

**NEUROHORMONAL ANTAGONISTS****(1) ACEI (FDA approved for heart failure treatment)**

ACEI	Accupril	Altace	Capoten	Mavik	Monopril	Prinivil	Vasotec	Zestril
Generic name	Quinipril	Ramipril	Captopril	Trandolapril	Fosinopril	Lisinopril	Enalapril	Lisinopril
Starting Dose	5 mg bid	1.25-2.5 mg qd	6.25-12.5 mg tid	1 mg qd	5 mg qd	2.5-5 mg qd	2.5 mg bid	2.5-5 mg qd
Target Dose (a)	20 mg bid	10 mg qd	50 mg tid	2-4 mg qd	20 mg qd	20 mg qd	10 mg bid	20 mg qd
Maximum Dose	40 mg bid	10 mg bid	100 mg tid	8 mg qd	40 mg qd	40 mg qd	20 mg bid	40 mg qd

(a) = average maintenance dose used in clinical trials

**(2) BETA BLOCKER (with Proven Benefit in Heart Failure)**

Beta Blocker	Action	Starting Dose	Target Dose	FDA App
Carvedilol (Coreg) (a)	Beta 1; Beta 2, Alpha 1	3.125 mg bid	25 mg bid	Yes
Metoprolol Succinate CR (Toprol XL)	Beta 1 (c)	12.5 mg qd	100-200 mg qd	Yes
Metoprolol Tartrate (b)	Beta 1 (c)	6.25 mg bid	50-75 mg bid	No
Bisoprolol (Zebeta)	Beta 1 (c)	1.25 mg qd	10 mg qd	No

- There are no proven benefit data for other Beta blockers.

- (a) = When prescribe low dose, only Carvedilol has proven benefit. Carvedilol is superior to Metoprolol Tartrate, although dosage may not be equivalent and there is no comparison to Metoprolol Succinate CR (COMET, 2003)

- (b) = There is no mortality benefit data for Metoprolol tartrate.

- (c) = At target dose in clinical trials, these selective beta blocker may become non selective ones

**(3) ARB**

ARB	Initial Dose	Target Dose	FDA approved
Losartan (Cozaar) (1)	25 mg qd	50 qd (4)	No
Valsartan (Diovan) (2)	80 mg qd	160 mg bid	Yes
Irbesartan (Avapro)	75 mg qd	150 - 300 qd (5)	No
Candesartan (Atacan) (3)	4 mg qd	32 mg qd	Yes

(1) In ELETE II, 2000. (2) In Val-Helf, 2001 and VALIANT, 2003. (3) In CHARM, 2003, . (4) Dose of 100 mg qd may be better. (5) Need to be confirmed

**(4) ALDOSTERONE ANTAGONIST (FDA approved for heart failure treatment)**

Aldosterone antagonist	Indication	Initial dose	Target dose
Spironolactone (Aldactone)	NYHA III-IV	12.5 mg qd	25 mg qd
Eplerenone (Inspra)	Post MI with heart failure	25 mg qd	50 mg qd

**NON NEUROHORMONAL ANTAGONISTS**

	Initial dose	Target dose	Comment
Digitalis (Digoxin)	No loading dose	0.125 - 0.25 mg qd	
Hydralazine	37.5 mg tid	75 mg tid	Hydralazine blocks the development of nitrate tolerance. It is an antioxidant. It works on higher dose.
Isosorbide Dinitrate	20 mg tid	40 mg tid	It should be used with hydralazine.

**Diuretics****Oral**

	Initial dose	Target dose	Maximal dose
<b>Loop Diuretics</b>			
Furosamide (Lasix)	20-40 mg qd	as needed	240 mg bid
Bumetanide (Bumex)	0.5-1.0 mg qd	as needed	10 mg qd
Torsemide (Demedex)	10-20 mg qd	as needed	80-120 mg bid
<b>Thiazide Diuretics</b>			
Hydrochlorothiazide	25-50 mg qd	as needed	100-200 mg qd
<b>Thiazide-Related Diuretics</b>			
Metolazone (Zaroxolyn) (a)	2.5-5.0 mg qd	2.5-5.0 mg 2-3 time/wk	10 mg qd

(a) = Metolazone may cause significant electrolyte imbalance.

**IV Bolus**

	Dose depending on Creatinine Clearance	Dose Frequency
Furosamide (Lasix)	>40 mg ----- 160-240 mg	q 8 hrs, q 12 hrs
Bumetanide (Bumex)	>2 mg -----	q 12 hrs
Torsemide (Demedex)	10-20 mg ----- 100 mg	q 12 hrs

**IV Infusion**

	Loading Dose (mg)	Infusion Rate (mg/hr)		
		CrCl >75 ml/min	CrCl 25-75 ml/min	CrCl <25 ml/min
Furosamide (Lasix) (a)	40	10	10-20	20-40
Bumetanide (Bumex)	1	0.5	0.5-1	1-2
Torsemide (Demedex)	20	5	5-10	10-20

**Diuretic Refractory**

1. Medication noncompliance, excessive salt and fluid intake and NSAIDs are the common reasons that the patients become refractory to diuretics.
2. Prescribe higher loop diuretic dose. Avoid single daily dose to decrease post diuretic sodium retention (Furosamide has short half life).
3. Oral Torsemide has better absorption and bioavailability than Furosemide in symptomatic HF with fluid retention.
4. Combine diuretics with different sites of action i.e... Metolazone (give 1/2 hour before) and Furosamide/Bumetanide/Torsamide. Use lowest effective Metolazone i.e.. 2.5-5.0 mg 2-3 times/week or prn per weight increase. For IV use, prescribe Chlorothiazide or hydrochlorothiazide 250-500 mg or 25-50 mg respectively, 1/2 hour before IV loop diuretic. Monitor electrolyte when use Metolazone.
5. Intravenous loop diuretics, **bolus**. May be used as outpatient.
6. Intravenous loop diuretics, **continuous infusion**, is more effective and requires less total daily dose than bolus form.
7. Combine diuretics and drugs that increase renal blood flow, i.e... Dobutamine, Milronone, Nesiritide, low dose Dopamine.
8. Ultracentrifuge.

**OTHER MEDICATIONS IN HEART FAILURE**

- **ASA:** Prefer 81 mg.
- **Antiarrhythmic Agents:** Only Amiodarone and Dofetilide (Tikosyn)
- **Calcium Channel Blockers:** Only Amlodipine.
- **Medications Avoid in Heart Failure:** NSAIDs, Cox 2 inhibitors, class I A and IC antiarrhythmic agents (Quinidine, Procainamide, Flecainide, Propafenone), calcium channel blockers except amlodipine (Norvasc) and felodipine, corticosteroid, lithium, tricyclic antidepressants, cardiotoxic agents, glitazones (in heart failure with fluid retention).