Heart failure

- complex clinical syndrome results from fn impairment < vent filling / ejection of blood
which lft SOB, fatigue, sign of ♡ failure, edema & rales.

Classification

With Reduced EF (HFrEF) (<40%)

1) CAD - MI, ischemia
2) Pressure overload < Obs valv ds / HTN
3) Volume overload < Regurg valv ds / L-R shunt / Extracardiac shunt
4) Lung ds < Cor pulmonale / pulm vasc dlo
5) DCMP < Familial (AD) / Infiltrative
6) Drug < Metabolic / Viral
7) Chagas
8) dlo rate, rhythm

↓

Pathogenesis HFrEF

- MS damage
- Inability of MS to generate contraction

↓

HF

↓

Compensation

↓

RAAS+ | Adrenergic | VD molecules (ANP, BNP, Bradykinin, PGE_2, E_2, NO) → Degraded by Nepxilysin

↓

Compensatory Maintenance of LV fn

↓

Threshold

↓

Myocyte Hypertrophy | Alt Myo cont | Apo, Necrosis → Myocyte loss | β adr desens | Abn myo energetics | Reorgn of ECM

↓

Cardiac Remodelling

Preserved EF - 40-50%

1) Pathological Hypertrophy
   - HCM (HOCM)
   - HTN
2) Aging
3) Endomyocardial dlo
4) RCM
5) Fibrosis

↓

Impaired Relaxation → Diastolic stiffness

↓

HFpEF

↓

Impaired Myocardial Relaxation

↓

Diastolic dysfn

- Myocardial Metabolism shift from Glucose → FA pathway
- Calcium Overload in Myocardium

High output states

1) Thyrotoxicosis
2) Beri Beri Anemia
3) Sys AV Shunting
4) Chr Anemia

Cardiac (LV) remodelling

Δ - mass, volume, shape, composition

Abn Hemodynamic loading condition

↓

↑ LV → EDV ↑ → Wall thinning

↓

Afterload Mismatch

↓

↓ SV

↓

- Subendo Hypoperfusion
- Oxidative stress → TNF, IL1β
- Sustained stretch activation of hypertrophic pathways

Clinical features

HFrEF

S/S

1) Fatigue
2) Shortness of Breath

Pulmonary congestion
↓
fluid in ISF, alv fluid
↓
Juxtacap ↑ (R) activation

↓ pulm compliance → SOB ← Resp MS / Diaphragm fatigue
Anemia ↑ Airway Resistance

3) Orthopnoea - SOB (Recumbent)
↓
Redistribution of fluid from Splanchnic (↓) & Lower extremity to central (↑)
↓
↑ PCWP
↓
SOB on lying down

4) Nocturnal cough
5) Paroxysmal Noct Dyspnoea (PND)
- awaken pt from sleep
- 1-3h after sleep
6) Cheyne Stoke Respiration
- periodic / cyclic
- 40% ≥ HFrEF
- Apnoea → Hb → Hyperventn
7) Acute pulm edema

P/E

1) ↑JVP, Abdominojugular Reflux
2) Pulm crackles, rales, crepitations
3) Pleural Effusion - BIL, more in (R)
4) S3 gallop, S4 ✓
5) Murmur → MR, TR → Advanced HF
6) Liver - enlarged, tender, jaundice, Ascites (hep congestion d/t sev. TR)
7) Edema - peripheral, Presacral, Scrotal
8) Marked wt loss
9) Cachexia

Ix

1) Lab - CBC/LFT/RFT (Electrolytes / Urine Analysis
- R/O DM/Dyslipidemia/thyroid d/o
(RBS) (Lipid) (TSH/T3/T4)
2) Ecg - LVH, prior MI, poor R wave progression
3) CXR - cardiomegaly, pulm vasc Δ, pulm edema
4) 2D Echo - most useful
- LV-size/fn/valvular/RWMA
5) Cardiac MRI - Gold std LV < mass / volume
6) Biomarkers
- BNP
- NT-ProBNP
- ST2 soluble
- Galectin 3
] Prognosis
- Dx & clinical decision also ↑ in ARNI
7) Cardiac exercise test - Assess need for cardiac transplant
- Adv HF

HFpEF (40-50%)

~ CF to HFrEF

Ix

1) (N) EF
2) LV volume Index > 40 ml/m²
3) LV mass Index < M > 149 g/m², F > 122 g/m²
4) Diastolic Dysfn
5) Cardiac MRI

Treatment of HF

HFREF < 40%

1) ACE ⊖ – Lisino | Enali | Capto | Trando | Ramipril (2.5-5mg)
2) ARBs – Losartan (50-150 OD) | Valsartan (40-160 BD) | Candesartan (4-32 OD)
3) Aldosterone Antagonist – Spironolactone (12.5-50 OD) | Eplerenone (25-50 OD)
4) Beta Blockers – Metoprolol succinate (12.5-200 OD) | Carvedilol (3.125-50 BD) Bisoprolol (1.25-10 mg BD)
5) AV Vasodilators – Hydralazine | ISDN ⇒ (37.5|20 – 75|40 OD)
6) ARNI – (100 – 200 BD)

- Pt. c̄ long term ACE ⊖ Rx → have pre R/t level of AT-II → Neurohormonal Escape phenomenon
- Start ② drugs → ACE ⊖ + β ⊖ OR ACE ⊖ + ARBs (when β ⊖ intolerant) OR ARB + β ⊖ (when ACE ⊖ intolerant)
- NYHA → 2 to 4 ⇒ Add Aldosterone Antagonist
- 4 Drug combination should be AVOIDED

7) Direct Renin ⊖ → Aliskiren – No major benefit
8) IVABRADINE → If current ⊖ in SA node < ↓ HR; No Negative Ionotropic effect
   - Benefits to pt → on ACE ⊖ + β ⊖ + AA but HR > 70
   → Unable to tolerate β ⊖
9) DIGOXIN – MOA – mild Ionotropic
   – Sympathetic ⊖
   – Attenuation of carotid sinus Baroreceptor
   ↓
   Only if pt. is profoundly symptomatic even after optimal therapy

⑩ Oral Diuretics → Loop → Furosemide

⑪ No role of Statin in non Ischemic HF

⑫ Current guideline → support use of ✓ Aspirin in Ischemic HF

⑬ PUFA → Long Chain Pufa Beneficial

Acute Decompensated HF [ADHF]

- Heterogenous clinical syndrome of → ↓ cardiac performance
  → Renal dysfunction
  → Altered vascular compliance
- High short term & long term (20%) Mortality (5%)

AD-Typical
- HTN & No vol overload
- Normotension & vol overload
  +
  RF + ACS + Arrhythmia + Hypoxia + pulm Embolism + Infection
- Rx - VD
  - Diuretics

AD pulm Edema
Hypoxia
+
S. pulm congestion
Rx
- O_2 (NIV)
- VD
- Diuretics
- Opiates

AD Low Output
Hypoperfusion
↓
Organ dysfn.
Rx
- Ionotropes
- Hemodynamic monitoring
- VD
- Cardiorenal
- Hepatic congestion

AD Cardiogenic Shock
↓BP + ↓CO + End organ damage
Rx
- Ionotropes
- Mechanical circulatory support (IABP) (Ultrafiltration)

ADHF - Intravenous ④

① DIURETICS
(1st choice - vol Overload, congestion)

a) Furosemide - 20-240 mg/d - severe congestion [Infusion]
b) Torsemide - 10-100 mg/d → Oral ✓
c) Bumetanide - 0.5-5 mg/d - Oral ✓
d) Metolazone (2.5-10 mg), Chlorthalidone
e) Acetazolamide
f) Spironolactone (↓ Hypokalemia)

② VASODILATORS
(Rapid Dyspnoea Relief)
(dlt pulm congestion)

a) NTG - 10-20 ug/min → 200 ug/min
(↑ 10 ug/min every 3-5 min)
b) Nesiritide - 2 ug/kg → 0.1 ug/kg/min
(arterial line)
c) Nitroprusside - 0.3 ug/kg/min → 5 ug/kg/min
d) Serelaxin - less efficient
e) Ularitide - 15 mg/kg/min (↓ SBP > 116 mm) ×48 h

③ IONOTROPES

a) Dobutamine - 2-20 ug/kg/min
b) Milrinone - 0.375-0.75 ug/kg/min
c) Levosimendan - 0.1 ug/kg/min (Ionotrope + PDE 3⊖)
d) Omecamtiv Mecarbil - ↑ contractility w/o ↑ O_2 demand

④ NeuroHormonal Antagonist

a) ROLO-phylline → Adenosine Ⓐ antagonist
b) Tol-Vaptan → Vasopressin Antagonist