

Acute Decompensated Heart Failure (ADHF)

Introduction

- Clinical diagnosis of the worsening sign and symptoms of HF.
- No specific definition, other terms include acute heart failure (AHF), acute heart failure syndrome (AHFS), de novo HF (if the 1st episode of acute 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 (OPTIMIZE-HF. Arch Intern Med 2008;168:847)

- Medication noncompliance, diet noncompliance, MI (15%), pulmonary process (15%), arrhythmia (15%), infection, HTN, worsening RF, NSAIDs, thyroid, anemia, PE, pregnant, iatrogenic, unknown (30-40%) etc.

Prognosis (ADHERE. JAMA 2005)

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

Evaluation

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

↑Congestion: Orthopnea, ↑JVP, rales, (+) HJR, ascites, edema, PSM, S3, square wave BP response to Valsalva.

↓Perfusion: ↓Mentation, narrow pulse pressure (PPP $\leq 25\%$ \sim Cl ≤ 2.2 . JAMA 1989;261:884), pulsus alternans, hypotension, cool extremities, ↑Cr, ↑LFT, ↑Lactic acid. (Nohria A. JACC 2003;41:1797).

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

- Crepitation or cephalization on CXR has 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"; 3. Transition to outpatient chronic care.

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 \geq home daily dose.
- Furosemide 80 PO = 40 IV = torsemide 40 PO = bumetanide 1 PO = 1 IV.

Diuretics resistant

- ↑ Dose, ↑ frequency, change to IV infusion
- Adding 2nd diuretic (thiazide, spironolactone).
- Tovaltan - 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).
- Ultrafiltration: Greater control but no greater weight loss compared to diuretics. More adverse effect (CARRESS-HF. NEJM 2012).
- "Renal dose (low dose) dopamine": Not selectively ↑renal blood flow or prevent renal failure (ROSE. JAMA 2013).
- 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
Loop Diuretics		
Bumetanide	1.0 mg	4 to 8 mg
Furosemide	40 mg	160 to 200 mg
Torsemide	10 mg	100 to 200 mg
Thiazide Diuretics		
Chlorothiazide	500 mg	1000 mg
Sequential Nephron Blockade		
Chlorothiazide	500 to 1000 mg (IV) once or twice plus loop diuretics once; multiple doses per day	
Metozalone (as Zaroxolyn or Dilulo)	2.5 to 5 mg PO once or twice daily with loop diuretic	
IV Infusions		
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 increased perfusion (by ↓ afterload and/or ↑ contractility)

IV vasodilator

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

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

IV Inotrope

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

	Dopamine	Dobutamine	Milrinone
Action	α_1 β_1 β_2 DA adrenergic agonist	β_1 β_2 (α_1) adrenergic agonist	PDE-3 inh increase cAMP
Onset of action	mins	mins	hours
Usual dose	2-20 mcg/kg/min	2-20 mcg/kg/min	0.125 - 0.625 mcg/kg/min
Effect on afterload	↑↑	↓↓	↓↓↓
S/E	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: Norepinephrine, Levosimendan (Calcium- sensitizing agents: Positive inotropic with vasodilator. Uncertain clinical efficacy and safety)

Other management

- Treat and modified precipitating factors.
- Na/fluid restriction. Carefully monitor I/Os, weight daily, check electrolytes
- O₂ if hypoxia. CPAP or NIPPV may have some benefits (3CPO NEJM 2008), Opiate if needed, DVT prophylaxis.
- 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 mechanical circulatory support (MCS eg. IABP, LVAD), OHT or palliative.
- Transition to chronic outpatient care
 - Education, self care, HF program/clinic
 - Guideline directed medical treatment (start, uptitrate to optimal doses)
 - Identified patient who may benefit from CRT/ICD device, revascularization.
- Guideline: ACC/AHA, ESC, HFSA, Thai Heart.
- Registry: ADHERE, OPTIMIZE-HF, ESCAPE, EHFS II, THAI-ADHERE