score
CORONA Risk Score
Specific to Chronic HFpEF
I-PRESERVE Score
Acutely Decompensated HF
ADHERE Classification and Regression Tree (CART) Model
American Heart Association Get with the Guidelines Score
EFFECT Risk Score
ESCAPE Risk Model and Discharge Score
OPTIMIZE HF Risk-Prediction Nomogram

Diagnostic Tests:

According to the 2016 ESC guideline for the management of heart failure, it was sketched for the role of diagnostic tests for heart failure.

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Recommendation	Class	Level
Initial laboratory evaluation of patients presenting with HF should include complete blood count, urinalysis, serum electrolytes (including calcium and magnesium), blood urea nitrogen, serum creatinine, glucose, fasting lipid profile, liver function tests, and thyroid-stimulating hormone.	**I**	**C**
Serial monitoring, when indicated, should include serum electrolytes and renal function.	**I**	**C**
A 12-lead ECG should be performed initially on all patients presenting with HF.	**I**	**C**
Screening for hemochromatosis or HIV is reasonable in selected patients who present with HF.	**IIa**	**C**
Diagnostic tests for rheumatologic diseases, amyloidosis, or pheochromocytoma are reasonable in patients presenting with HF in whom there is a clinical suspicion of these diseases.	**IIa**	**C**

Biomarkers:
Recommendations for biomarkers as per 2016 ESC guideline are as follows:

Biomarkers	Setting	COR	LOE
Natriuretic Peptides			
Diagnosis or exclusion of HF	Ambulatory, Acute	**I**	**A**
Prognosis of HF	Ambulatory, Acute	**I**	**A**
Achieve GDMT	Ambulatory	**IIa**	**B**
Guidance of acutely decompensated HF therapy	Acute	**IIb**	**C**
Biomarkers of myocardial injury			
Additive risk stratification	Acute, Ambulatory	**I**	**A**
Biomarkers of myocardial fibrosis			
Additive risk stratification	Ambulatory	**IIb**	**B**
	Acute	**IIb**	**A**

In this perspective we also need to know about the causes of raised level of natriuretic peptides. The causes are:

Cardiac	Noncardiac
• Heart failure, including RV syndromes • Acute coronary syndrome • Heart muscle disease, including LVH • Valvular heart disease • Pericardial disease • Atrial fibrillation • Myocarditis • Cardiac surgery • Cardioversion	• **Advancing age** • Anemia • **Renal failure** • Pulmonary causes: obstructive sleep apnea, severe pneumonia, pulmonary hypertension • Critical illness • **Bacterial sepsis** • **Severe burns** • Toxic-metabolic insults, including cancer chemotherapy and **envenomation**

Role of Cardiac Imaging:

Imaging is one of the basic tools in the diagnosis & treatment of heart failure. It plays a pivotal role in both diagnostic & therapeutic fields of heart failure. So, we need to know the recommendations. Recommendations for non-invasive cardiac imaging as per 2016 ESC guideline are as follows:

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Recommendation	COR	LOE
Patients with suspected, acute, or new-onset HF should undergo a chest x-ray	I	C
A 2-dimensional echocardiogram with Doppler should be performed for initial evaluation of HF	I	C
Repeat measurement of EF is useful in patients with HF who have had a significant change in clinical status or received treatment that might affect cardiac function, or for consideration of device therapy	I	C
Noninvasive imaging to detect myocardial ischemia and viability is reasonable in HF and CAD	IIa	C
Viability assessment is reasonable before revascularization in HF patients with CAD	IIa	B
Radionuclide ventriculography or MRI can be useful to assess LVEF and volume	IIa	C
MRI is reasonable when assessing myocardial infiltration or scar	IIa	B
Routine repeat measurement of LV function assessment should not be performed	III	B

On the basis of these issues the treatment modalities are divided into the following categories:

- Non-pharmacological
- Pharmacological
- Interventional: PCI, Devices etc.
- Surgical: CABG, Valve Repair or Replacement, Transplant etc.
- Cardiac Rehabilitation: The most neglected part.

Treatment Modalities of Heart Failure Patients:

Now comes the very important portion of heart failure management. There are so many modalities of heart failure treatment but before that the following ten pivotal issues to be solved:

- ✓ How to initiate, add, or switch therapies to new GDMT for HFrEF
- ✓ How to achieve optimal therapy
- ✓ When to refer to an HF specialist
- ✓ How to address challenges of care coordination
- ✓ How to improve medication adherence
- ✓ What is needed in specific patient cohorts: Afro-Americans, older adults and the frail
- ✓ How to manage costs & access to HF medications
- ✓ How to manage the increasing complexity of HF
- ✓ How to manage common comorbidities
- ✓ How to integrate palliative care & the transition into hospice care

Treatment algorithm for the patients with HFpEF:

In this modern era there are so many issues for the treatment of HFpEF. But the basic algorithm for the management of HFpEF is:

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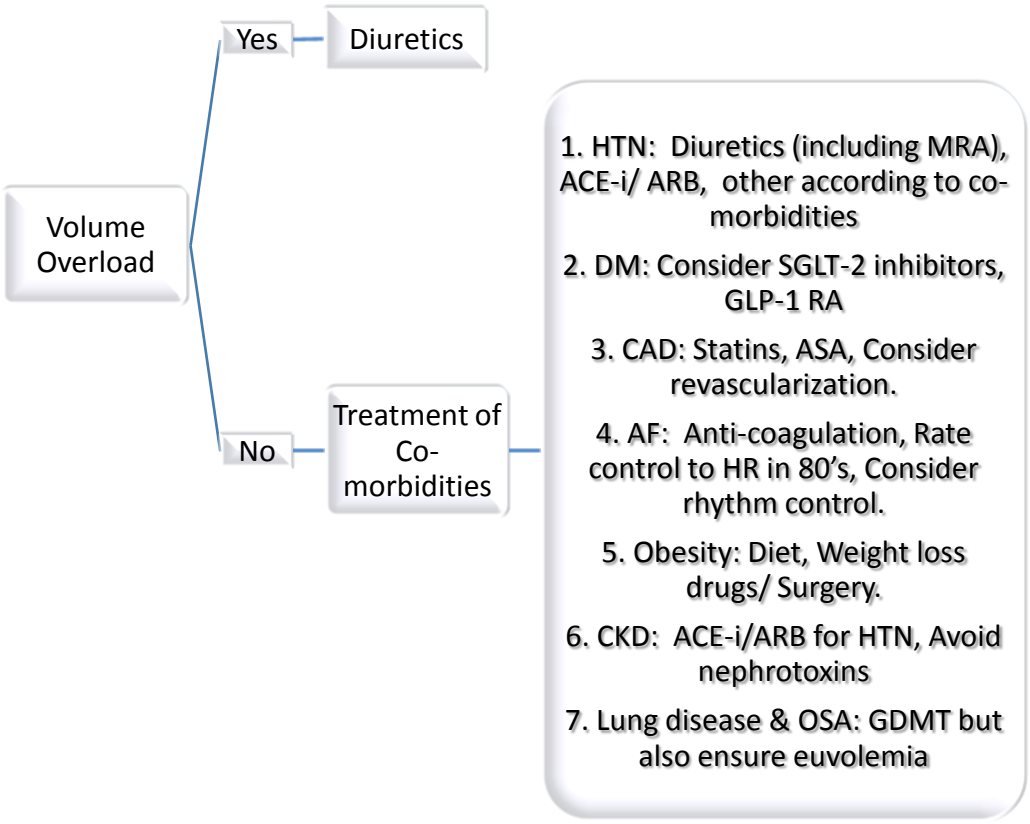

Figure: Treatment algorithm of HFpEF

Treatment for the patients with Stages A to D as per guideline:
It may be divided into both non-pharmacological & pharmacological. Let's have a look into both wings:

- **Non-pharmacological management:**

The guideline says the following:

Recommendations	COR	LOE
Patients with HF should receive specific education to facilitate HF self-care.	I	B
Exercise training (or regular physical activity) is recommended as safe and effective for patients with HF who are able to participate to improve functional status.	I	A
Sodium restriction is reasonable for patients with symptomatic HF to reduce congestive symptoms.	I	C
Continuous positive airway pressure (CPAP) can be beneficial to increase LVEF and improve functional status in patients with HF and sleep apnea.	IIa	B
Cardiac rehabilitation can be useful in clinically stable patients with HF to improve functional capacity, exercise duration, and mortality.	IIa	B

- **Pharmacological management:**

The guideline says:

STAGE A

Recommendation	Class	LOE
Hypertension and lipid disorders should be controlled in accordance with contemporary guidelines to lower the risk of HF.	**I**	**A**
Other conditions that may lead to or contribute to HF, such as obesity, diabetes mellitus, tobacco use, and known cardiotoxic agents, should be controlled or avoided.	**I**	**C**
Fluid restriction (1.5 to 2 L/d) is reasonable in stage D, especially in patients with hyponatremia, to reduce congestive symptoms.	**IIa**	**C**

STAGE B

Recommendation	Class	LOE
In patients with a history of MI and reduced EF, ACE inhibitors or ARBs should be used to prevent HF.	**I**	**A**
In patients with MI and reduced EF, evidence-based beta blockers should be used to prevent HF.	**I**	**B**
In patients with MI**, statins should be used to prevent HF.**	**I**	**A**
Blood pressure should be controlled to prevent symptomatic HF.	**I**	**A**
ACE inhibitors should be used in all patients with a reduced EF to prevent HF.	**I**	**A**
β blockers should be used in all patients with a reduced EF to prevent HF.	**I**	**C**
Non-dihydropyridine calcium channel blockers may be harmful in patients with low LVEF.	**III**	**C**

- **Stage C pharmacological intervention:**

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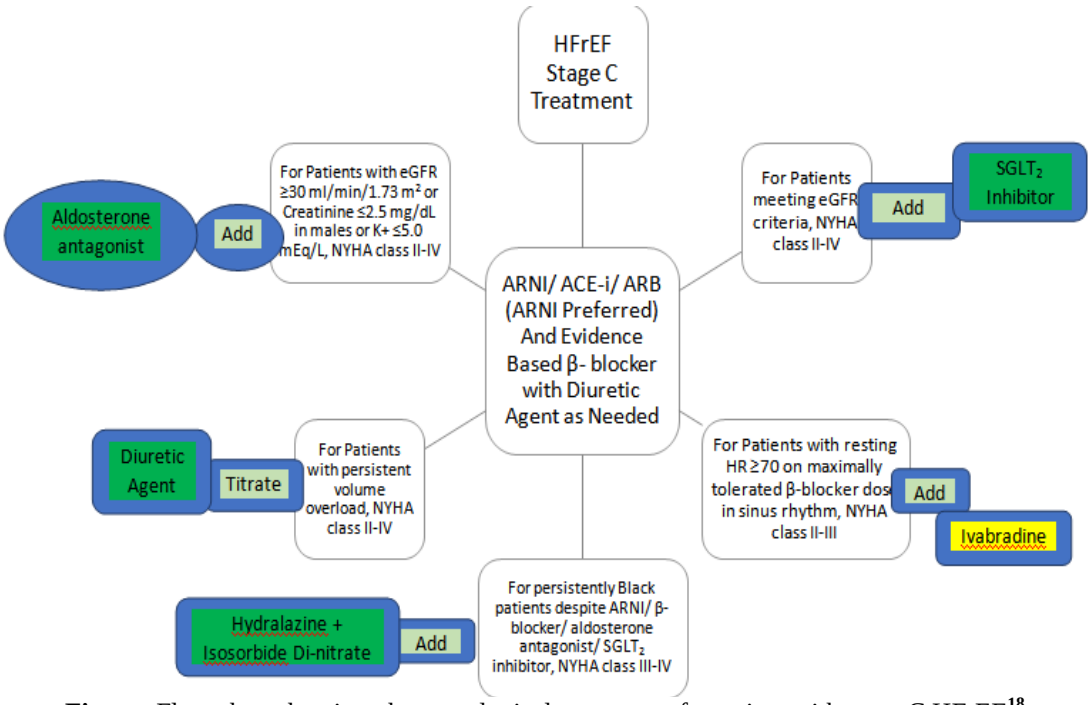

Figure: Flow chart showing pharmacological treatment of a patient with stage C HFrEF[18]

Drugs commonly used for HFrEF (Stage C HF):

Drug	Initial daily dose(s)	Maximum dose(s)
Beta Blockers		
Bisoprolol	1.25 mg once	10 mg once
Carvedilol	3.125 mg twice	25 mg twice if weight <85 kg and 50 mg twice if weight ≥85 kg
Metoprolol Succinate	12.5 to 25 mg daily	200 mg daily
Sacubitril/ Valsartan		
Sacubitril/ Valsartan	24/26 mg – 49/51 mg twice daily	97/103 mg twice daily
ACE-i		
Captopril	6.25 mg 3x daily	50 mg 3x daily
Enalapril	2.5 mg 2x daily	10-20 mg 2x daily
Lisinopril	2.5-5 mg daily	20-40 mg daily
Ramipril	1.25 mg daily	160 mg 2x daily
ARBs		
Candesartan	4-8 mg daily	32 mg daily
Losartan	25-50 mg daily	150 mg daily
Valsartan	40 mg 2x daily	160 mg 2x daily

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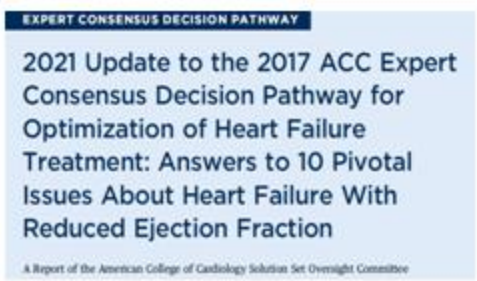
Drug	Initial daily dose(s)	Maximum dose(s)
Aldosterone Antagonists		
Eplerenone	25 mg daily	50 mg daily
Spironolactone	12.5-25 mg daily	25-50 mg daily
$SGLT_2$ Inhibitors		
Empagliflozin	10 mg daily	10 mg daily
Dapagliflozin	10 mg daily	10 mg daily
Vasodilators		
Hydralazine	25 mg 3x daily	75 mg 3x daily
Isosorbide Di-nitrate	20 mg 3x daily	40 mg 3x daily
Fixed dose combination Isosorbide Di-Nitrate/ Hydralazine	20 mg/37.5 mg (1 tab) 3x daily	2 tabs 3x daily
Ivabradine		
Ivabradine	2.5 -5 mg 2x daily	Titrate to HR 50-60 beats/min Maximum dose 7.5 mg 2x daily

Renin- Angiotensin System Inhibition with ACE Inhibitor or ARB or ARNI: Recommendations

Recommendation	COR	LOE
ARNI should not be administered concomitantly with ACE inhibitors or within 36 hours of the last dose of an ACE inhibitor	**III**	**B-R**
ARNI should not be administered to patients with a history of angioedema	**III**	**C-EO**



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Indications for ARNI:
- ✓ HFrEF (LVEF<40%)
- ✓ NYHA class II-IV HF
- ✓ In conjunction with a background of GDMT for HF in place of an ACE-i or ARB

Contraindications:
- ✓ Within 36 hours of ACE-i use
- ✓ H/O angioedema with or without an ACE-i or ARB
- ✓ Pregnancy
- ✓ Lactation (but no data)
- ✓ Severe hepatic impairment
- ✓ Concomitant aliskiren use in patients with diabetes
- ✓ Known hypersensitivity to either ARBs or ARNIs

Cautions:
- ✓ Renal impairment: Mild to moderate (eGFR 30-59) no starting dose adjustment but severe (eGFR<30) reduce to 24/26 mg bid; double in every 2-4 weeks to target 97/103 mg bid.
- ✓ Hepatic impairment: Mild no starting dose adjustment but moderate reduce to 24/26 mg bid; double in every 2-4 weeks to target 97/103 mg bid.
- ✓ Renal artery stenosis
- ✓ SBP <100 mmHg
- ✓ Volume depletion

Ivabradine: Recommendations

2013 ACCF/AHA Guideline	2017 ACC/AHA/HFSA Focused Update
Ivabradine was not Recommended	**Ivabradine** is introduced. **COR: IIa**, **LOE: B-R** **Recommendation**: Ivabradine can be beneficial to reduce HF hospitalization for patients with symptomatic (NYHA class II-III) stable chronic HFrEF (LVEF ≤35%) who are receiving guideline-directed evaluation and management, including a beta blocker at maximum tolerated dose, and who are in sinus rhythm with a heart rate of 70 bpm or greater at rest

Indications:
- ✓ HFrEF (LVEF ≤35%)
- ✓ On maximum tolerated dose of β- blocker
- ✓ Sinus rhythm with a resting heart rate ≥70 beats/ min
- ✓ NYHA class II or III HF

Cautions:
- ✓ SND
- ✓ Cardiac conduction defects
- ✓ Prolonged QT interval

Contraindications:
- ✓ HFpEF
- ✓ Presence of angina with normal EF
- ✓ Hypersensitivity
- ✓ Severe hepatic impairment
- ✓ Acute decompensated HF
- ✓ Blood pressure <90/50 mmHg
- ✓ SSS without a pacemaker
- ✓ SA nodal block
- ✓ 2nd or 3rd degree A-V block without a pacemaker
- ✓ Resting heart rate <60 beats/min
- ✓ Persistent AF or flutter
- ✓ Atrial pacemaker dependence

Recommended Starting Dose of Ivabradine

Population	Initial Dose
✓ Minimally tolerated β-	5 mg twice daily with meals

	blocker dose ✓ Persistent resting heart rate ≥70 beats/min	
✓ ✓	H/O conduction defects Age ≥75 years	2.5 mg twice daily with meals

Harmful treatment combinations in patients with symptomatic HFrEF:

Recommendation	Class	Level
Thiazolidinediones	III	A
NSAIDS or COX-2	III	B
Diltiazem or Verapamil	III	C
Addition of ARB with ACE-i & MRA	III	C

Other modalities of treatment for HF patients:

- **Interventional:** PCI, Devices etc.
- **Surgical:** CABG, Valve Repair or Replacement, Transplant etc.

Guideline for PCI:

Scenario	CABG	PCI
2 vessel CAD+ Proximal LAD	IB	IC
LM CAD+ High Syntax (>33)	IA	IIIB

*** 2018 ESC guideline for myocardial revascularization

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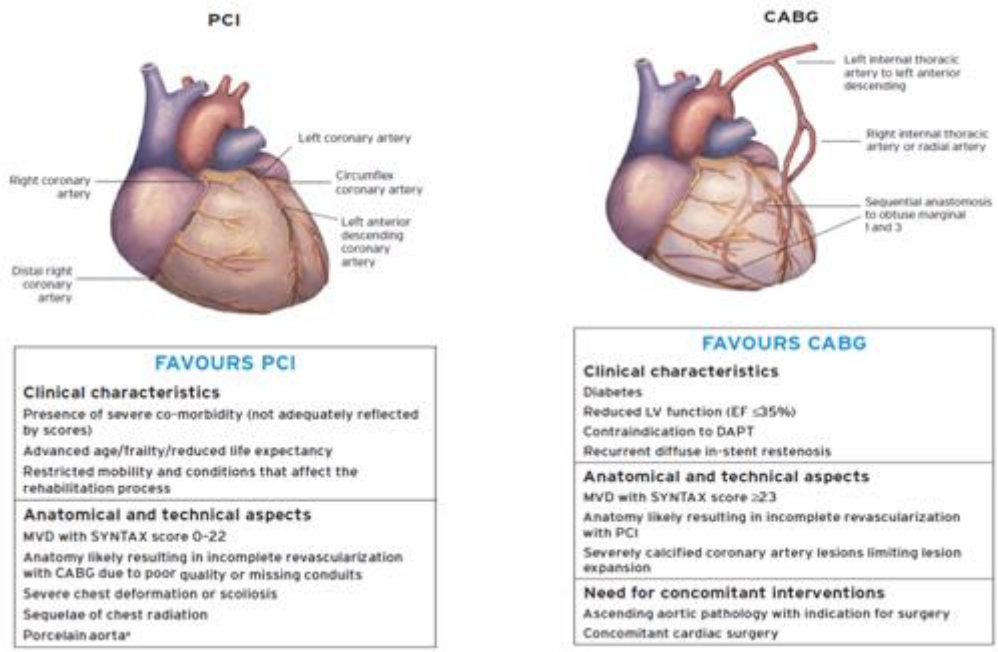

Figure: Suitability for PCI or CABG

ICD in patients with HF: Recommendations

Recommendation	Class	Level
Primary Prevention: ✓ Symptomatic NYHA II-III HF ✓ LVEF ≤35% ✓ ≥ 3 months of OMT		
IHD (No H/O MI in last 40 days)	**I**	**A**
DCM	**I**	**B**
Within 40 days of MI	**III**	**A**
Secondary Prevention: To reduce SCD & all-cause mortality-- ✓ Who recovered from a haemodynamically unstable ventricular arrhythmia, ✓ Expected to survive for >1 year with good functional status	**I**	**A**

CRT in patients with HF: Recommendations

Recommendation	Class	Level
➢ Symptomatic HF patients ➢ QRS ≥150 msec ➢ LBBB QRS morphology ➢ LVEF ≤35% despite OMT	**I**	**A**
➢ Symptomatic HF patients ➢ QRS 130-149 msec	**I**	**B**

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➢ LBBB QRS morphology ➢ LVEF ≤35% despite OMT		
➢ HFrEF regardless of NYHA class ➢ Indication for ventricular pacing ➢ High degree A-V block including patients with AF	**I**	**A**
➢ QRS <130 msec	**III**	**A**

LVAD in patients with HF: Recommendations

>2 months of severe symptoms despite OMT & device therapy and more than one of the following:
LVEF <25%, peak VO_2<12 mL/kg/min
≥ 3 HF hospitalization in previous 12 months without an obvious precipitating cause
Dependence on I.V inotropic therapy
Progressive end-organ dysfunction
Absence of severe RV dysfunction together with severe tricuspid regurgitation

All Failed……...Transplant!!!!!

Figure: Transplant

Drug, interventional & device treatment for HF_rEF:

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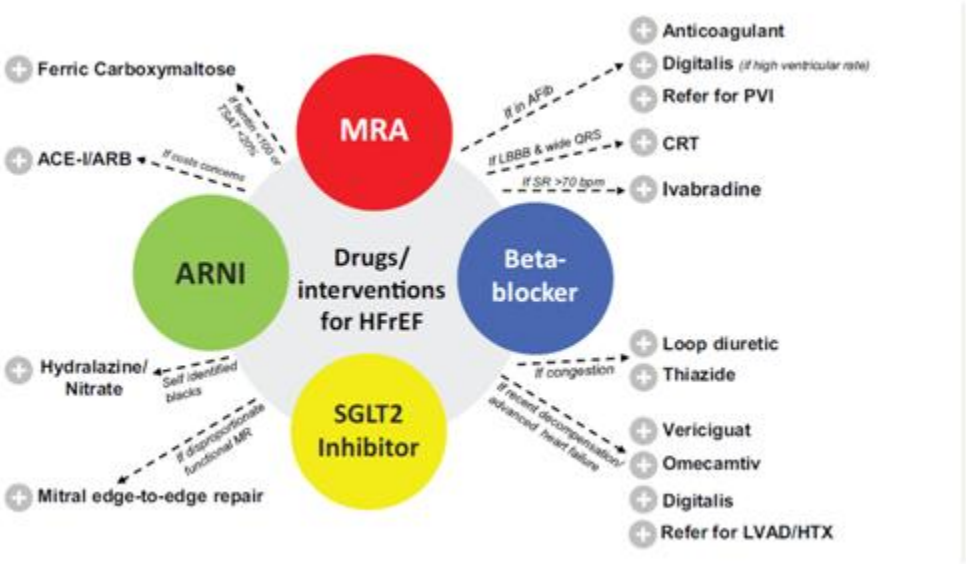

Figure: Multi modalities of treatment in heart failure patients[19]

Heart failure in special situation: Clinical Outcomes in patients with HF hospitalized with covid-19[20]
Treatment modality of HF patients: Cardiac rehabilitation[21]

- Among patients with chronic HF hospitalized with COVID-19 nearly 1 in 4 died in hospital.
- Hospitalization with COVID-19 in patients with HF was associated with high use of in-hospital resources.
- Advanced age, morbid obesity, and diabetes were associated with worse in-hospital outcomes in patients with HF hospitalized with COVID-19.
- Dedicated and innovative efforts surrounding education and infection control are needed for this high-risk population as the pandemic continues to evolve.

Treatment modality of HF patients: Cardiac rehabilitation[21]

- Globally, the prevalence of coronary heart disease and heart failure is increasing, and there is some evidence of the health benefits of cardiac rehabilitation.
- Effective implementation of cardiac rehabilitation after acute coronary syndrome, coronary revascularization, and heart failure has remained suboptimal, with overall participation rates <50% over recent decades despite international recommendations.
- International guidelines now recommend that cardiac rehabilitation programmes include health education and psychological counseling.
- Patients should be offered a choice of community and home- based cardiac rehabilitation programmes to fit their needs andpreferences.
- Clinicians should endorse cardiac rehabilitation for patients with a recent diagnosis of coronary heart disease or heart failure.

Cardiac rehabilitation[21]:

- Reduces cardiovascular as well as total mortality
- Improves myocardial perfusion
- May reduce progression of atherosclerosis when combined with aggressive diet.
- Improves exercise tolerance without significant CV complications
- Improves skeletal muscle strength and endurance in clinically stable patients
- Promotes favourable exercise habits
- Decreases angina & CHF symptoms

Discharge:Criteria for discharge from hospital and follow-up

- When haemodynamically stable, euvolaemic, established on evidence-based oral medication and with stable renal function for at least 24 hours before discharge.
- Should be reviewed within 1 week of discharge.
- Seen by the hospital cardiology team within 2 weeks of discharge if feasible.

CONCLUSION:

The study team concluded that evidence-based guideline directed diagnosis, evaluation and therapy should be the mainstay for all patients with HF.Effective implementation of guideline-directed best quality care reduces mortality, improves quality of life and preserves health care resources.Ongoing research is needed to answer the remaining questions including: prevention, non-pharmacological therapy of HF including dietary adjustments, treatment of HFpEF, management of hospitalized HF, effective reduction in HF readmissions, more precise use of device-based therapy and cell-based regenerative therapy.

REFERENCE:

[1]. Bozkurt B, Coats A, Tsutsui H. Universal Definition and Classification of Heart Failure. J Card Fail. 2021 Feb 7: S1071-9164 (21) 00050-6.

[2]. McMurray John J, Stewart S et al. Epidemiology, aetiology, and prognosis of heart failure. Heart 2000; 83: 596-602.

[3]. Parameshwar J, Shackell M M, Richardson A, Poole-Wilson P A, Sutton G C. Prevalence of Heart Failure in three general practices in north west London. British Journal of General Practice 1992; 42 (360): 287-9.

[4]. Mair F S, Crowley T S, Bundred P E. Prevalence, aetiology and management of heart failure in general practice.British Journal of General Practice 1996; 46 (403): 77-9.

[5]. Clark A P, McDougall Jr G J, Joiner-Rogers G, Innerarity S, Delville C, Meraviglia M, Davila A. Explanatory Models of Heart Failure Etiology. Dimens Crit Care Nurs. 2012; 31(1): 46–52.

[6]. Ho KK, Pinsky JL, Kannel WB, Levy D. The epidemiology of heart failure: the Framingham Study. J Am Coll Cardiol. 1993 Oct; 22 (4 Suppl A):6A-13A. doi: 10.1016/0735-1097(93)90455-a. PMID: 8376698.

[7]. Komanduri S, Jadhao Y, Guduru S S, Cheriyath P, Wert Y. Prevalence and risk factors of heart failure in the USA: NHANES 2013 – 2014 epidemiological follow-up study. Journal of Community Hospital Internal Medicine Perspectives 2017; 7(1): 15-20.

[8]. Eriksson H, Svardsudd K, Larssonj B, Ohlsonj L O, Tibblin J, Welin L, Wllhelmsen L. Risk factors for heart failure in the general population: The study of men born in 1913. European Heart Journal (1989) 10, 647-656

[9]. Murphy N F, Simpson C R,McAlister F A, Stewart S, MacIntyre K, Kirkpatrick M, Chalmers J, Redpath A, Capewell S, McMurray J J V. National survey of the prevalence, incidence, primary care burden,

and treatment of heart failure in Scotland. Heart 2004; 90:1129–36.
[10]. A. Mosterd, A.W. Hoes, M.C. de Bruyne, J.W. Deckers, D.T. Linker, A. Hofman, D.E. Grobbee. Prevalence of heart failure and left ventricular dysfunction in the general population; The Rotterdam Study. European Heart Journal (1999) 20, 447–55.
[11]. Kupari M, Lindroos M, Iivanainen A M, Heikkila J, Tilvis R. Congestive heart failure in old age: prevalence, mechanisms and 4-year prognosis in the Helsinki Ageing Study. Journal of Internal Medicine 1997; 241: 387-94.
[12]. S Morgan, H Smith, I Simpson, G S Liddiard, H Raphael, R M Pickering, D Mant. Prevalence and clinical characteristics of left ventricular dysfunction among elderly patients in general practice setting: cross sectional survey. BMJ 1999; 318: 368-72.
[13]. Gerber Y, Weston S A, Redfield M M, Chamberlain A M, Manemann S M, Jiang R, Killian J M, Roger V L. A Contemporary Appraisal of the Heart Failure Epidemic in Olmsted County, Minnesota, 2000 to 2010. JAMA Intern Med. 2015;175(6):996-1004
[14]. Senni M, Tribouilloy C M, Rodeheffer R J, Jacobsen S J, Evans J M, Bailey K R, Redfield M M. Congestive Heart Failure in the Community. Trends in Incidence and Survival in 10- Year Period. Arch Intern Med. 1999; 159: 29-34.
[15]. Cowie MR, Wood DA, Coats AJ**,** et al**.** Incidence and aetiology of heart failure; a population-based study. Eur Heart J 1999; **20**:421–8.
[16]. National Cancer Institute. Cancer stat fact sheets. Available at: http://seer.cancer.gov/statfacts. Accessed 31 May 2016.
[17]. Roger et al. JAMA 2004;292:344–50
[18]. Maddox et al. 2021 Update to 2017 ECDP for Optimization of Heart Failure Treatment. JACC 2021.
[19]. Bauersachs J. Heart failure drug treatment: the fantastic four. European Heart Journal. 2021 Feb;42(6):681-683. DOI: 10.1093/eurheartj/ehaa1012.
[20]. Bhatt et al. Heart Failure and COVID- 19. JACC Heart Failure 2021; 9 (1): 65-73.
[21]. Dalal H M, Doherty P, Taylor R S. Cardiac rehabilitation. BMJ 2015; 351: h5000 doi: 10.1136/bmj.h5000