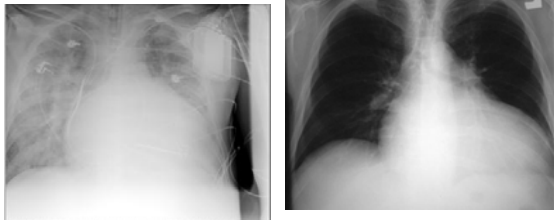


Heart Failure Management

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Heart failure

The inability of the myocardium to pump sufficient blood to body tissues to meet metabolic needs.



Incidence

- 4.7 million Americans suffer from HF
- 50% mortality in 5 years
- Greatest volume of hospital admissions for elderly population.
- Five cents of every healthcare dollar is spent on management of HF.

Heart Failure Classification

Graded by the extent of dyspnea and fatigue experienced by the patient
Classifications developed by the NYS Heart Association

Heart Failure Classification

- **Class I:** No symptoms with ordinary activity.
- **Class II:** Symptoms with ordinary activity, slight limitation.
- **Class III:** Symptoms with less than ordinary activity and marked limitation with daily tasks.
- **Class IV:** Severely decompensate when symptoms are present, any type of activity or rest.

Types of Heart Failure

Defined by ejection fraction

- Systolic Dysfunction
- Diastolic Dysfunction

Heart Failure Differentiation

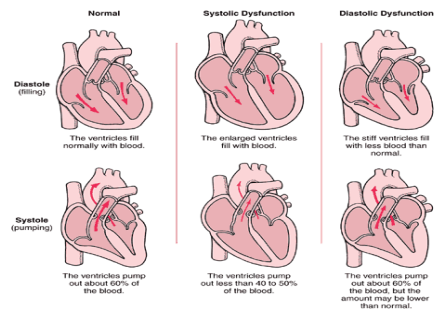
Ejection Fraction

- The percentage of blood ejected from the left ventricle during systole.
- Normal > 60%.

Heart Failure Differentiation

Systolic Dysfunction

- Ejection fraction < 40%
- Reduced cardiac output secondary to depressed cardiac contractility.



Systolic Dysfunction

- Dysfunction stimulates the sympathetic nervous system (SNS) and increases salt & water retention. LVH also occurs to unload individual muscle fibers thereby decreasing wall stress & afterload.
- As process progresses, there is a progressive decline in the max. CO generated for any given cardiac filling pressure. Based on 2 factors:
- Hrt has reached it's max. capacity to increase contractility in response to increasing stretch.
- Poor cardiac compliance, small volume produces lg. increase in LVEDP, but no increase in stretch & therefore little change in CO.

Heart Failure Differentiation

Diastolic Dysfunction

- Normal ejection fraction >50%.
- Slowed & incomplete myocardial relaxation, Impaired ventricular filling and altered passive elastic properties of the ventricle resulting in increased passive stiffness.

Diastolic Dysfunction

- LVEDP & SV are preserved, but there is abn. increase in LVEDP at any given volume. This reflects decrease diastolic compliance therefore a higher diastolic pressure is required to achieve the same diastolic volume or contractility.
- Compensatory increase in left atrial pump function which eventually leads to stiffness, increase in left atrial afterload and atrial pump dysfunction.

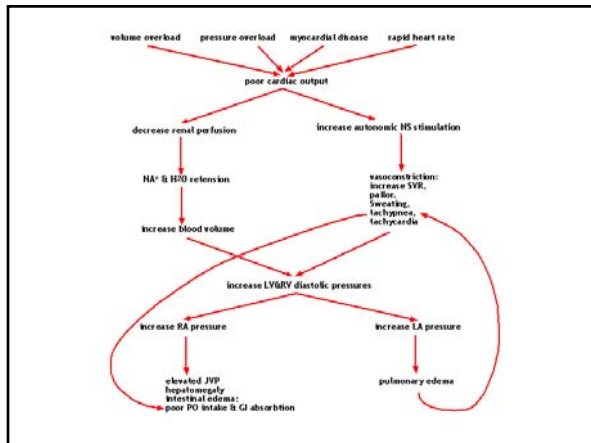
Left vs Right Sided

Left Ventricular Failure:

- Left ventricle weak or overloaded.
- Symptoms of pulmonary congestion.

Right Ventricular failure:

- Right ventricle is impaired.
- Symptoms of systemic venous congestion.



Systems Affecting Heart

Compensatory Neuro-Hormonal Mechanisms

- Sympathetic Nervous System
- Renin-angiotension System (RAA)
- Secretion of Vasoconstrictive Substances

SNS

- Increased Adrenergic (Sympathetic) Activity
 - Accelerate HR (+ chronotropic effect),
 - Increases cardiac contraction (+ inotropic effect)
- Increases vascular tone.

SNS & Heart Failure

- Baroreceptors in aortic arch & carotid sinus stimulated by heart failure
- Sympathetic activity- release of catecholamines (epi & norepi)
- Adrenergic receptor sites (on the surface of myocardial and vascular smooth muscle cells) affected.

SNS & Heart Failure

- Prolonged sympathetic stimulation is detrimental to patient's with heart failure
- Their prognosis is highly correlated to amount of norepi. in the blood.

RAA

- Release of renin
- Renin converts angiotension I to angiotension II, a potent vasoconstrictor
- Promotes sodium and water retention due to stimulation of aldosterone from the adrenal cortex

RAA & Heart Failure

- Activation of the RAA system is stimulated by renal hypoperfusion caused by HF.
- RAA system is activated
- Increase stress to the failing ventricle with increase preload and afterload.
- Cycle of vasoconstriction & water retention taxes the already compromised LV.

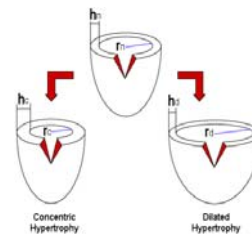
Vasoconstrictive Substances

- Vasopressin & endothelin released by worsening heart failure. Vasopressin produced by the pituitary gland has effect on kidney by causing reabs. of water. Endothelin synthesized in endothelial cells in bld. vessels.
- Strong vasoconstrictive properties with arterial and venous vasoconstriction produced
- Increase preload & afterload stress the failing heart.
- Promotes cardiac remodeling

Remodeling

- Characterized by morbid changes in ventricular geometry, mass, & volume.
- Cardiac myocytes are cells that decrease in# & become hypertrophic to increase SV & increase thickness of the vent. wall.
- Remodeling leads to pathogenesis ventricular arrhythmias.
- Cardiac Troponin I & T are released during myocyte injury and are elevated in patients with HF. Markers of ongoing myocyte damage.

Myocardial Remodeling



BNP

- Brain Natriuretic Peptide: Cardiac hormone secreted by vent. myocytes in response to wall stretch. Useful in producing balanced vasodilation, positive neurohormonal changes (decreased endothelin & aldosterone levels) and increased diuresis.
- Highly specific & sensitive for Dx of HF.
- Used to differentiate pulmonary & cardiac causes of dyspnea.
- Not useful in the patient with renal failure.

Management of Heart failure

Goals of therapy:

- Symptom relief
- Improve quality of life.
- Decrease mortality

Management of HF

- Correction of systemic factors (thyroid dysfunction, infection, & DM).
- Treatment of underlying cardiac disease: HTN
- renovascular disease
- Ischemic hrt disease
- Valvular disease

Management of Heart failure

Treatment:

- Pharmacology
- Risk Factor Reduction
- Diet
- Exercise
- Patient & family Education
- Surgical management

Pharmacology

- ACE inhibitors
- Diuretics
- Digoxin
- Beta-adrenergic Blockers (B-Blockers)
- Hydralazine-nitrates
- Anti-arrhythmic agents
- IV Iontropic Agents
- Anticoagulants
- Antiplatelets
- Lipid lowering agents
- Aldosterone Inhibitors

Ace Inhibitors

- Blocks the enzyme responsible for angiotension I - angiotension II conversion
- Blocks RAA stimulation
- Used for systolic dysfunction (EF<40%).
- Numerous clinical trials have shown decrease morbidity, mortality, symptom improvement, and decrease hospitalizations with their use.
- All pts, with symptomatic/symptomatic HF should be started on an ACE.

Ace Inhibitors

Goal is slow titration to maximum dose regardless of patient toleration of lower doses

Ace Inhibitors

- Assess BP before starting & dose increases.
- BP should be >90mmHg.
- Monitor BUN, CR and K closely.
- Limitations: Symptomatic hypotension, cough, Cr > 3.0-4.0, K > 5.5mq/l.
- Contraindications: Allergy, bilateral renal stenosis and pregnancy.
- Angiotension Receptor Blockers (ARB): can be effective as an ACE, but should not be used in preference to an ACE

Diuretics

- Used to treat volume overload, pulmonary & peripheral edema.
- Use only when there is clinical evidence of volume overload
- Inappropriate dosing: To low will cause fluid retention, decrease response to ACE/ARB/BB. To high will risk hypotension, volume contraction, renal insuff. With ACE/ARB.
- Loop diuretics (lasix), determine most effective single dose. Target weight loss, 0.5-1.0 Kg/day.

Diuretics

- Endpoints of therapy: relief of symptoms, orthostatic changes in BP, or progressive increase in BUN and Cr.
- Dose should not be maximized at the expense of ace inhibitors
- Monitor electrolyes closely

Digoxin

- Used for patients with symptomatic heart failure (Class II,III IV), systolic dysfunction and atrial fibrillation.
- (+) ionotropic effect/decrease ventricular response.
- Dose based on renal function

Beta Blockers

- Blocks sympathetic stimulation in heart failure.
- Protect the myocardium from the harmful effects of excessive catacholamine production.
- Clinical trials have shown B-Blockers to improve ejection fraction and reduced left ventricular hypertrophy.
- Shown to increase survival, lower mortality & hospitalizations.

Beta Blockers

- Used in class II or III symptoms, not class IV.
- Begin at low dose and titrate up after patient stabilized on ACE, diuretic and digoxin
- Symptoms may increase 4-10wks before improvement.
- Decrease dose if resistant edema persists.
- May cause hypotension & light-headedness.
- Administer at least two hours after ACE and diuretics.

Hydralazine-nitrates

- Combination used when patient can not tolerate ACE/ARB.
- Added to ACE when refractory symptoms are present/HTN.
- Hydralazine may decrease the development of nitrate tolerance.
- Hydralazine is titrated up slowly to relieve symptoms (50-100mg TID)/Isordil 40mg TID-QID.
- Less effective than ACE/ARB

Aldosterone Antagonists

- Spironolactone/Eplerenone are potassium sparing diuretics that compete with aldosterone for mineralcortical receptor sites.
- Increase survival
- Recommended for only Class IV HF
- Use only if Serum CR < 2.5 & K < 5
- Monitor for hypokalemia

Anti-arrhythmic agents

- Atrial fibrillation/NSVT most common arrhythmias in HF.
- Only amiodarone should be used in patients with chronic heart failure.
- Used to convert or prevent recurrent A Fib. If digoxin/BB not effective.
- Assess TSH and LFT'S prior to use
- May interfere with digoxin levels and coumadin dosages.

IV Inotropic Agents

- Used only when other therapies have failed to improve quality of life. Refractory HF
- Increases mortality and myocardial oxygen demands.
- May increase ventricular ectopy and risk for sudden cardiac death.

- Anticoagulants: Thrombus occurs d/t stasis of blood in dilated hypokinetic LV, need for anticoagulation in AF.
- Antiplatelets
- Lipid lowering agents: statins
- Erythropoietin/IV Iron: keep hgb 10, improve HF and EF, decrease hospitalizations.

Exercise

- Exercise improves activity capacity, heart failure symptoms, peripheral perfusion & delays anaerobic metabolism.
- Guidelines for stable HF patients are mild-moderate dynamic exercise with gradual increase in speed and duration.
- Increases survival, lowers hospitalizations.

Diet

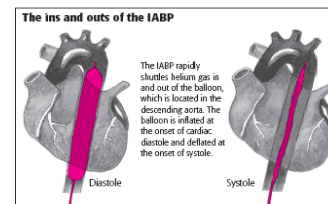
- Sodium intake should not be > 3 Gms per day.
- Fluid restriction only necessary with hyponatremia.
- Avoid ETOH if possible or limit intake to 1 drink per day.

Surgical Management of Heart Failure

- Mechanical support
- Surgical intervention
- Cardiac transplantation

IABP

- First VAD



Ventricular Assist Devices

- Bridge to Transplant
- Destination therapy



