

# Acute Decompensated Heart Failure (ADHF)

## Introduction

- Clinical diagnosis by worsening S&Ss of HF.
- Another name is AHF. If the 1<sup>st</sup> episode of ADHF = de novo HF.

## Epidemiology

- Most common cause of hospitalization in pts ≥ 65 yo (Circ 2013;127:e6).
- High mortality and morbidity (50% re-hospitalization at 6 months. (Am Heart J 2010;160:885).
- Heterogeneous groups of patients: ACS, HTN crisis, shock, RV failure, preserved EF (50%) etc.

## Precipitating factor

- Medication noncompliance, diet noncompliance, ACS, infection, HTN, arrhythmia, worsening RF, NSAIDs, thyroid, anemia, PE, pregnant, iatrogenic etc.

## Prognosis (ADHERE. JAMA 2005)

- Overall in-hospital mortality = 4%. 30% mortality at 1 year. 50% recurrent hospitalization at 6 months.
- If BUN ≥43, SBP ≤115 and Cr ≥2.75, in-hospital mortality rate of 20%.

## Evaluation

- Know patient's clinical hemodynamics status. "Warm - Wet - Cold - Dry"

↑Congestion: Orthopnea, ↑JVP, rales, (+) HJR, ascites, edema, Valsalva square wave BP, PSM, S3.  
 ↓Perfusion: ↓Mentation, narrow pulse pressure (PPP ≤25% ~ CI ≤2.2. JAMA 1989;261:884), pulsus alternans, hypotension, cool extremities, ↑Cr, ↑LFT, ↑Lactic acid. (Nohria A. JACC 2003;41:1797).

	<b>CONGESTION</b>	
	--	+
ADEQUATE PERFUSION	+ <b>A</b>	+ <b>B</b>
	dry-warm (N=123)	wet-warm (N=222)
↓	<b>L</b>	<b>C</b>
	dry-cold (N=16)	wet-cold (N=91)

- Crepitation, cephalization on CXR have low sensitivity (<30%) in pt with history of chronic HF.
- BNP >100 has 90% Se, 76%Sp for diagnosis of ADHF in pt presented to ED with dyspnea (BNP. NEJM 2002). BNP should not be used in isolation from clinical. May compare to "dry BNP"
- Goal of therapy: 1. Improve symptoms; 2. Prevent and restore end-organ damages by shift hemodynamics to "Dry and warm".

## To Decrease Preload

### Loop Diuretic

- Sigmoid dose-response curve. No response until threshold dose is reached. Minimal additional response after that.
- Once effective dose established, increased frequency of dosing for more urine output.
- Initial IV dose should be ≥ home daily dose.
- Furosemide 80 oral ~ 40 iv = torsemide 40mg = Bumex 1 oral = 1 iv.

### Diuretics resistant

- ↑ Dose, ↑frequency, change to IV infusion, adding 2<sup>nd</sup> diuretic (thiazide, spironolactone).
- Ultrafiltration: Greater control but no greater weight loss compared to diuretics. More adverse effect (CARRESS-HF. NEJM 2012).
- "Renal dose dopamine": Not selectively ↑renal blood flow or prevent renal failure (ROSE. JAMA 2013).
- Tovoltan - Vasopressin receptor blocker: Greater weight loss and less symptoms at 1 day but no Δ CV death or rehospitalization at 10 months. (EVEREST. JAMA 2007).
- Serelaxin - Recombinant human relaxin-2: ↓dyspnea, ↓length of stay, ↓CV death at 180 days in both HFrEF and HFpEF with AHF (RELAX-AHF. Lancet 2013).

Drug	Initial Dose	Maximum Single Dose
<b>Loop Diuretics</b>		
Bumetanide	1.0 mg	4 to 8 mg
Furosemide	40 mg	160 to 200 mg
Torsemide	10 mg	100 to 200 mg
<b>Thiazide Diuretics</b>		
Chlorothiazide	500 mg	1000 mg
<b>Sequential Nephron Blockade</b>		
Chlorothiazide	500 to 1000 mg (IV) once or twice plus loop diuretics once; multiple doses per day	
Metozalone (as Zaroxolyn or Diulo)	2.5 to 5 mg PO once or twice daily with loop diuretic	
<b>IV Infusions</b>		
Bumetanide	1-mg IV load then 0.5 to 2 mg per hour infusion	
Furosemide	40-mg IV load then 10 to 40 mg per hour infusion	
Torsemide	20-mg IV load then 5 to 20 mg per hour infusion	

## To improve perfusion (afterload reduction and/or increase contractility)

### IV vasodilator

- ↑afterload → ↑cardiac output → ↓PCWP
- ↓preload → rapid symptom relief
- No side effect of inotrope/pressors eg. arrhythmia (AF, VT/VF), MI (from ↑MVO2)
- Should be avoid in hypotension, MS, AS

	Nitroglycerin	Nitropusside	Nesiritide
<b>Mechanism</b>	Nitric Oxide	Nitric Oxide	BNP
<b>Onset of action</b>	Mins	Mins	hours
<b>Usual dose</b>	10 - 200 mcg/min	0.1 - 5 mcg/kg/min	2 mcg/kg iv bolus then 0.01 – 0.03 mcg/kg/min
<b>Effect on CPWP</b>	↓	↓↓	↓↓
<b>S/E</b>	Headache (20%) Hypotension	Thiocyanate Hypotension	? worsening RF Hypotension
<b>Expense</b>	\$	\$\$	\$\$\$\$
<b>Note</b>	V > A dilatation Decrease preload Tachyphylaxis	V = A Very fast onset	? Diuresis effect Cannot measure BNP VMAC. JAMA 2002 ASCEND-HF. NEJM 2011

### IV Inotrope

- ↑contractility → ↑cardiac output → ↓PCWP
- Choosing based on hemodynamic effects. No data consistently shows improved clinical outcome.
- Use only when needed (severe hypoperfusion with hypotension). Wean off as soon as possible.
- Bridge to definite treatment eg. revascularization, resolution of precipitating factors, optimization of preload and afterload stage.

	Dopamine	Dobutamine	Milrinone
<b>Action</b>	α1 β1 β2 DA adrenergic agonist	β1 β2 (α1) adrenergic agonist	PDE-3 inh increase cAMP
<b>Onset of action</b>	mins	mins	hours
<b>Usual dose</b>	2-20 mcg/kg/min	2-20 mcg/kg/min	0.125 - 0.625 mcg/kg/min
<b>Effect on afterload</b>	↑↑	↓↓	↓↓↓
<b>S/E</b>	VT/VF AF/Aflutter	VT/VF AF/Aflutter may ↓ hospitalization ↑ QoL but ↑ mortality	Pt who was on beta blocker 10% hypotension 5% Aflutter/Aflutter OPTIME-CHF

- Other inotropes that may be consider: Dopamine, Norepinephrine. Levosimendan - Calcium-sensitizing agents: Positive inotropic with vasodilator. Uncertain clinical efficacy and safety (compare to dobutamine)

## Other management

- Treat precipitating causes.
- Na/fluid restriction. Carefully monitor I/Os, weight, electrolytes.
- O2 if hypoxia. NPPV (3CPO NEJM 2008).
- DVT prophylaxis. Opiate if needed.
- Chronic HF meds should be continued unless there are contraindications or hemodynamic instability.
- If hypotension, severe hypoperfusion, may consider PA cath and or arterial line.
- When inotrope is not enough consider OHT, mechanical circulatory support (MCS), or palliative care.
- Before discharge: Reverse precipitating cause, start/up-titrate chronic HF meds, education. Identified patient who may benefit from revascularization or devices.